Immersive but not Inclusive: Challenges Faced by Underrepresented Groups in Immersive Audio

by

Leslie Gaston-Bird

Submitted for the Degree of Doctor of Philosophy

Institute of Sound Recording
Faculty of Arts and Social Sciences
University of Surrey

Principal Supervisor: Russell Mason
Co-Supervisor: Enzo De Sena

Abstract

Despite the efforts of organizations to improve the balance of participation in music technology and audio engineering, representation remains low among women and minorities: fewer than 10% of professionals are from these underrepresented groups (UGs). This figure also accurately reflects representation for professionals in immersive audio, based on a review of membership data from multiple organizations.

This lack of representation is in part due to Barriers to Entry and Discouraging Influences (BEDIs) including microaggressions, discrimination, and unequal access to training. Further, interested women and minorities who express interest in STEM (Science, Technology, Engineering and Mathematics), music technology, and audio leave earlier and at higher rates than their white male counterparts due to these factors. This has been described as a "leaky pipeline".

In order to counter these BEDIs, training programmes in STEM, feminist collectives, and affinity groups have proved successful in mitigating BEDIs by providing role models, networking, mentoring, and training in safe, affordable spaces.

Given the success of those programmes, an invitation to a similar training programme in immersive audio was used as the basis for a grounded theory (GT) study to discover the main concerns of participants in immersive audio workshops and how they process those concerns. The study introduces a grounded theory derived from open-ended, semi-structured interviews with 23 participants. Analysis of the data consisted of identifying certain codes and categories; constant comparison of those codes, categories, memos to find patterns and themes; and theoretical sampling. The resulting GT presented in this dissertation is that the main concern of UGs in immersive audio classes is "being viewed as credible", while "leaking up, not leaking out" of the career pipeline is the core category which explains how they attempt to resolve their concerns. They do this by choosing whether to decipher established codes of credibility or to circumvent these codes by going it on their own, pushing, learning, seeking mentorship, innovating, seeking affinity groups, and teaching.

Suggestions for future work include: refining mentorship and training programmes to meet the specific skills identified by participants; identifying "leak points" in the career path; widening studies on participation by including UGs working outside of the major studios that create and distribute music, games, movies, and television content; and shifting the perspectives of gatekeepers who are in a position to modify their recruiting and hiring practices by examining unconscious bias and issues of trust and credibility. Incorporating these strategies have the potential to reshape diversity, equity, and inclusion in immersive audio.

Acknowledgements

A very special “thank you” goes out to the following people without whom this work would not have been possible:

- to all of the participants;
- to my sponsor, Sean Richardson;
- to scholars and data gatherers in the field: Ky Brooks, Kat Young, Brian Schmidt, Erin Barra, Eddie Dobson, Amandine Pras, Jude Brereton, and Monica Hoff to name just a few;
- to my mentors: Dr. Pamela Laird, Dr. Judith Coe, Dr. Helen Scott, Lorrie Evans, and Dr. Michelle Fine;
- to the Board of Directors at Immersive and Inclusive Audio, CIC: Phebean Adedamola Oluwagbemi, Amira Battle, George Hess, and Nathan Freeman;
- to my audio colleagues who were giving of their time and expertise: Alexandria Smith, Emily Lazar, Carolyn Malachi, Master Sgt. Brandie Lane, Will Kennedy, Erin Barra, Mika Sellens, and Anna Bertmark;
- to my family: Andy Bird, Zachary Gaston-Bird, and Kira Gaston-Bird;
- to Anna Whitelock and Lesley Main at City, University of London;
- to everyone I met at a conference in the hallways, cafés, and lobbies and talked to me about their experiences;
- to my proof-readers: Gertie Steinacker, Katherine Ann Wiedeman, Less Lincoln, Lexi Stern, and Kellie Dixon;
- to Karrie Keyes of SoundGirls and Terri Winston of Women’s Audio Mission; and
- to my supervisors, Dr. Russell Mason and Dr. Enzo De Sena.

This project was also made possible with support from: Conception X, Innovate UK’s Women in Innovation Award, and the Avid Learning Collective’s Avid DEI Sponsorship.

Table of Contents

List of Figures

List of Tables

Abbreviations

AA	African American
AAA Game Title	Triple-A Game Title (denotes a game title with a large budget produced by a large studio)
ACI	Avid Certified Instructor
AES	Audio Engineering Society
AES AVAR	Audio Engineering Society's Audio for Virtual and Augmented Reality conference
AVAR	Audio for Virtual and Augmented Reality
BD-A	Blu-ray Disc (Audio)
BECTU	Broadcasting Entertainment Communications and Theatre Union
BEDI	Barriers to Entry and Discouraging Influences
BIPOC	Black, Indigenous, People of Color
BME	Black and Minority Ethnic
BSPs	Basic Social Processes
CAGR	Compound Annual Growth Rate
CAQDAS	Computer-Assisted Qualitative Data Analysis Software
CD	Compact Disc
CRAS	Conservatory of Recording Arts and Sciences
CRT	Critical Race Theory
CUNY	The City University of New York
DA'EF	Digital Audio Ecofeminism
DAMS	Dolby Atmos Mastering Suite
DAPS	Dolby Atmos Production Suite
DAWs	Digital Audio Workstations
DEI	Diversity, Equity, and Inclusion
DoE	Department of Education
DTS	Digital Theater Systems
DVD-Audio	Digital Versatile Disc, Audio
EEOC	Equal Employment Opportunities Commission
GBP	Great Britain Pounds
GPA	Grade Point Average
GT	Grounded Theory
HBCU	Historically Black College or University
HRTFs	Head Related Transfer Functions
HST	Hubble Space Telescope
HST TAC	Hubble Space Telescope Time Allocation Committee
IASIG	Interactive Audio Special Interest Group
IGDA	International Game Developers Association
ITV	Independent Television (A British television network)
LGBTQ	Lesbian, Gay, Bisexual, Transgender, Queer
LGBTQIA+	Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, Intersex, and Asexual
MAGE	Microaggressions around Age

MCUL	Microaggressions around Culture
MDIS	Microaggressions around Disability
MGEN	Microaggressions around Gender
MN	Minnesota
MRET	Microaggressions around Race / Ethnicity
MSOR	Microaggressions around Sexual Orientation
MT	Music Technology
NCLAM	National Center for Leadership in Academic Medicine
NETP	National Education Technology Plan
NPR	National Public Radio
NSBE	National Society of Black Engineers
OTT	Over the Top Television
P(#)	Interview Participant (Number)
ROI	Return on Investment
RQ	Research Question
SAM	Silencing and Marginalization
SDDS	Sony Dynamic Digital Sound
SIG	Special Interest Group
SIP	Summer Immersion Program
SNAAP	Strategic National Arts Alumni Project
SOB	Assumptions of Beauty and Sexual Objectification
STE	Stereotyped
STEM	Science, Technology, Engineering, and Math
UCSD	University of California, San Diego
UCSD SOM	University of California, San Diego School of Medicine
UG	Underrepresented Groups
UKRI	UK Research Institute
URM	Underrepresented Minority
USD	United States Dollar
W.M.	workplace microaggressions
WAM	Women's Audio Mission
WI	Wisconsin
YPAR	Youth Participatory Action Research

Chapter 1: Introduction

Immersive audio allows an audience to experience sound that appears to come from all directions from loudspeakers or headphones. It is a creative approach to sound which has existed in various forms since the early 20th century [Roginska et al., 2017]. Some of the more recognizable formats which have emerged over the last 50 years include quadraphonic sound in the 1970s, Dolby Pro Logic in the 1980s, Dolby Digital®, DTS® (Digital Theater Systems) and SDDS® (Sony Dynamic Digital Sound) in the 1990s, Super Audio CD® and DVD-Audio® in the early 2000s, and more recently, BluRay® discs.

For a while, it seemed as though these formats would disappear as quickly as they emerged. However, their evolution over the last decade hints at growing longevity with cinema formats such as Dolby Atmos® and Auro 3D®; home streaming through Over the Top Television (OTT) devices (Apple TV®, Roku®); video games and virtual / augmented / mixed reality platforms (Oculus®, HTC Vive®), and music streaming platforms with the introduction of Dolby Atmos for Tidal®, Amazon HD, and spatial audio for Apple Music®.

The literature shows there is now demonstrable and sustainable growth in the global market for immersive audio (also called "3D audio"). According to market research published before the coronavirus pandemic, "the global 3D audio market [was] valued at US $3.45 Bn (billion) in 2017" and was forecast to grow "at a CAGR (compound annual growth rate) of 17.2% … from 2018 to 2026" [Credence Research, 2018] to around $14.4 billion. In November 2020, that number was revised to $13.7 billion by 2027 at a rate of 16.1% , showing that the industry suffered a relatively minor impact due to the pandemic [Research and Markets, 2020]. As of 2022, global sales of 3D audio reached $6.6 billion (US dollars) with a growth rate of 15.3%, forecast to reach $16.2 billion from 2022 to 2032 [Future Market Insights, 2022]. The reports includes statistics from Auro, dearVR, Dolby, Sennheiser, Fraunhofer, and Waves Audio Ltd., among others [Credence Research, 2018].

However, as the industry proved to be resilient in the face of tremendous global economic stress, certain societal dynamics are playing out on the world stage such as the continuing fights for social justice and equity by women and minorities. The questions of who has access to the technology and who can participate in the field and in the profession have therefore become important. Fostering participation of women and other minorities in this currently growing profession is key towards ensuring a more diverse audio industry, perhaps more so in immersive audio because of the promise of new job opportunities. This thesis discusses the participation and representation of women and other underrepresented groups in the field of immersive audio, barriers to entry and discouraging influences (BEDIs), remedies to those BEDIs, the concerns of underrepresented groups invited to immersive audio workshops, and how they resolve those concerns.

This chapter covers a background of the format, definition of immersive audio, social context, motivation, and the structure of the thesis.

1.1 Background

The development of immersive technology is happening alongside certain events which create an alignment of cultural tension as well as societal and technological opportunities. This section defines the usage of the term "immersive audio", describes the surrounding social contexts, and gives an overview of how many women in minorities are represented in the field.

1.1.1 Immersive Audio

Immersive audio can be defined as 1) a technology, 2) a field, 3) an industry, and 4) a profession as follows:

1) Immersive audio as a technology: refers to the software and hardware are used to create immersive audio. For example, Digital Audio Workstations (DAWs) are used to route and move (or "pan") sounds in a mix, and the listener experiences these sounds through loudspeakers or headphones. Dolby Atmos and Auro 3D are examples of immersive audio formats available for sharing content between the creator and the consumer. The technology of immersive audio is different from traditional, 2-channel (left and right) stereo music or sound for film and television, because content creators will either:

a) place loudspeakers at locations around a listener to create a sense of immersion, with configurations including but not limited to: two in front and two behind ("quadrophonic"); three in front and two behind, sometimes with a subwoofer ("5.1"); three in front, two on the sides, and two behind with a subwoofer ("7.1"); and a variation of the latter with four speakers placed above ("7.1.4"); or

b) use psychoacoustic filtering ("Head Related Transfer Functions", or "HRTFs") to create the illusion of immersion within a 360º space using only a pair of headphones.

2) Immersive audio as a field: students and professionals who are interested in immersive audio may wish to learn more by studying the subject. There are university degrees that offer single courses or course sequences in immersive audio: for example, the University of Colorado Denver's Recording Arts program has a class called Surround Sound; Belmont University (Tennessee, USA) and the Conservatory of Recording Arts and Sciences (CRAS in Arizona, USA) both offer classes in Dolby Atmos; and the University of Salford and the University of Surrey in the UK offer laboratories for studying spatial audio. Also, at academic and trade conferences focused on audio there are lectures dedicated to immersive sound design. In this instance, immersive audio is an area of study.

3) Immersive audio as an industry: as mentioned in the market research above, manufacturers and content providers are now marketing immersive audio as a way to enjoy music, television, games, and podcasts. “Immersive audio” and “spatial audio” are now buzzwords that are generating curiosity in the general public, and the industry is cashing in on this emerging market by selling headphones such as Apple’s AirPods Pro®, television “sound bars” (some featuring Dolby Atmos integration), loudspeakers, and software to bring immersive audio to consumers.

4) Immersive audio as a profession: some engineers can now offer immersive sound mixing services to content creators, and in this way are able to make a full-time career out of recording, editing, and mixing immersive content.

1.1.2 Social Context

The #MeToo movement, which emerged in 2006 and has continued to grow ever since, served as a wake-up call for the audio industry as evidenced by the emergence of over 70 “all-women and feminist sound/music tech collectives, co-ops, non-profits” as documented by Dr. Liz Dobson [Dobson, 2018b]. Similarly, the racial justice movement in the US received worldwide attention, and the active engagement of music and audio industry organizations to support the Black community represented a notable departure from their usual activities. In the midst of a pandemic that consumed the world in the spring of 2020, a man named George Floyd was pinned down by police. He struggled for breath and eventually died in their custody. His death fuelled another global episode: the fight for racial justice [Cornish et al., 2021]. These events contradicted the assumption (on the part of some) that the status quo was acceptable.

Although some advocates for diversity feared that the pandemic, which began around December 2019, might derail progress in efforts to make improvements in diversity and inclusion across all industries, its relative importance can be illustrated with a quote from a participant in a study called, “Diversity Wins”: “I know we have to deal with COVID-19,” writes the CEO of a consumer-goods company, “but inclusion and diversity is a topic too important to put onto the back burner” [McKinsey & Company, 2020].

In previous years, it may have been hard for some to acknowledge the connection between police brutality and representation in the workforce, but the Floyd incident put these in stark relief as the words “systemic racism” began appearing in news feeds around the world. In fact, the following is only a partial list of media and entertainment companies, some specifically dedicated to audio, that directly acknowledged the problem of racism as people took to the streets to air their grievances:

- The Audio Engineering Society (AES) stated, "We condemn racism and brutality in the strongest terms and appreciate the outpouring of concern and support that has come from our international community. We support the Black community, we believe that Black lives matter, and we stand with those who are affected by systemic and institutionalized racism" [Audio Engineering Society, 2020].

- The Association of Motion Picture Sound posted the following: "AMPS supports any attempts to end racism and discrimination. We stand in solidarity with those fighting for change. We need to listen more, to learn more, to understand more, to do more and to change more" [Association of Motion Picture Sound, 2020].

- The Recording Academy partnered with Color of Change, the "largest online racial justice organization in the United States", so that the two could "work together to identify key opportunities to drive and influence change in the music industry, and … be dedicated to building power for Black music creators and professionals" [Aswad, 2020].

- SoundGirls.org pointed out that gestures like "blackout day" (where social media users could replace their profile photos with an all-black graphic) were not effective at social change. Instead, they "used the day to share information for protesters, Anti-Racist resources, reading materials, and organizations that are doing the hard work. We hope those working in the music industry will use their platforms every single day, not just one to support Black Artists" [SoundGirls.org, 2020].

- She Shreds posted a statement that "as musicians, we carry a certain responsibility to distribute … awareness. The very foundations of America are rooted in racism and the destruction of black bodies, and we cannot ignore it or brush it off as something that doesn't affect us or claim that politics aren't a part of music—because it does, and it is" [She Shreds Staff, 2020]. They also offered a compilation of several anti-racist organizations, charities, and advocacy resources.

- Sony Music developed a $100 million fund "to support social justice and anti-racist initiatives around the world. The Company, inclusive of all of its recorded music and content divisions and music publishing company, will immediately begin to donate to organizations that foster equal rights" [Sony Music, 2020].

1.1.3 Representation

There is growing evidence about the lack of diversity in the entertainment and audio industries, particularly in spatial and immersive audio, but to what degree? The evidence comes from both academic and non-academic sources; for example, the title of an article published in The Atlantic magazine asks, *Why Aren't There More Women Working in Audio?* [Lanzendorfer, 2017] The piece first focuses the experience of girls participating in a "live sound camp" organized by SoundGirls.org; followed by accounts of women working in the music industry as producers who are missing from the Billboard charts; the complete absence of Grammy-winning female producers in the "Best Producer: Non-Classical" category; and women who produce but whose technical contributions are downplayed, including Janet Jackson, Björk, Mariah Carey, and Sheryl Crow) [Lanzendorfer, 2017].

Even academic sources citing data on participation of underrepresented groups (UGs) in audio rely on industry statistics: Hepworth et al., in their book *Gender and Music Production*, [2020]; Brooks et al. in their journal article on microaggressions titled *Do We Really Want to Keep the Gate Threshold That High?* [2021]; and Buckingham et al.'s "Factors Contributing to Gender Imbalance in the Audio Industry" [2019] all rely on the study, "Inclusion in the Recording Studio?" by the Annenberg Inclusion Initiative. According to the Initiative's website, they are the "leading think tank in the world studying diversity and inclusion in entertainment through original research and sponsored projects" [Annenberg Inclusion Initiative, 2022].

Thus, in order to get a sense of how rare minoritized[1] audio engineers and creators are in the field of audio in general and immersive audio in particular, engagement with current academic literature, academic conference panels, interviews with industry leaders, "think tanks", and artist profiles and groups on social media is necessary.

1.2 Research Questions

Diverse viewpoints and cultural backgrounds should be part of a creative landscape where stories are being told and information is being presented using an emerging new media format. Examples of the value that diversity brings include: increased profitability [McKinsey & Company, 2020]; trust and engagement between health professionals and the public [Kapadia et al., 2022]; and potentially life enriching relationships with people from different cultures [Allen, 2011].

However, underrepresented groups sometimes face resistance to their efforts to participate in creative and entertainment spaces, such as instances where women faced hostility (including death threats) when trying to change male-dominated "gamer culture" [Todd, 2015].

[1] "Minoritized" denotes a socially constructed nature of underrepresentation and disadvantage [Casado Perez, J., 2019].

So what should the action be? This research aims to investigate the factors contributing to the dearth of representation along with potential remedies, and in doing so, contribute to the ongoing discussion about improving representation in immersive audio. Thus, the following research questions are asked:

1) what is the current data regarding the participation of UGs (RQ1);

2) what are the barriers to entry and discouraging influences (BEDIs) which exist in immersive audio (RQ2);

3) how might these BEDIs be removed (RQ3); and

4) based on RQ3 discover what are the main concerns of participants in immersive audio workshops (RQ4a) and how they process those concerns (RQ4b)?

1.3 Motivation

The motivation for this paper came from the researcher's lived experiences of being an audio engineer who is also a woman and minority whose identity is Black and African American. The researcher has been involved with and held leadership roles in the Audio Engineering Society, SoundGirls, the Recording Academy, Association for Motion Picture Sound, Cinema Audio Society, and Motion Picture Sound Editors. Through her career she wrote the book *Women in Audio*, which showcases women role models and describes the emergence of affinity groups for women in audio. Through her studies she has learned about the dearth of representation, but very few qualitative studies show what happens to these people on their journeys to discover how are they doing and what are they doing to cope, thrive, and succeed.

1.4 Structure

The following chapters provide answers to these questions, as well as a methodology for developing the final grounded theory (GT):

Chapter 2: "Participation" addresses RQ1 by showing data related to representation and participation by women and minorities in audio-related fields which utilise immersive audio.

Chapter 3: "Barriers to Entry and Discouraging Influences (BEDIs)" addresses RQ2 by identifying BEDIs for women and minorities in audio fields, and sets up a comparison with non-industry-specific fields within Science, Technology, Engineering and Math including medicine ("STEM"). The BEDIs discussed include gender-, age-, and race-based discrimination; microaggressions; gatekeeping and unconscious bias; and economic factors including access to technology via educational programmes.

Chapter 4: "Removing Barriers" addresses RQ3 by showing a number of successful programmes which aim to change the landscape of participation. Examples are given by looking at other STEM fields and the emergence of feminist audio collectives and minority-led organizations in the field of audio.

Chapter 5: “Methodology” describes the classic GT approach undertaken in the project, including coding, analytical memoing, and theoretical sampling, along with the recruiting strategy and interview questions.

Chapter 6: “Data Analysis” provides details about participant experiences in the way described by the GT methodology. Included is a description about the population under study, subgroups of that population, and emergent themes. This section also presents the emergent theory.

Chapter 7: “Theory” summarizes the theory and main findings along with comments. It also discusses limitations of the study and future research.

Chapter 8: “Conclusion” synthesizes the answers to the four research questions and reveals original contributions to knowledge that have the potential to strengthen diversity and inclusion in the field of immersive audio.

Chapter 2: Participation

In order to address the problem of underrepresentation, it is important to understand the current climate in the immersive audio industry. As alluded to in the introduction, the participation of UGs is not equal to that of white males in audio engineering, but it is necessary to determine the degree of this inequality, and in doing so, describe the extent of the problem and establish a baseline from which to demonstrate improvement.

Therefore, this chapter examines current participation and barriers to that participation in immersive audio by asking, "what is the current data regarding the participation of UGs (RQ1)?"

In order to answer this question, this report reviews present work related to the related field of music production; provides a look at the demographics of the Audio Engineering Society; and discusses of representation and participation in a variety of audio-related fields in which utilise immersive audio (such as game sound and sound for film and television).

2.1 Current Representation and Participation

Trying to determine current representation and a "rate of participation" specifically for immersive audio is difficult because a) some recent surveys are not specific to this discipline, and b) immersive audio itself is used in a combination of industries: radio; film and television; video games; VR/AR/MR; and sound art, among others, resulting in a fragmented field which makes getting data more difficult. Nonetheless, we can examine a few recent studies to get an idea of the extent of the problem.

2.1.1 The Annenberg Inclusion Study

Efforts have been made in the music industry to survey the participation of women in order to help drive change. In 2018, the Annenberg Inclusion Initiative published a report called "Inclusion in the Recording Studio? Gender and Race/Ethnicity of Artists, Songwriters & Producers across 600 Popular Songs from 2012–2017". The statistics for women who work as producers on hit-making songs are very bleak (only 2.1%; see Table 2-1) – and even more so for women of color (just four) [Smith et al., 2018], [Gaston-Bird, 2019].

Artists	Songwriters	Producers
21.7%	12.3%	2.1%

Table 2-1: Percentage of women across who have contributed to the Billboard charting songs in the music industry from 2012-2017. Only 2% are producers. [Smith et al., 2018]

However, Erin Barra (formerly Erin Barra-Jean), co-author of a study titled *Women in the US MUSic IndUStry (sic): Obstacles and Opportunities* [Prior et al., 2019] emphasizes that these numbers must be used carefully. She took to Instagram to air her grievances in an "all-caps" tirade:

> *"THIS BOTHERS ME A LOT SO I'M GOING TO SAY SOMETHING HERE. WHEN YOU USE THE 'LESS THAN 2% OF WOMEN ARE PRODUCERS' STAT, YOU ARE COMPLETELY DISTORTING THE DATA. THE CORRECT PHRASE IS 'OUT OF A SUBSET OF 600 SONGS THAT HIT THE HOT 100 CHARTS, 2.6% OF THEM WERE WOMEN.*
>
> *"...THERE ARE A [expletive] MORE WOMEN PRODUCING THAN 2% AND WHEN YOU SAY THINGS LIKE THAT, YOU RENDER A TSUNAMI OF WOMEN INVISIBLE. WE'RE HERE. THERE ARE MANY OF US. WE HAVEN'T BEEN GIVEN THE SAME ACCESS AND OPPORTUNITY TO HIT AN ARBITRARY AND RIDICULOUS LEVEL OF SUCCESS TO APPARENTLY MATTER ENOUGH TO BE COUNTED.*
>
> *"I KNOW THE STAT IS COMPELLING FROM A FUNDRAISING STANDPOINT AND IT GETS PEOPLE WOUND UP. BUT I HAVE BEEN DOING THIS WORK FOR FAAARRRR TOO LONG TO LET THIS 2% THING FLY. THERE ARE SO MANY MORE OF US NOW AND WE ARE INCREDIBLE - WE JUST DON'T HAVE HOT 100 HITS" [Barra, 2021].*

This quote is important because:

- Barra frames representation in terms of visibility (see: **Error! Reference source not found.**, "**Error! Reference source not found.**");
- Barra outlines the criteria for being counted as "being successful" and "worthy" (see: 3.1.3 "Gatekeeping and Unconscious Bias"); and
- Barra notes that women have not been given the same access and opportunity (see: 3.2.3, "Discrimination in the Music Industry").

To further frame this issue, Barra responds to a comment on her post which laments the exclusion of gender non-conforming individuals. Barra replied that the Annenberg report "assigned gender identities to people based upon Google searches" [Barra, 2021]. (According to the Annenberg report, "the gender of each artist was obtained using evidence from online sources including photos, pronoun usage, and other referents" [Smith et al., 2018]).

Another important conclusion from Barra's retort is that she did not supply any numbers to support what constitutes a "tsunami of women". Given Barra's expertise in studying representation of women in the music industry, this illustrates a need for more research so that we can have a true picture of how many women are working in the field and at what level (i.e., "hit makers" versus "non-hit makers"). Similarly, corresponding data for immersive audio should be gathered.

In response to the Annenberg Inclusion Study, 650 individuals took a pledge to work with a woman producer or engineer as part of the #womeninthemix campaign. Of those 650, 25 were represented across the 2021 Billboard Hot 100 Year-End Chart. Of those 25, only four worked with a female producer, and five worked with a female engineer. [Hernandez et al., 2022]

"From these results," write the authors of the Annenberg Inclusion Study, "it is difficult to see how the Women in the Mix (#womeninthemix) pledge has impacted the ranks of women producers or engineers on some of the most profitable songs in the industry. While the pledge may facilitate women's involvement in less popular songs, women still are not reaching the top of the industry as producers and engineers" [ibid.].

2.1.2 Women at AES Conferences

Due to the lack of demographic data available, and before a 2019 AES membership survey, Young et al. in their report "The Impact of Gender on Conference Authorship in Audio Engineering: Analysis Using a New Data Collection Method," [2018] took an innovative approach towards the goal of determining how many women participate at AES conferences. By generating a list of authors from conference proceedings between the years 2012-2019, the researchers gathered 1,761 "data points" which represented 20 conferences and 702 presentations. In order to determine gender, they relied on a) personal knowledge of the author, b) published biographies, c) email requests, d) cross-referencing names with a site called Behind the Name (www.behindthename.com), and e) photographs. If none of these efforts yielded a response, an answer of "unknown" was entered. The limitations of this data collection method are discussed in depth within the paper; however, most obstacles were successfully mitigated. For example, a name like "Andrea" might be feminine in the US but masculine in Europe, but a photograph or email would help put the question to rest. Likewise, an email was sent to every author asking for their preferred pronoun, thus non-binary and gender non-conforming people could be included in the results. The time-consuming nature of this research was also cited as a limitation and pointed to the need for more robust demographic data collection in general [ibid.].

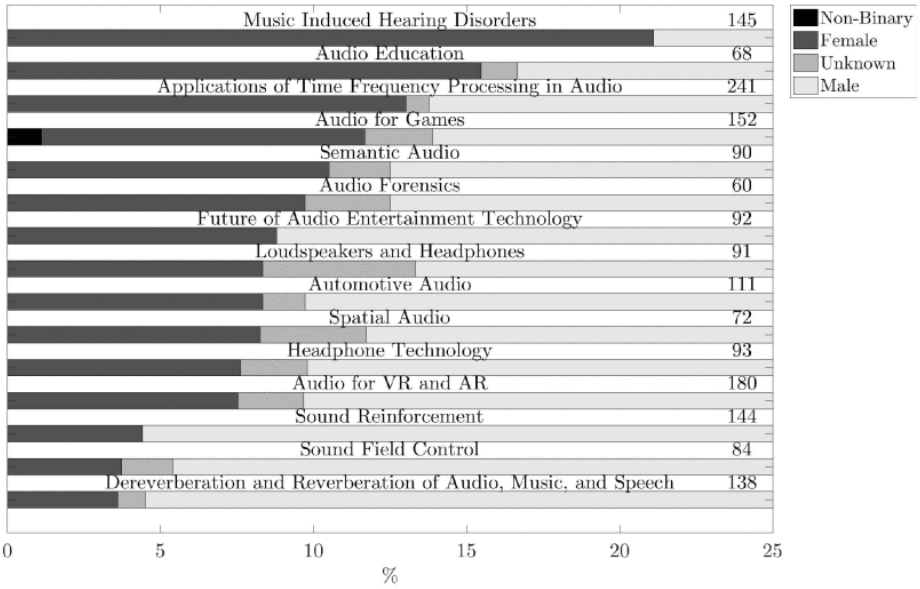

Figure 2-1: Gender composition by conference topic, where the number on the right is the population size for each topic [Young et al., 2018].

In Figure 2-1, a lack of representation is apparent for women in sound reinforcement, de-reverberation of audio, and soundfield control (all less than 5%), followed by audio for VR and AR and by headphone technology (approximately 7% each). Spatial audio, automotive audio, and "the future of audio entertainment technology" are among those with 10% or fewer women represented. Note the maximum representation on the x axis is 25% [ibid.].

An interactive visualisation of the data comparing the years 2012-2016 to 2012-2019 was uploaded by Young and their colleagues, and shows an improvement in participation by women in the Audio for AR and VR category (almost doubling from 7.53% to 13.06%), while other categories remained roughly the same [Young et al., 2019]. The increase of women participating in the Audio for AR and VR category may be due in part to two factors: 1) organizers of the AVAR conference making a pledge to increase speaker diversity, and 2) the occurrence of a focused AES AVAR Conference at the University of York, which lent an additional opportunity to participate outside of the bi-annual convention (AES conferences can be on any topic; therefore, it was coincidental that there happened to be an AVAR conference during the period of time studied). In the first case, on behalf of the 2018 AES AVAR organizing committee, Matt Klassen asked the AES to "set aside a portion of the proceeds from this conference to support diversity among speakers invited to future AES conferences" [AES AVAR Committee, 2018].

2.2 AES Membership Demographics

Eager to get better demographic data, the Audio Engineering Society (AES)[2] deployed a survey to its approximately 12,000 members in September 2019. A total of 1,622 people participated, representing a response rate between 10 and 15% (assuming all 12,000 members were reached). The survey was not explicitly designed as a "D&I (Diversity and Inclusion)" survey; in fact, the questions aimed at demographic data were marked as optional, so some answers had fewer responses.

Table 2-2 shows the results of Question 45, "What is your racial or ethnic identity?" A total of 1,569 of 1,622 respondents answered, but the total responses given are 1,632. This may reflect the fact that people could choose more than one answer to reflect their multi-ethnicity. Almost 78% (1,219) of respondents identified as "White or Caucasian", and no other single category totalled more than 10%. The next two highest-ranking answers were "Hispanic" (8.8%) and "None of the above" (5.93%). In the category "None of the above", answers included "Jewish" (2), "European" (30), "Australian" (1), "Puerto Rican" (1), "African" (1), "mixed" (4), "American" (1), "Italian" (4), "Brazilian" (2), "Japanese" (1), "Swiss German" (1), and "Hungarian" (1). With the exception of "Jewish", it seems some respondents equated "race or ethnicity" with "nationality". Unfortunately, there was no geographic data to accompany the survey, which would have provided interesting insights into geographical diversity as well.

Also in the category "None of the above", several people left angry, facetious, or admonishing comments, reflecting some of the hostility and pushback surrounding diversity work; however, the AES has only agreed to allow the aggregate data to be published, not the comments.

[2] Full disclosure: At the time of writing, the researcher is President-Elect for the Audio Engineering Society.

Race or Ethnicity	Percentage	# of Responses
Pacific Islander	0.19%	3
American Indian or Alaskan Native	0.38%	6
South Asian	0.89%	14
Middle Eastern	1.40%	22
Southeast Asian	1.91%	30
Black or African American	1.98%	31
East Asian	4.84%	76
None of the above (please specify)	5.93%	93
Hispanic/Latinx	8.80%	138
White or Caucasian	77.69%	1,219

Table 2-2: AES Demographic Survey Question 45: "What is your racial or ethnic identity?" [Audio Engineering Society, 2019] Used with permission.

Table 2-3 (below) shows the results of question 43 on the AES survey, "What is your gender?" A total of 1,615 people answered. The total of men is 1,472 or about 91% of respondents. The total of women is 124, or 7.68% of respondents. There are 5 people who identify as gender non-conforming and 6 who identify as non-binary, with 12 people responding their choice was not represented. Only one of the 12 responding with an alternate choice put "transgender"; unfortunately, the other 11 people used the response to write facetious remarks, which in itself is a commentary on the sometimes unwelcoming environment in which many marginalized groups find themselves working.

Gender identity	Percentage	# of Responses
Gender non-conforming	0.31%	5
Non-binary	0.37%	6
Not listed above (please specify)	0.74%	12
Woman	7.68%	124
Man	91.15%	1,472

Table 2-3: AES Demographic Survey Question 43: "What is your gender identity?" [Audio Engineering Society, 2019] Used with permission.

2.2.1 Facebook Data

Inspired by the results of Young et al. [2018], the researcher embarked on an empirical observation of the Facebook group "Atmos Mixing Professionals" (which has since been renamed to "Atmos Music Mixing Professionals"); however, the method presented here did not include emailing or messaging participants in the group to request gender-identifying pronouns. This means it was not possible to identify non-binary or gender non-conforming people. Similarly, people of mixed race were not identified. There are over 2,000 members of the group but only 1,581 profiles are viewable in the "Members" menu, from which data was gathered from around 832 people using their names and profile pictures.

Male	Female	Unknown	Total
808	18	6	832
97.12%	2.16%	0.72%	

Table 2-4: Atmos Mixing Professionals Facebook Group: Gender [Gaston-Bird et al., 2021].

White	Asian	Hispanic	Black	Unknown	Total
651	85	77	8	9	830
78.43%	10.24%	9.28%	0.96%	1.08%	

Table 2-5: Atmos Mixing Professionals Facebook Group: Ethnicity [Gaston-Bird et al., 2021].

Fewer than 3.6% of group participants appear to be female, with Asian and Hispanic individuals representing 10% each of the group's total. Fewer than 1% of participants appear to be Black or of Black origin. However, as a reminder, the use of this survey instrument is limited to audio engineers who use Facebook and who are aware of and choose to join the "Atmos Mixing Professionals" group. As a side note, the numbers are not equal (832 observations of gender and 830 observations of ethnicity) because in some cases there were no profile pictures, only names.

The results (shown in Figure 2-2) were confirmed by group administrators in 2022 and are being used with permission. Two percent of members are women (blue bars), with the majority of women being between 25-34 years of age.

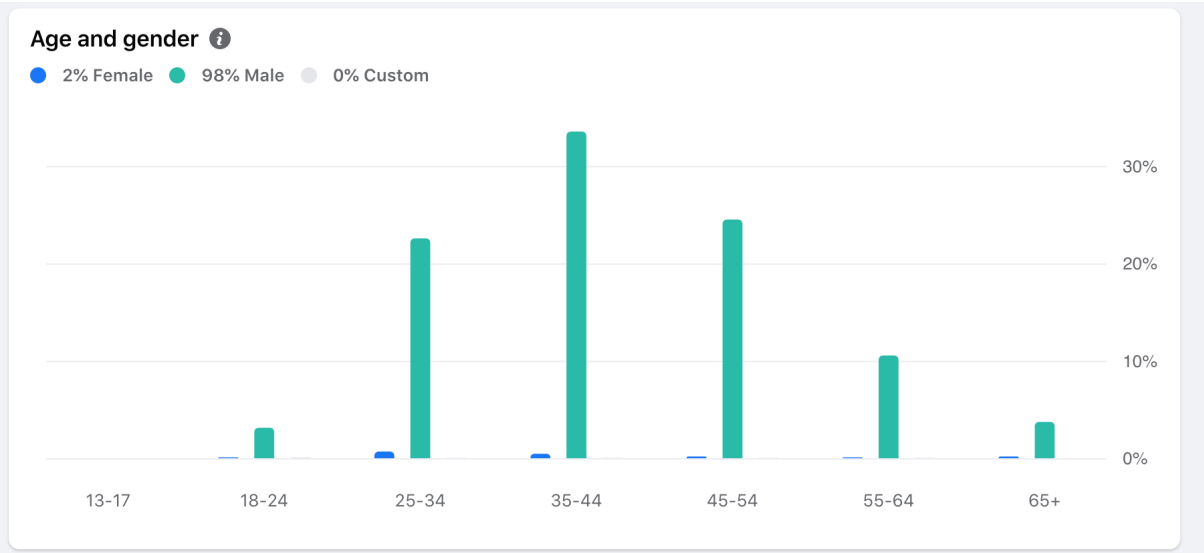

Figure 2-2: Membership in the Atmos Music Mixing Professionals Facebook group (used with permission)

Thus, if this group was considered to be representative of all groups on social media related to immersive audio, the representation is worse for women and people of color than it is for the field of audio engineering as a whole.

However, there is another Facebook group called "Spatial Audio in VR/AR/MR," which, at the time of writing, has approximately 11,800 members. The researcher had a preliminary look at her personal contacts ("Facebook friends") who are also in the group: out of 161 of her contacts, 37 are women and six are people of color. In order to eliminate the bias of her contact list, which may contain more UGs based on the nature of her network, the researcher contacted the administrators of that group for its demographics.

The administrators pointed her to two charts, one in 2018 and the other in 2023. Stats about the age and gender balance in the "Spatial Audio in VR/AR/MR" Facebook group are shown in Figure 2-3:

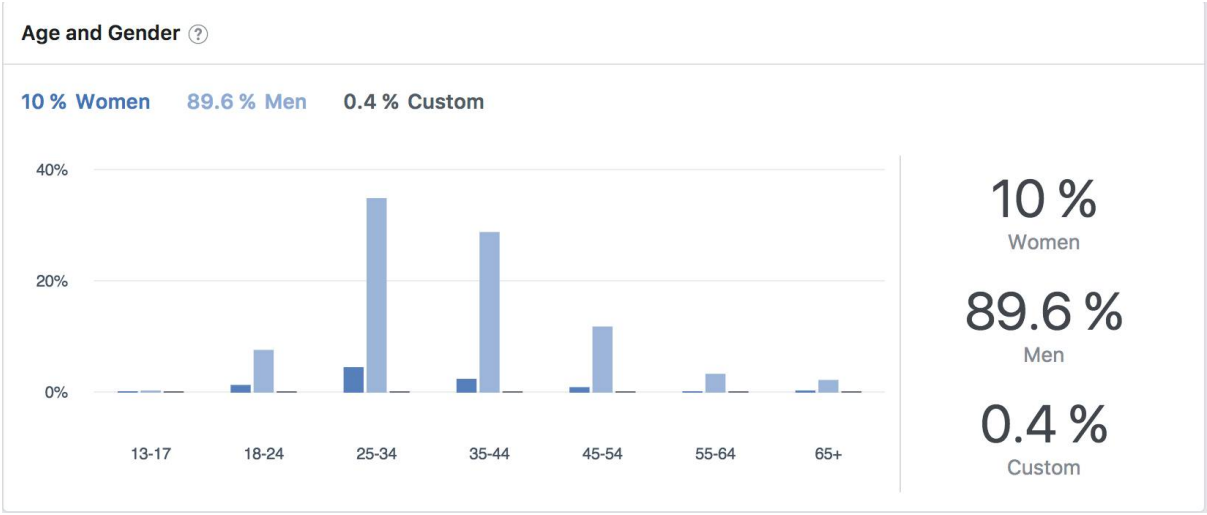

Figure 2-3: Membership in the "Spatial Audio for VR/AR/MR" Facebook group in 2018 (used with permission)

That number has gone down slightly, from 10% to 9%. The results as of 2023 are shown in Figure 2-4:

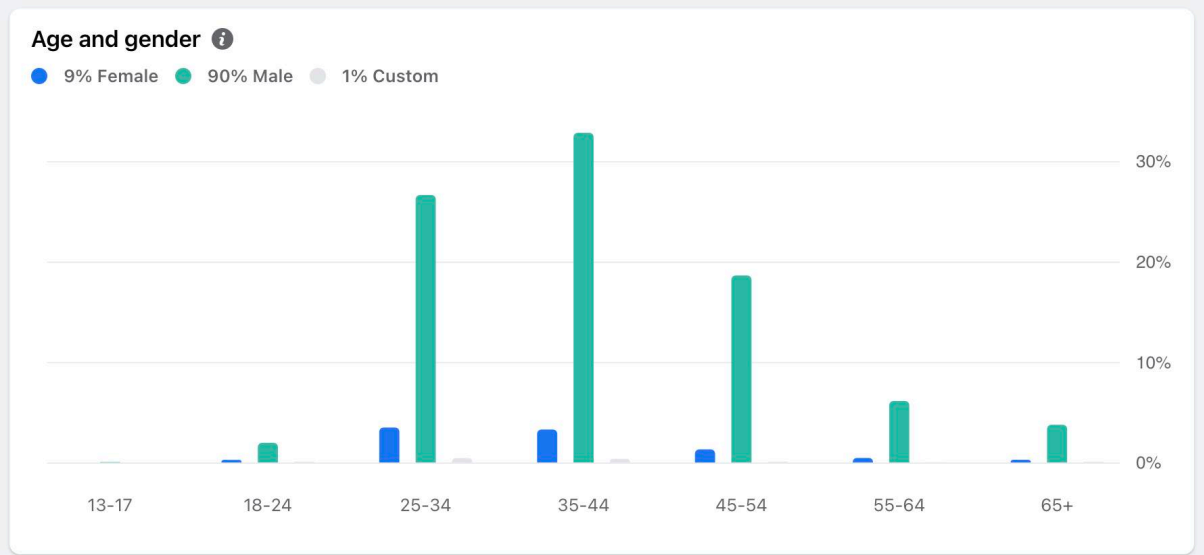

Figure 2-4: Membership in the "Spatial Audio for VR/AR/MR" Facebook group in 2023 (used with permission)

Therefore, two social media groups related to immersive audio also show 10% or less of members are women. These numbers are only relevant for audio engineers who have Facebook accounts, know about the groups, and choose to join them. However, the data is useful because it seems to mirror the industry as a whole based on other findings in this chapter.

2.2.2 Game Sound

In its 2019 survey (see Table 2-6), GameSoundCon.com (the Game Sound Conference website) highlights a difference between the numbers of women working in the US versus the UK. "Considering only salaried employees, breaking down gender makeup by region shows that in the US, the gender imbalance is significantly worse than in UK or the EU (not including the UK). More than 9 in 10 US employees overall reported they were male" [Schmidt, 2019].

	Male	Female	Other/Non-Binary
USA	91.6%	8.4%	0%
UK	83.9%	16.1%	0%
Europe	84.8%	15.2%	0%

Table 2-6: 2019 GameSoundCon Game Audio Industry Survey [Schmidt, 2019].

As of 2021, the number of women in the US had gone up, slightly, but numbers of women who are game audio engineers in the UK and Europe had fallen to 9.2% [Schmidt, 2021].

	Male	Female	Other/Non-Binary
USA	82.3%	13.7%	3.9%
UK	90.8%	9.2%	0%
Europe	89%	10.9%	0%

Table 2-7: 2021 GameSoundCon Game Audio Industry Survey [Schmidt, 2021].

Also, the most recent survey finds that "The salaries of game audio employees for women are generally less than that of their male counterparts" [ibid.]. GameSoundCon.com commissioned an analysis which found that "the difference in salary is most likely attributed to the difference in reported years of experience, and not to any particular systemic bias based on gender." However, they also reported that such a bias was found in its previous study, stating: "this is a different outcome from a previous look into the salary discrepancy between men and women in game audio in 2016, which did find such a [systemic] bias. Of note: in 2016, the average (Mean) years of experience for women was 6.7; it has dropped to 5.3, while increasing for men from 8.9 to 9.3 years. Whether this reflects larger number of less experienced entering the field or experienced women leaving the field could not be determined." If it is true that women with experience are leaving, it could point to yet another example of a "leaky pipeline" [Schmidt, 2021].

2021 was also the first year GameSoundCon.com reported the results of ethnicity. Figure 2-5 shows over 75% of respondents were White / Caucasian, 8.4% were Hispanic/Latino, and 6.3% were Asian. Only 2.6% of respondents identified as Black, and other ethnicities were fractions of a percent each [Schmidt, 2021].

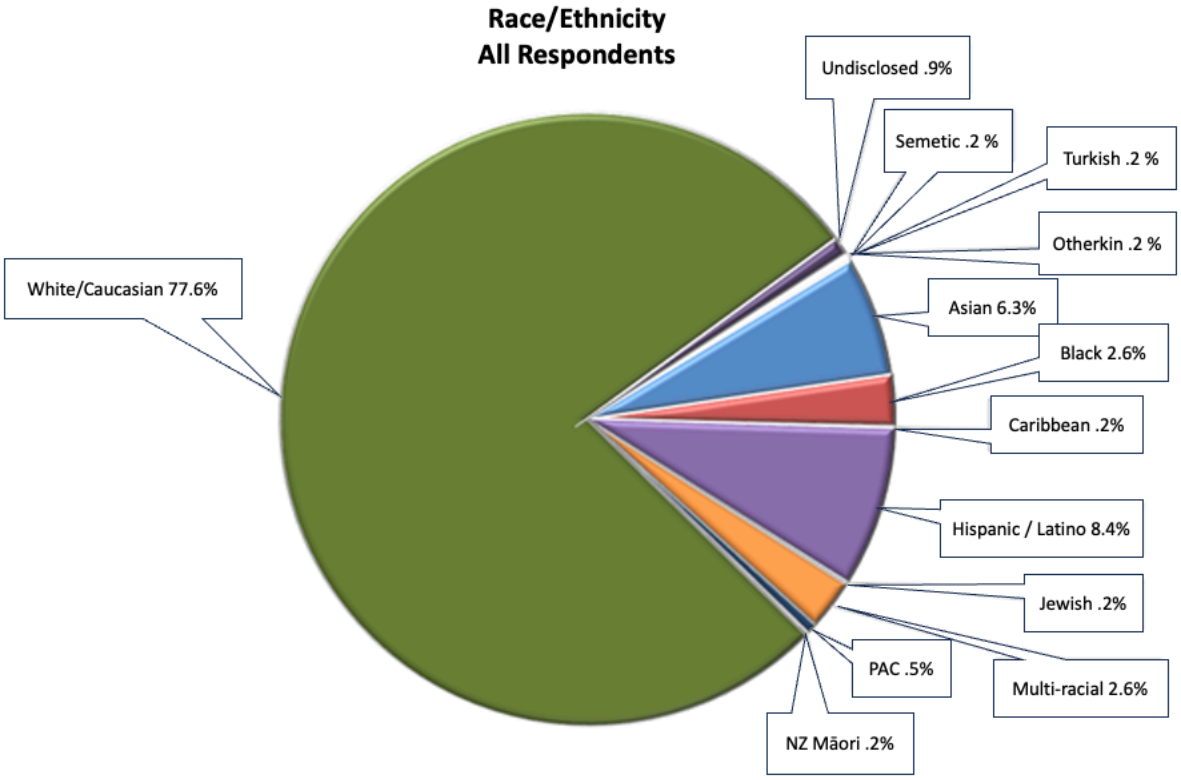

Figure 2-5: GameSoundCon chart of ethnicities in the game sound industry. Over 75% are White / Caucasian with no other group above 9%. [Schmidt, 2021]

Along those lines, four Black composers brought their expertise to an event titled "Being Black in Game Audio: navigating a game audio career while Black," jointly hosted by the IGDA (International Game Developers Association), the Interactive Audio Special Interest Group (IASIG), and Black in Games Special Interest Group (SIG) (see Figure 2-6).

Figure 2-6: Promotional poster for "Being Black in Game Audio" lecture series [International Game Developers Association (IGDA), 2020].

"Despite the public commitment to diversity," began moderator Li Xiao'an, "Black talent continues to be severely underrepresented in a disproportionately white game audio industry" [Roget II et al., 2020]. The panel featured game composers including Jasmine Cooper, Hassan Durant, Chase Bethea, and Wilbert Roget II. Roget stated, "…we're in a situation where not only are there not many of us in total, but especially not in senior or leadership positions. I honestly can't think of a single non-white audio leader or director, and only a small handful of non-male ones" [ibid.].

2.2.3 Sound for Film and Television

In the United States, the Motion Picture Editors Guild released the results of a survey launched by its diversity and inclusion committee.

	Total	Females	Percent
Active Members	8088	1792	22%
Central	90	27	30%
East	880	261	30%
West	7175	1504	21%
Interntaional	32	6	19%
Editorial	6386	1531	24%
Post Sound	1128	101	9%
Lab	72	16	22%
Story Analyst	95	39	41%
Editors	2908	628	22%
Assistant Editors	2070	628	30%

Table 2-8: Motion Picture Editors Guild Membership Statistics [Tucker, 2021]

Of the trades defined in Table 2-8, "Post Sound" is the most likely discipline wherein technicians use immersive sound, such as Dolby Atmos for cinema. It is also the discipline where the presence of women is the lowest (9%).

In the UK, author Emma Butt did a study based on data from *Broadcast Magazine's* quarterly reports on highest-rated shows, on-screen credits, and IMDB. She was specifically focused on the audio post-production roles of dialogue editor, sound effects editor, and re-recording mixer. In terms of racial and ethnic diversity, she found that out of 60 such roles, only one mixed-race person was a member of a post-production sound team. "No other sound team from within the sample included someone from a Black or ethnic minority background of any gender," she reported [Butt, 2020].

In terms of gender diversity, only three white women out of 60 were involved in audio post-production for the highest rated shows on BBC1 and BBC2, and only one white woman was involved for ITV (who worked on two separate productions). Channel 4 had no women, and Channel 5 had one white woman (a re-recording mixer) [ibid.].

2.3 Chapter 2 Summary

To shed light on the present participation in the immersive audio industry (RQ1), data provides context about the numbers of women and underrepresented minorities in various audio-related fields, all of which use immersive audio. Participation data from the Annenberg Inclusion Study, AES membership demographics and conference participation, Motion Picture Editors Group demographics, and a survey of employees creating sound for video games shows that there is a dearth of representation of women and minorities in these disciplines as follows:

- fewer than 2% of producers for popular ("hit") songs were women between 2012-2019, and those numbers have decreased as of the 2021 report;
- fewer than 10% of presentations on immersive audio at AES conferences were done by women;

- there are very few women (less than 2%) and minorities (less than 1%) participating in the Atmos Facebook group;
- there are few women (less than 10%) and minorities (less than 1%) participating in the Spatial Audio in VR/AR/MR Facebook group, and the number has decreased;
- fewer than 10% of people working in sound design for video games in the US are women (around 16% in the UK); the number has gone up in the US but down in the UK slightly;
- fewer than 9% of post sound producers in Hollywood's Motion Picture Editors Group are women, while in the UK only 4 to 5 out of 60 audio post-production roles was held by a woman (around 8.3%), and only 1 of those roles was held by a mixed-race woman;
- very few, if any, leaders or directors in sound at leading ("AAA") game audio companies are Black or female, and fewer than 2% of game sound engineers identify as Black or African American.

All of these are examples of areas where immersive content is created in the audio industry. Barra, in her social media post, lamented the omission of women who are working in the industry but do not have high-profile album credits and visibility. This points to a gap in the literature as there is no data showing how many women are doing this work outside of the top charting songs. Roget's statement that he couldn't think of any senior audio directors who were Black (and only a few women) also points to a gap in the literature: although GameSoundCon.com captured numbers representing the ethnicity of sound designers, it did not look at the ethnicities of people in leadership roles.

Next, in order to understand the factors preventing or dissuading UGs from participating, Chapter 3: "Barriers to Entry and Discouraging Influences" discusses RQ2, "what are the barriers to entry and discouraging influences (BEDIs) which exist in immersive audio (RQ2)?"

Chapter 3: Barriers to Entry and Discouraging Influences

Research Question 2 (RQ2) asks, "what are the barriers to entry and discouraging influences (BEDIs) which exist in immersive audio (RQ2)?" Defining these BEDIs is important because it is not enough simply to observe the lack of representation without trying to understand the underlying mechanisms at work. Rather, the impediments to representation are investigated so that possible solutions are revealed and can be effectively utilised to make inroads to improving representation in the immersive audio industry.

Because similar BEDIs for UGs exist in other industries, a look at these STEM fields (Science, Technology, Engineering, and Math, including medicine) reveals echoes of these themes within the audio industry. Establishing these links will be helpful because remedies to these barriers can be emulated (see: Chapter 4: "Removing Barriers"). Therefore, we look at:

- non-industry-specific BEDIs (3.1); and
- industry-specific BEDIs (3.2).

3.1 Non-industry-specific BEDIs

The immersive audio discipline exists within the larger industry of audio engineering, which includes creative fields such as music production, sound for video games, and sound for film and television. However, the BEDIs which exist in audio are similar to barriers in other STEM industries (including medicine) and corporate environments in the UK and US. What follows is a wider, critical review of gender-, race-, and age-based BEDIs across different disciplines.

The barriers discussed include:

a) gender-, race-, and age-based discrimination (3.1.1);

b) microaggressions (3.1.2);

c) gatekeeping and unconscious bias (3.1.3); and

d) economic factors including access to technology via educational programmes (3.1.4).

3.1.1 Gender-, race-, and age-based discrimination

In the US and UK, it is against the law to discriminate based on gender, race, or age. However, the burden of proof is on the person against whom the offense is committed, and often victims do not feel safe filing a complaint with their supervisor, human resources department, or local civil rights authorities. As just one example, the study "Racism in two UK global health institutions" found "many people of colour feel unsafe, racist incidents are dismissed or 'brushed under the carpet', and distrust of leadership among staff is widespread" [Obasi et al., 2022].

The Equal Employment Opportunity Commission in the US describes discrimination as:

- Unfair treatment because of your race, color, religion, sex (including pregnancy, gender identity, and sexual orientation), national origin, disability, age (age 40 or older), or genetic information.

- Harassment by managers, co-workers, or others in your workplace, because of your race, color, religion, sex (including pregnancy, gender identity, and sexual orientation), national origin, disability, age (age 40 or older), or genetic information.

- Denial of a reasonable workplace change that you need because of your religious beliefs or disability.

- Improper questions about or disclosure of your genetic information or medical information.

- Retaliation because you complained about job discrimination or assisted with a job discrimination proceeding, such as an investigation or lawsuit [U.S. Equal Employment Opportunity Commission, 2020].

In the United Kingdom, discrimination is defined as:

- direct discrimination - treating someone with a protected characteristic less favourably than others.

- indirect discrimination - putting rules or arrangements in place that apply to everyone, but that put someone with a protected characteristic at an unfair disadvantage.

- harassment - unwanted behaviour linked to a protected characteristic that violates someone's dignity or creates an offensive environment for them.

- victimisation - treating someone unfairly because they've complained about discrimination or harassment [GOV.UK, 2012].

Both the UK and US mention unfair treatment, harassment, and retaliation / victimisation, but in slightly different ways (e.g., "unfair" treatment versus "less favourable" treatment). The commonalities and differences between the two countries are examined by Patrick Simon [2005]. Both countries seek to "redress historical wrongs", and the mechanics of determining how often transgressions occur against a specific group relies on statistical data. The gathering of that data was based on the different wording ("unfair", "less favourable", etc.) and intent used by each country's respective agency. As Simon puts it, "Statistical data make it possible to attack subtle and disguised forms of discrimination, in other words to make the invisible visible" [Simon, 2005]. However, both the Employment Opportunity Act passed in the US (1972) and the Equal Opportunities Policies developed in the UK (1984) apply to businesses with over 100 employees. This presents a dilemma for the audio industry, where small recording studios, content creation studios, and freelance workers fall outside of the "critical mass" needed to a) have the necessary data to study and b) adhere to the legislative guidelines around reporting data. For example, only companies with more than 100 employees in the US need to complete an EEO (Equal Employment Opportunities) report which provides data about the ethnicity, race and gender composition of a company [U.S. Equal Employment Opportunity Commission, 2022].

Regarding ageism, Emma Butt [2020] gives an example of a man who experienced ageism in the UK entertainment industry: "What he found was that 'there was certain resentment towards older people'. People working in the industry told him he shouldn't have to start from entry-level positions (due to his age), but took the decision out of his hands by not considering him for these entry-level roles, even though he was prepared to work his way up." [Ibid.]

In addition, although large companies reported demographic data to the government, they did not have to reveal salary info; that is, until an uproar in 2017 regarding the gender-based salary gap at the BBC, where women journalists were found to have earned up to 50% less than their male counterparts [Simpson et al., 2020]. That year, businesses with over 250 employees were required by law to report information on gender-based salary discrepancies [Government Equalities Office, 2020], but as of 2021 they do not have to report the same information for race- or ethnicity-based salary discrepancies [House of Lords Library, 2021].

Thus, an important question arises: is it the case that you cannot legislate what you cannot measure? Perhaps this is why scholars and industry think tanks are eager to gather as much data as possible: despite legislation prohibiting it, the problems of discrimination persist. With such data, advocates for equality can expose inequity and work for change at the institutional level. It is that type of change which dissertations like this seek to affect in the long term.

3.1.1.1 Sexism

Sexism is a specific type of gender-based discrimination [Encyclopedia Brittanica, n.d.]. In their paper, "Is it just me, or was that sexist?" authors Kirkman et al. [2020], state, "women do not identify sexism as such every time it occurs".

The term “intersectionality” refers to people who might fit more than one group; for example, an African American woman would be part of two minoritized groups. According to Tanja Takala [2018], “Black women often experience discrimination which is qualitatively different from racism experienced by Black men or sexism experienced by White women” [Ibid.].

Following this description, other characteristics can add to the layers of identity and complexity; for example, a younger Black woman, an older LGBTQIA+[3] woman, etc.

Recognizing sexism and intersectionality is necessary to discover possible solutions to improving representation in the immersive audio industry because they both play a significant role in limiting opportunities. The research by Kirkman et al. emphasizes that women may not always recognize sexism when it occurs, highlighting the need for awareness and education, while Takala's article underscores the complexity of overlapping identities, such as age, sexual orientation, and race, which may further exacerbate the challenges faced by individuals seeking opportunities.

3.1.1.2 Corporate barriers

According to the research firm McKinsey and Company, [2020] “Black women face the greatest barriers to progress in the workplace, a consequence of accumulation of different forms of discrimination, including racism, sexism, and classism”. They go on to cite their previous study, “Women in the Workplace”, which shows that “for every 100 men who receive their first promotion from entry level to manager, only 79 women receive that same promotion. For black women that number is 60” [Huang et al., 2019].

McKinsey surveyed 15 countries and found that in each, the average percentage of women represented of all races and ethnicities on executive teams was less than 28% (Norway), 21% (United States), and 18% (United Kingdom). Figure 3-1 below shows the average percentage as a blue bar overlaid with a black bar showing the percentage of companies with at least one woman on the executive team.

[3] (Lesbian, Gay, Bisexual, Transgender, Queer or Questioning, Intersex, and Asexual (the "+" symbolizes other sexual orientations and gender identities not explicitly listed in the acronym)

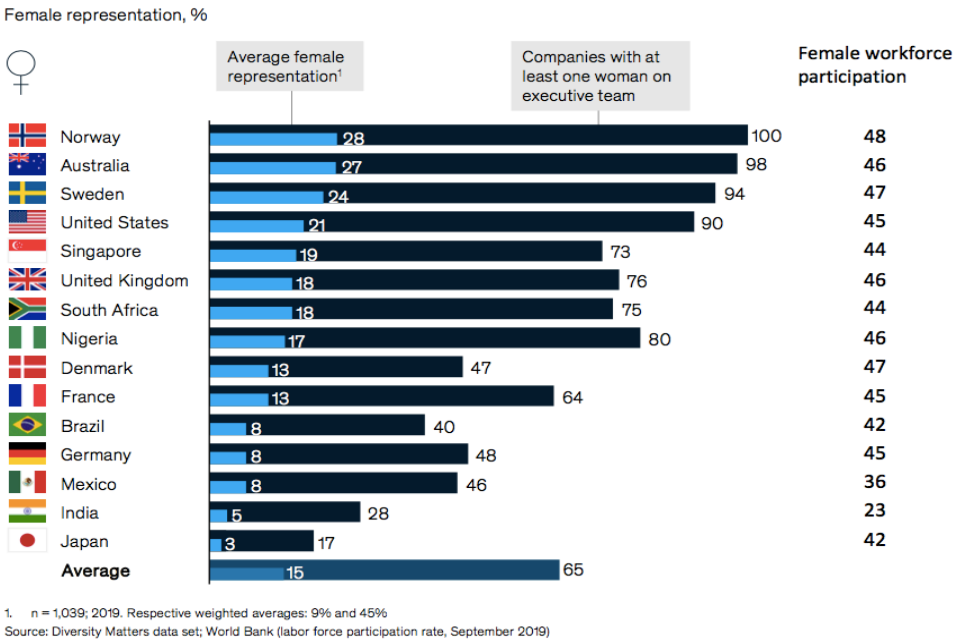

Figure 3-1: In nearly all 15 countries surveyed, women are underrepresented on executive teams [McKinsey & Company, 2020].

Between 2015 and 2019, McKinsey surveyed 250,000 women and held 100 one-to-one interviews. The survey found that some progress has been made with companies committing to increase gender diversity, but women still felt as though their gender was a barrier to their advancement, and the perception of microaggressions remained the same; in fact, Figure 3-2 shows that respondents perceived the representation of women at the managerial level and the representation of women of color had experienced little or no improvement. Similarly, women still felt their gender was a barrier to advancement and that there was no real change in microaggressions toward women.

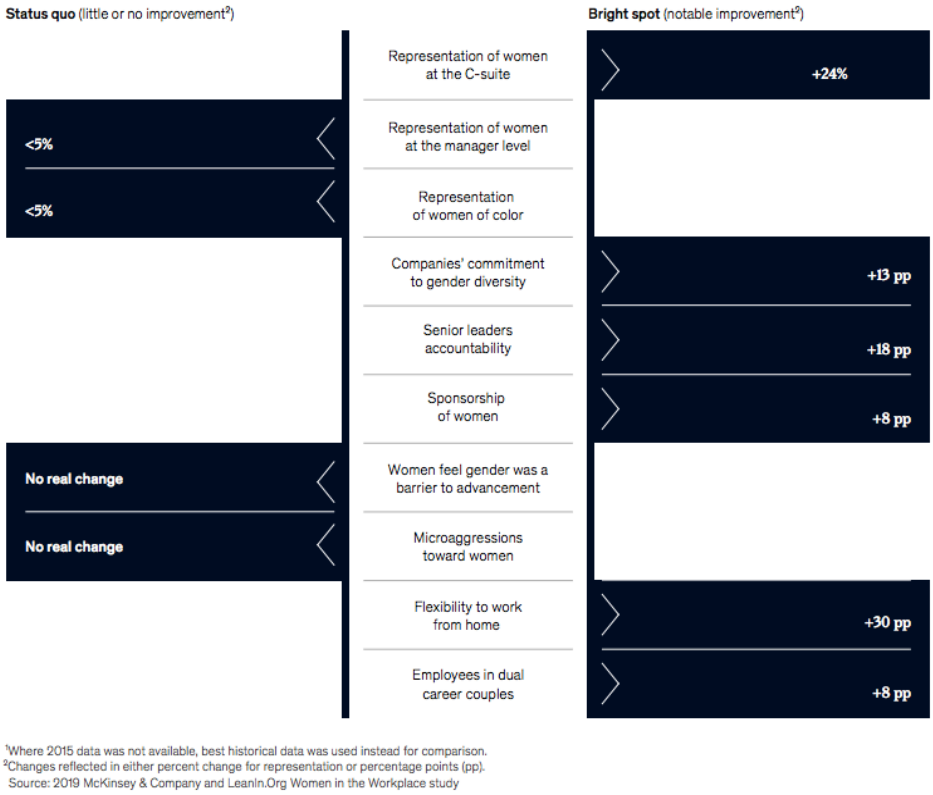

Figure 3-2: How much progress women feel has been made from the years 2015-2019 [McKinsey & Company, 2020].

The findings of McKinsey are echoed in academic literature. One study in particular sets out to demonstrate that this lack of representation is detrimental to company performance, and that corporate firms can benefit from increasing female leadership. The research, "Do Female Executives Make a Difference? The Impact of Female Leadership on Gender Gaps and Firm Performance" [Flabbi et al., 2019] investigates how wage distributions and firm performance is affected by the presence of female executives. Like McKinsey, the authors established the underrepresentation of women in leadership, citing the fact that "women are almost ten times less represented than men in top positions in firms" [ibid.]. However, their findings showed that "a female CEO taking over a male-managed firm with at least 25% women in the workforce increases sales per employee by 3.25%" [ibid.]. This finding could be an incentive for corporations to diversify their workplaces and place women in decision-making positions; nonetheless, McKinsey's research shows that progress is very slow, as shown in Figure 3 2.

Possible causes of this resistance are discussed in depth in the book *Managing the Organizational Melting pot: Dilemmas of Workplace Diversity* [Prasad, 1997]. Factors include:

- the perception that "diversity programs … may be offering more hype than substance";
- the phenomenon of "white rage" which has "resulted in fierce battles over the literary canon in American universities, the assault on affirmative action, tougher immigration laws in California, the reversal of employment equity laws in Ontario, and 'scientific' claims of superior intelligence of certain racial groups"; and

- organizational monoculturalism, which holds that certain "norms and values do not easily accommodate multicultural preferences on a number of issues, including the boundaries between work and home, the role of work in society, and the conduct of interpersonal relationships within organizations." For example, one manager might be sympathetic to the needs of parenting, but is constrained by the organization's structure for handling parental leave [Prasad, 1997].

3.1.1.3 Discrimination in Lending Practices

Freelancers and small business owners who enter the labour market in the US face another barrier: small business lending practices. This can be traced to a "lack of diversity in venture capital investment firms themselves", according to a hearing on the matter titled *Barriers to Entry in the Tech Industry for Diverse Entrepreneur* [United States Congress Senate Committee on Small Business Entrepreneurship, 2020]. Emilia Dimenco, in her testimony before Congress, highlights the stark differences in access to funding:

> *"Access to capital is particularly hard for women and minority-owned businesses, both debt and equity capital. And it is essential for them also to start growing and expand their businesses … only 2.2 percent of all venture capital funding went to female-founded teams. Black and Latino entrepreneurs received even less, just 1 percent of all start-up financing" [United States Congress Senate Committee on Small Business Entrepreneurship, 2020].*

Geri Agliplay, in her testimony, also painted a bleak picture which details the inequity in lending practices:

> *"… businesses owned by people of color were three times more likely to be denied a loan than non-minority firms, and when they do access alone, their average loan amount is actually less than half the amount of white-owned businesses. And while women-owned businesses are the fastest growing segment of our economy in the United States, research shows women in general start off with fewer assets and receive inequitable access to both loans and venture capital, and women receive nearly 50 percent less funding than their male counterparts. It is this credit gap that hurts the profitability of these small business owners and inhibits their ability to grow" [United States Congress Senate Committee on Small Business Entrepreneurship, 2020].*

In summary, people of color are more likely to be denied a loan, and women receive almost one half of the funding of men, despite the fact that the number of women-led businesses are increasing more rapidly. This credit gap is damaging to these aspiring business owners. A small business loan may be desirable in order to get started (e.g., for building a recording studio), but the statistics on approval rates given above are disappointing.

3.1.1.4 Access to Senior Leaders: "Pull Discrimination"

The research firm Seramount released a report titled *Barriers Underrepresented Groups Face Impact: Advancement & Retention* [Diversity Best Practices, 2016]. They reported that nearly half of white employees (49% men, 40% women) reported they felt they had access to senior leaders at work, while only a third of Black employees (34% men, 30% women) felt that way. "Black professionals don't have the same opportunities to forge relationships with key decision makers", they concluded [ibid.]. For example, one respondent said:

> *"If I were to say to my supervisor, 'I don't know what I want to do, but I want to change my job', that's like saying you don't have it together. But I have white counterparts who say that all the time, and people move mountains to create positions for them" [Diversity Best Practices, 2016]*

This is a type of discrimination Pamela Laird refers to as "pull discrimination": while women and minorities fought for and won legislation against being "pushed out" because of their gender or skin color, power structures are able to stay in place because "pull" discrimination ensures only some people can advance [Laird, 2006]. "Affirmative action programs provided some help by ensuring that individuals had access to some of the same paths for advancement (education, job ladders, in-house training)," summarizes Laura J. Owen in her review of Laird's book. "However," she continues, "they could not completely equalize paths because some access to social capital is social (off-the-job) and women and minorities could still be excluded." [Owen, 2007]

3.1.2 Microaggressions

Microaggressions are another BEDI at work in society that affects women and minorities. Two definitions of microaggressions are given as follows:

- "Microaggressions are verbal, behavioral, or environmental actions (whether intentional or unintentional) that communicate hostility toward oppressed or targeted groups including people of color, women, LGBTQ persons, persons with disabilities, and religious minorities" [The Grainger College of Engineering, 2021].

- "Racial microaggressions are brief and commonplace daily verbal, behavioral, or environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color" [Sue et al., 2007].

Despite the prefix "micro," microaggressions occur daily and are commonplace; also, microaggressions do not necessarily have negative intentions. In Derald Wing Sue's authoritative text, "Racial Microaggressions in Everyday Life: Implications for Clinical Practice" [Sue et al., 2007], Sue and his colleagues provide a table demonstrating themes and examples of comments and situations that can be classified as racial microaggressions and the underlying message of each (see Table 3-1):

Theme & Context	Microaggression	Message
Alien in own land - When Asian Americans and Latino Americans are assumed to be foreign-born - A person asking an Asian American to teach them words in their native language	"Where are you from?" "Where were you born?" "You speak good English."	You are not American. You are a foreigner.
Ascription of intelligence - Assigning intelligence to a person of color on the basis of their race	"You are a credit to your race." "You are so articulate." Asking an Asian person to help with a math or science problem.	People of color are generally not as intelligent as Whites. It is unusual for someone of your race to be intelligent. All Asians are intelligent and good in math/sciences.
Color blindness - Statements that indicate that a White person does not want to acknowledge race	"When I look at you, I don't see color." "America is a melting pot." "There is only one race, the human race."	Denying a person of color's racial/ ethnic experiences. Assimilate/acculturate to the dominant culture. Denying the individual as a racial/ cultural being.
Criminality/assumption of criminal status - A person of color is presumed to be dangerous, criminal, or deviant on the basis of their race	A White man or woman clutching their purse or checking their wallet as a Black or Latino approaches or passes. A store owner following a customer of color around the store. A White person waits to ride the next elevator when a person of color is on it.	You are a criminal. You are going to steal/ You are poor/ You do not belong. You are dangerous.
Denial of individual racism - A statement made when Whites deny their racial biases	"I'm not racist. I have several Black friends." "As a woman, I know what you go through as a racial minority."	I am immune to racism because I have friends of color. Your racial oppression is no different than my gender oppression. I can't be a racist. I'm like you.
Myth of meritocracy - Statements which assert that race does not play a role in life successes	"I believe the most qualified person should get the job." "Everyone can succeed in this society, if they work hard enough."	People of color are given extra unfair benefits because of their race. People of color are lazy and/or incompetent and need to work harder.
Pathologizing cultural values/ communication styles - The notion that the values and communication styles of the dominant/White culture are ideal	Asking a Black person: "Why do you have to be so loud/animated? Just calm down." To an Asian or Latino person: "Why are you so quiet? We want to know what you think. Be more verbal." "Speak up more." Dismissing an individual who brings up race/culture in work/school setting.	Assimilate to dominant culture. Leave your cultural baggage outside.
Second-class citizen - Occurs when a White person is given preferential treatment as a consumer over a person of color	Person of color mistaken for a service worker Having a taxicab pass a person of color and pick up a White passenger	People of color are servants to Whites. They couldn't possibly occupy high-status positions. You are likely to cause trouble and/ or travel to a dangerous neighborhood.

Table 3-1: Examples of Racial Microaggressions [Sue, 2010].

Sue et al. also provide themes and contexts for gender based microaggressions [Sue, 2010], which are adapted here in Table 3-2, which was created by the National Education Association's Center for Social Justice [NEA Center for Social Justice, 2021]:

Theme & Context	Microaggression	Message
Second-class Citizen	In class, an instructor tends to call on male students more frequently than females. Assigning women less important roles; offering better equipment for men in sports facilities	The contributions of female students are less worthy than the contributions of male students. Women do not deserve the same opportunities or benefits as men.*
Sexist Language	Use of the pronoun "he" or the term "guys" to refer to all people.	Women are lesser beings.*
Sexual Objectification	"You look sexy today, what's the occasion?"	How a woman looks is important.*
Traditional Gender Role	"You're a girl, you don't have to be good at math or science." Labelling an assertive female committee chair/dean as a "b____," while describing a male counterpart as a "forceful leader." "Why do you want to take a job away from a man who needs it?"	Women are less capable in math and science. Women are out of line when they are confident or assertive. A woman's place is in the home.*
Denial of the Reality of Sexism	"Men don't stand a chance these days of getting hired because they are the wrong gender."	Women are advantaged in society.*
Myth of Meritocracy	"Men and women have equal opportunities for achievement."	The playing field is even so if women cannot make it, the problem is with them.

Table 3-2: Examples of Gender Microaggressions [NEA Center for Social Justice, 2021]. An asterisk (*) denotes where themes and interpretations from the original text have been incorporated.

Finding a tool for defining and quantifying microaggressions is important because well-meaning, homogeneous groups will flatly deny that they are racist or sexist [Sue, 2010].

One common example is to refer to a Black person as "articulate" in a complimentary way; the negative side of that compliment is the insinuation that being "articulate" is not ordinary for a Black person. Phrases such as "we just want the best person for the job" become loaded with subtext when the group aspired to is predominately white and male; does this mean the "best people" are neither minorities nor women? Recruiting language such as "We can't find enough qualified Black candidates" and "I would gladly hire a qualified woman engineer, if I could find one" are "myth of meritocracy" microaggressions. By defining what a microaggression is and showing the implicit biases that we all hold, a clearer picture emerges about why certain groups are excluded from participating in certain areas, and how the sheer number of these daily experiences accumulates into feelings of self-doubt, anger, anxiety, and even worse, physical health problems and lack of access to equal opportunities [ibid.].

3.1.3 Gatekeeping and Unconscious Bias

Lewin [1947], provides a definition of "gate sections", and describes the "gate keepers" that control them: "Gate sections are governed either by impartial rules or by 'gate keepers. In the latter case an individual or group is 'in power' for making the decision between 'in' or 'out.' Understanding the functioning of the gate becomes equivalent then to understanding the factors which determine the decisions of the gate keepers and changing the social process means influencing or replacing the gate keeper" [Lewin, 1947].

Gates and gatekeeping can be seen in different industries and academic environments. In music, for example, gatekeepers decide "which music reached the public and in what specific form" [Tschmuck, 2006]. In this case, the "gate" is music distribution. In academia, a "gate" could be passage to a specialized or advanced area of learning, and gatekeeping is done with challenging classes meant to limit the students who can progress [Gasiewski et al., 2011]. In journalism and media, gates and gatekeeping are the way news items "find their way from discovery to transmission" [Shoemaker et al., 2001].

According to the Equity Challenge Unit, an organization that works with institutions of higher education on issues related to diversity, equity, and inclusion, unconscious bias is defined as "associations that we hold which, despite being outside our conscious awareness, can have a significant influence on our attitudes and behaviour" [Equity Challenge Unit, 2013].

Gatekeeping and unconscious bias are intertwined; in the field of science there is a desire for rigor (perhaps even perfection) as students are pushed to be excellent and "let in through the gate," while underperforming students are kept out. This seems to be out of necessity because of the demands of the discipline. However, unconscious biases influence the classroom dynamic and decisions about who "gets through the gate", as illustrated in the following sections.

3.1.3.1 Gatekeeping classes / courses

One type of gatekeeping is done by means of a "gatekeeping class" or "gatekeeping course": for example, an introductory math or science class at the university level which is designed by nature to "weed out" lower tier students [Gasiewski et al., 2011]. However, the dynamic between the professor and students is a key part of this "rising to the top". Students are more engaged when their instructor is open to questions, when they feel comfortable asking questions, and when the instructor recognizes their role in helping students succeed [ibid.]. The difference in dynamics is summarised with three categories: "gatekeeper professors", "engaged STEM professors", and "engaged STEM students" (see Table 3-3).

Gatekeeper professor	Engaged STEM professor	Engaged STEM student
Lectures straight from a PowerPoint, reluctant to make slides available	Uses strategies that encourage active learning; encourages cooperation among students	Wants to bolster knowledge for advanced study and exams; eager and resourceful
Impossible to write down everything in the lecture, but students afraid to speak up	Explains a concept, then asks students to explain it to each other while listening for accuracy	Focused on high grades and mastery of material
Disregard different learning styles	Uploads PowerPoint slides, podcasts, or video clips that illuminate difficult-to-grasp material	Meets with peers
Expects students to understand at a sophisticated level	Facilitates student excitement in the classroom through humor, enthusiasm, and practical application	Wants to build rapport with instructor as a teaching assistant
May deflect students from the major by continuously making content feel intimidating and difficult to learn	Uses physical objects to model the concepts in class	Inspired to study the topic more and becomes dedicated to science
Inaccessible through office hours or email	Responds to email and encourages office hour visits	

Table 3-3: Adapted from the composite representations from a qualitative study by Gasiewski et al. in "From Gatekeeping to Engagement: A Multicontextual, Mixed Method Study of Student Academic Engagement in Introductory STEM Courses" [Gasiewski et al., 2011]

However, the access to STEM programmes are themselves subject to gatekeeping. Janssen et al. [2022] found that ethnic- and racial-minority students face discrimination "when interacting with high school guidance counsellors and district administrators, when applying for college admission, when participating in college courses, and when seeking mentorship from graduate advisors." Further, they concluded that "these iterative barriers create a collective system that seeks to oppress and restrict ethnic–racial minorities' educational attainment".

On the topic of why students from all demographics leave science degrees, Daryl Chubin lamented the "difficult culture" in science, stating:

> *"The culture of science says, 'Not everybody is good enough to cut it, and we're going to make it hard for them, and the cream will rise to the top'… I took a Ph.D. in 1973 and people were saying the same thing then. 'Look to your left, look to your right, some of you will be gone.' There's a joy of attrition; demonstrating your manliness, back then it was all manliness, by failing students" [Epstein, 2006].*

Chubin's characterization of "manliness" is troubling, as we also witness the lack of gender parity in STEM fields (see 3.3.1.2: The Leaky Pipeline for Women in STEM). Therefore, the "gatekeepers" seem to be biased in some way. A look at unconscious bias follows in the next section.

3.1.3.2 Unconscious Bias in STEM

> *"Unconscious bias makes choices for persons that are based on racist, sexist, and other negative choices while consciously they may feel they are a good person and would never intentionally make such a choice. This is what I call the "gatekeeper effect" of unconscious bias. It keeps the doors closed to fairness, equality, diversity, and inclusion and is difficult to root out because the persons perpetrating it either don't realize it; or if they do, they aren't motivated to consciously do anything about it." [Landers, 2020]*

Unconscious bias can do a great deal of harm, and is related to gatekeeping because "gatekeepers" may not be aware that these biases affect their decisions about who to "let through the gate". One example comes from astronomy, a STEM field. Large telescopes such as the Hubble Space Telescope (HST) are highly sought-after tools for scientific research, so time is allocated using a peer review process. The objectivity of this review was called into question after a disproportionate number of men were given access to the telescope. One indicator of this inequity was that different review panels had significantly different rankings for incoming requests to use the equipment [Reid, 2014].

In an interview with National Public Radio (NPR), Neill Reid, author of the study "Gender-Correlated Systematics in HST Proposal Selection" [2014], says he was "surprised" at the consistency in the higher number of men given access. "There was a systematic effect", he concluded [Greenfieldboyce, 2022]. Following this, he and his colleagues tried to anonymize papers by using only the initials of applicants (beginning in Cycle 22 in Figure 3-3 and Figure 3-4), but the efforts were fruitless. Next, he reached out to researchers Stefanie Johnson and Jessica Kirk, who had expertise in the area of social sciences.

Johnson and Kirk recommended a stronger method called "dual anonymization". They then reported the outcome of switching to this method, wherein all information about the principal investigator was removed in order to reduce gender bias [Johnson et al., 2020]. Figure 3-3 shows how the dual-anonymization process was used by the Hubble Space Telescope Time Allocation Committee (HST TAC):

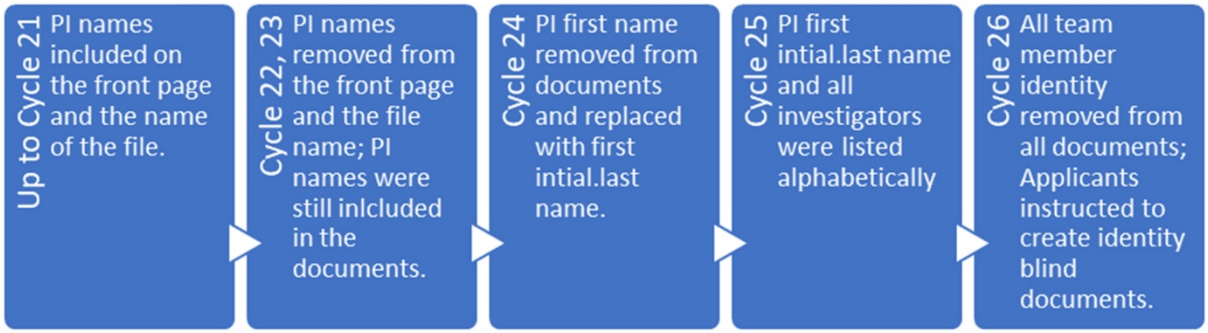

Figure 3-3: Stages of dual-anonymization at HST TAC. Boxes contain additional changes made in each cycle [Johnson et al., 2020].

The HST TAC approves requests during a certain review "cycles". Figure 3 4 shows women were approved at a higher rate than men for the first time in the past 16 cycles as a result of the dual-anonymization process:

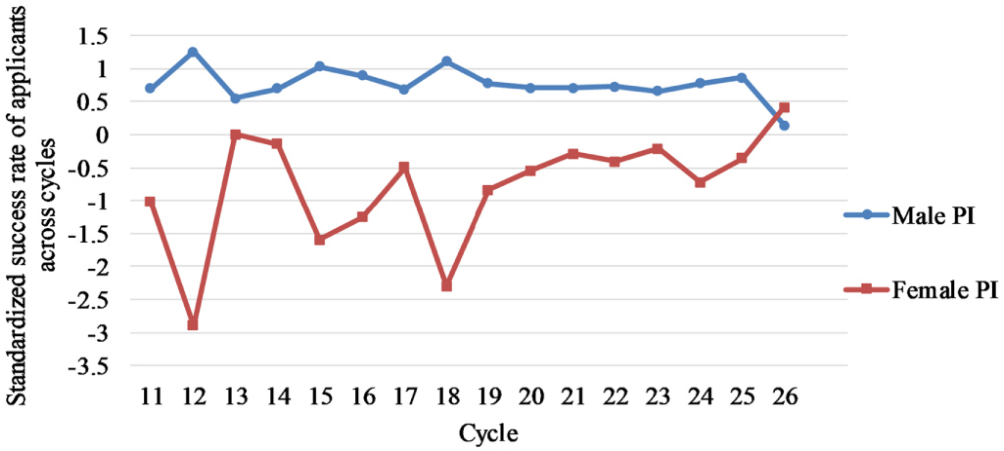

Figure 3-4: Success rate (percent funded divided by percent applied by gender) over the last 16 application cycles at HST TAC. Plot of the standardized residuals controlling for overall percent accepted at each cycle. The blue line represents the acceptance rate for male PIs and the red line represents the acceptance rate for female PIs. HST TAC began making changes to the application process in Cycle 22, although full dual-anonymization was not adopted until Cycle 26 [Johnson et al., 2020].

Johnson and Kirk also discussed their research with NPR and revealed that part of their methodology included sitting in the HST TAC meetings, where they noticed that the reviewers discussed who had submitted the proposal rather than the science itself [Greenfieldboyce, 2022]. Johnson recalled:

> *"There might be a question about it, like, 'Oh, you know, this seems really good but can they actually do this?'" recalls Johnson. "A lot of times, there's someone who will speak up in the room and say, 'I know this person ... they will figure it out, because that's who they are.'" [Greenfieldboyce, 2022]*

The quote above illustrates the aforementioned, "intertwined" nature of unconscious bias and gatekeeping: people who were well-known by the committee had someone to vouch for them and gained access to the equipment (an example of gatekeeping) while lesser known but equally competent applicants were kept out (due to unconscious bias).

3.1.4 Economic Barriers including Access to Technology

3.1.4.1 Access in STEM education

Several studies have established that underrepresented students in their first year of school are equally likely (sometimes more likely) to enrol in science and engineering, but are more likely to change majors, and less likely to complete a STEM degree [Tsui, 2007] (see also: 3.3 "The "Leaky Pipeline"). Success in STEM relies on a number of factors, including:

- Rigorous mathematics and science in high school;
- Teachers with superior mathematics knowledge;
- Access to equipment; and
- Lab activities [Tsui, 2007].

However, socioeconomic status and racial status continue to be tied to educational access, or lack thereof [May et al., 2003]. Figure 3-5 shows that from 1993-1994, some public school teachers delivering math courses did so without a major or certification in the subject, and that figure was highest in schools where there were more minority students.

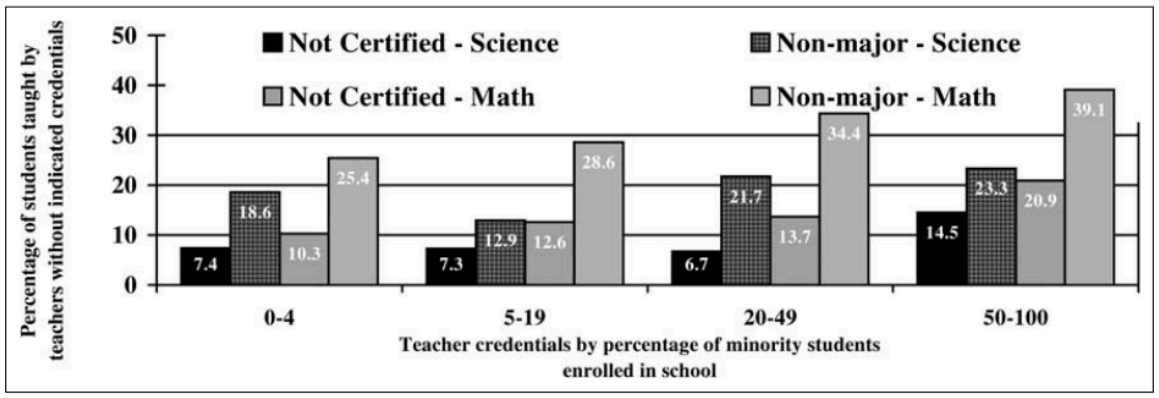

Figure 3-5: Public school teachers of mathematics without a major or certification in class subject, School Year 1993-1994 [May et al., 2003].

This disparity was attributed to a shortage of math and science teachers, leading to the hiring of underqualified teachers. As a result, the authors concluded, "these students are not getting the high-quality instruction needed to succeed in the pursuit of a STEM career such as engineering" [May et al., 2003].

3.2 Industry-specific BEDIs

Chapter 2: "Participation" established that numbers of UGs working within these professions is as low or lower than other disciplines. Perhaps a first step towards improving those numbers is to identify the BEDIs that prevent or dissuade more diverse participation in the audio industry generally, and in immersive and spatial audio specifically. Identification of these barriers will enable more effective targeting of interventions to enable greater access.

Table 3-4 shows examples of where immersive sound technology can be found in different areas of the audio industry:

Music	Dolby Atmos, Sony 360, etc.
	Apple Music "Spatial Audio"
	Blu-ray (BD-A)
	SACD and DVD-Audio
	Quadrophonic
	Live Performance
Television and Film	Auro 3D
	Dolby Atmos
	DTS:X
Game Sound (including audio for virtual and augmented reality)	Auro 3D
	dearVR
	Wwise
	Unity

Table 3-4: Immersive Sound Formats by Discipline

There are some nuances in the different barriers based on the subdisciplines of audio (music, game audio, and sound for film and television). For example, in her upcoming book, *Business Essentials for the Emerging Audio Professional* [2022], author April Tucker shared with the researcher her finding that challenges for women were not the same for women across disciplines. "For example," Tucker said, "in video games, you can apply to a job posting (that you find publicly online) and could actually have a chance at an interview just by having a really great and interesting demo. Fundamentally, it's the quality of your work that opens the door. Whereas in a recording studio or post-production studio, they would probably never listen to your demo, and your resume will just go in a pile unless you have a personal recommendation" [Tucker, 2021]. Pairing this comment with the data regarding participation in sound for video games opens up an interesting question: if "quality of work" is the only criteria required to "open the door", why is there still a comparatively low number of women in the industry? It is therefore important to consider that although the challenges women face are slightly different across disciplines, factors such as discrimination, lack of access to training, unconscious bias, and gatekeeping should still be taken into account.

3.2.1 Long hours and caregiving

In the audio industry, there are many examples where long hours are required. For live concerts, on movie production sets, and when deadlines loom the engineering crew are often the first to arrive and the last to leave.

Some of the BEDIs were documented in a report by the Broadcasting Entertainment Communications and Theatre Union (BECTU). “Women tell BECTU that 'staying current' with their industry skills and their career can be incompatible with a family life” [Evans et al., 2017]. In the games industry, long hours and low pay can be a barrier to entry for career aspirants: “recognition is given to a diverse range of temporary, intermittent and insecure jobs with weak work-life boundaries … passionate but precarious ‘play slaves’” [Thompson et al., 2016].

BECTU also found that “the screen industries remain largely incompatible with caring and parenting responsibilities … failing to enable and advocate for their workers with children or adult dependents” and “experiencing exponential exclusion as their caregiving intersects with other protected characteristics and socio-economic exclusions" [BECTU, 2021].

In summary, the combination of long hours and caregiving responsibilities acts as a significant barrier to entry for underrepresented groups in these industries.

3.2.2 Discrimination in The Sound for Film and Television Industry

Authors of a Motion Picture Editor Guild survey asked, “Do you believe discrimination occurs in the workplace?” A solid majority of members believe discrimination occurs “often” or “sometimes” in the workplace [Rodrigo, 2021] (see Table 3-5):

Do you believe discrimination occurs in the workplace?		
	Men	Women
Often	14.33%	31.19%
Sometimes	56.88%	58.31%
Rarely	20.71%	7.12%
Never	5.67%	1.69%
Decline	2.41%	1.69%
	100.00%	100.00%

Table 3-5: "Do you believe discrimination occurs in the workplace?" [Rodrigo, 2021].

Additionally, Table 3-6 shows 88.64% of participants who were men "always" or "sometimes" felt safe to report discrimination to a superior or human resources, while 74.99% of participants who were women felt safe to do so; additionally, a significant number of women (21.62%) responded they "never" felt safe to do so, compared with 8.1% of men. Although the detailed results are only accessible to Guild members, the article reports that 800 participants replied in the open-ended answers with "personal stories about being unable to safely report discrimination and/or harassment", and "several respondents described the backlash that they experienced when they spoke out against discrimination and/or harassment" [Rodrigo, 2021].

Do you feel safe to report an incident of discrimination to a superior or human resources?		
	Men	Women
Always	52.56%	20.61%
Sometimes	36.08%	53.38%
Never	8.10%	21.62%
Decline	3.27%	4.39%
	100.00%	100.00%

Table 3-6: "Do you feel safe to report an incident of discrimination to a superior or human resources?" [Rodrigo, 2021]

The Guild also concluded that "despite the publicity surrounding industrywide diversity efforts, gender and ethnic representation within the Guild itself has remained basically unchanged compared to four years ago" [Rodrigo, 2021].

3.2.3 Discrimination in the Music Industry

Another study focused on gender-based BEDIs, "Women in the US mUSic indUStry [sic]: Obstacles and Opportunities" [Prior et al., 2019], found that women in this industry faced a number of challenges in the workplace, based on the following factors: Gender Bias, Race and Ethnicity, Compensation, Work / Life Impact, and Career Advancement. The researchers gave participants a text box to indicate what they felt were barriers facing women in the industry. This gave additional wide range of answers, but "the most commonly cited barrier was gender discrimination, harassment, or abuse, which was mentioned in nearly a third of comments" [ibid.].

The data also revealed that "the majority of women had experienced gender bias in the music industry": 84% had been treated differently due to their gender and 68% said "gender affected their employment. They also found that women of color (who comprised 20% of respondents) "felt less supported in the workplace than non-Hispanic white women", and that white women were more likely to be in senior positions" [Prior et al., 2019].

The participants in the survey held various roles in the industry, including performers, songwriters, producers, media, business/administration, venue management, artist development, and rights management.

Figure 3-6 summarises the responses to the question: "What do you think have been the biggest barriers to your career development?"

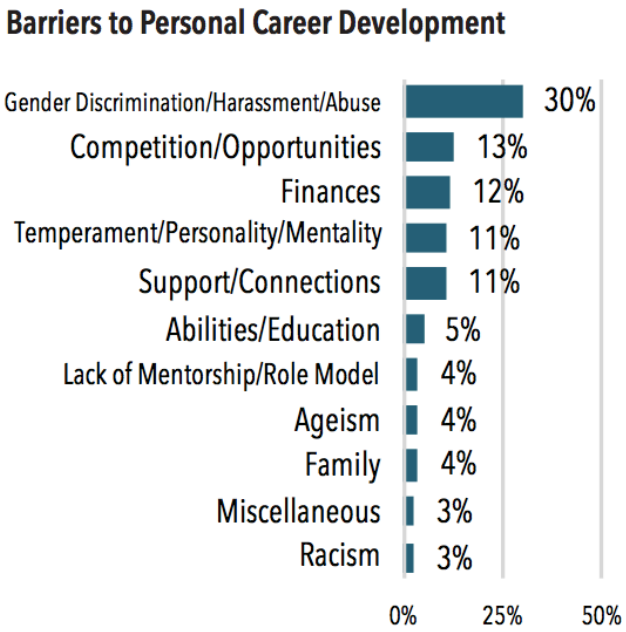

Figure 3-6: Summary of themes in response to the question: "What do you think have been the biggest barriers to your career development?" [Prior et al., 2019]

The responses in these open-ended questions include the following:

> *"There's still a bias against female engineers, where I feel we need to prove ourselves more than our male counterparts."*

> *"I **wanted to be taken seriously*** (see: 6.4.1) *and recognized for my talent and hard work and not because I could look hot. Agents and musicians propositioned me relentlessly."*
>
> *"I had an internship at a small record label during college and was actually told that I was wasting the label's time because I'd just have kids one day and drop out of the industry (!!!). Ultimately, I chose to pursue a career on the "fringes" of the music industry, but even here I face casual misogyny from the old boys' club" [Prior et al., 2019].*

About 7% of respondents indicated "Music Production and Recording" was their primary occupation, and 8% indicated it was a secondary occupation. Interestingly, these engineers had the highest job satisfaction recorded by the study (see Figure 3-7):

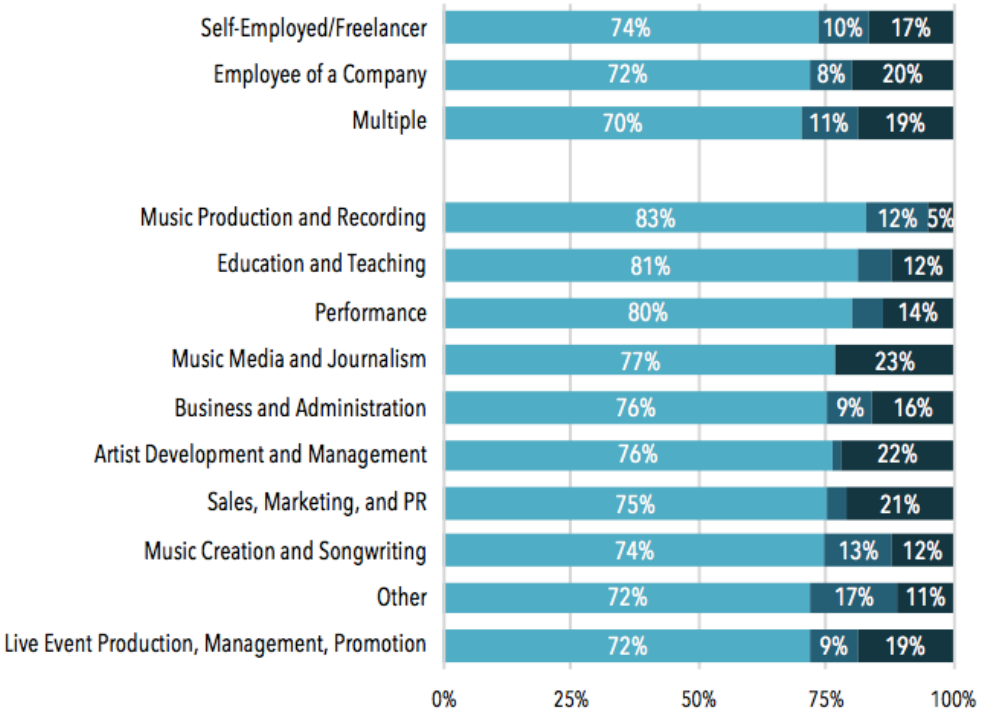

Figure 3-7: Overall job satisfaction by job type. Light blue bars: "extremely satisfied"; medium blue bars: "neither satisfied nor dissatisfied"; dark blue bars: "extremely / somewhat dissatisfied". [Prior et al., 2019]

Co-author Erin Barra explained:

> *"…women who were working in technology across the spectrum — whether that was in DSP or software engineering or audio engineering — made a lot more money. The technology sector of the music industry is where the higher paying jobs are, relative to a songwriter or an artist a typical music industry job. And there was a correlation between* ***mentorship*** (see 6.4.8) *and these roles as well; women who were in this space were mentored and brought in and developed over time. There was (also) a direct correlation between mentorship and salary … The way we contextualized the question was, "are you where you think we should be in the industry" and these women [in technology] tended to identify as closer to where they should be - not all of them, some said 'maybe I should be further ahead' but relative to many other professions in the industry, women in technology did feel that they were closer to where they should be: they experienced more mentorship, and they made more money. That being said, they were one of the lowest categories that we found! The propensity for women to be in these fields was very, very low. But the women that were, were doing all right" [Winston et al., 2021].*

To summarise the quote above: women in music technology are the lowest represented subdiscipline of music, but also one in which mentoring leads to job satisfaction and higher salaries. These observations support the conclusions drawn by Laird that mentorship is one of the key ingredients to building social capital: e.g., personal connections, references, and general reputation [Laird, 2006].

3.2.4 The Gendered Studio

In their seminal[4] paper, "Music Technology, Gender, and Class: Digitization, Educational and Social Change in Britain", Georgina Born and Kyle Devine [2015] establish that "traditional music degrees draw students with higher social class profiles than the British national averages, while their gender profile matches the wider student population; music technology degrees, by contrast, are overwhelmingly male and lower in terms of social class profile". The authors raise concerns about these "bifurcating demographics" and what implications this could have on the music industry at large [ibid.].

In their discussion, they point out that music technology degrees are relatively new (compared to history, literature, architecture, etc.), but have grown at a rapid rate. On the face of it, this growth could be tied to the popularity of the degree which makes it easy to market, and to a burgeoning industry ready for interns and entrepreneurs. However, they point to social, political, economic, technological, and musical constructs that influence this growth; all factors which contribute to the ethnic and gender makeup of the degree and in turn, the profession [ibid.].

[4] The paper has been cited 135 times according to Google Scholar.

They point to a phenomenon in the 1990s where white, working-class boys were "identified as underachievers in relation both to working-class girls and to working-class black and minority ethnic youth" [Perry et al., 2010]. "While this issue has been a concern for educationalists and policy makers for a number of years," Born et al. state, "it was recently given added urgency due to the increasing uncertainties surrounding recruitment to undergraduate degrees in Britain following the sharp hike in university fees in 2012" [Born et al., 2015]. Because of this, the authors hypothesized that music tech degrees expanded because of "their apparent ability to attract and absorb what HE (higher education) policy debate deems to be this problematic demographic" [ibid.], although a cynic might conclude that the expansion was purely based on increasing revenue all around.

Economic drivers of this change are visible as music technology makers aim to create and build new markets. This is not new; even manufacturers of "pianos, organs, and band instruments" contributed to educational curricula since the 19th century [Theberge, 1999], while the same type of influence today is seen by manufacturers of technology such as the Casio and Yamaha keyboards, Pro Tools, and Ableton Push, which now have a ubiquitous presence in classrooms around the world. Dolby Atmos, an immersive technology with its new curriculum, seemingly aims to do much the same.

Born et. al. [2015] characterize this as "musical toys for boys," highlighting the striking fact that the student population among music technology degrees is 90% male, as contrasted with traditional music degrees which are 45% male.

Other conclusions from the study include the finding that Black and minority ethnic (BME) students make up about 6% of traditional music degrees, compared with 11% of Black undergraduate students overall. Interestingly, that number is 15% for music technology degrees. The authors go a step further to explain that some degrees are focused on "urban" populations, and therefore have higher numbers, and offer the hypothesis that traditional music degrees could be alienating to minority students but that "these exceptions seem to stem from particular institutional reputations and catchments rather than acceptance policies" [ibid.].

3.2.5 Microaggressions in Audio

Based on the premise of the "gendered studio" in the field of music technology and audio engineering, gender-based BEDIs include macro- and microaggressions that have been demonstrated by scholarly research and supported with experiences and anecdotes shared on social media. This has been seen before in history:

> *"The second invasion of women into business likewise accompanied a wave of feminism plus a civil-rights-inspired influx of members of ethnic minorities, two populations that had never before challenged mainstream bastions of workplace authority. Sexist and racist harassment humiliated, demoralized, and intimidated its targets, driving them out of the workplace or into submission; it was a significant and well-documented cause of absenteeism and quitting" [Laird, 2006].*

In the quote above, Laird describes the shift happening in the business world during the 1960s and 1970s: as the male dominated workforce changed, sexism and racism increased.

Similarly, the male-dominated audio industry is changing, and we have seen some bad behaviours emerging — behaviours that have led to women being frustrated and even leaving the industry, as documented in the reactions to the story that follows.

3.2.5.1 Women's success: Merit and hard work or sexual favours? Micro- and macro-aggressions as BEDIs

One of the more notorious examples of the kind of male chauvinism and misogyny that fall into the category of "macroaggressions" on social media manifested on 21 September 2018. Engineer and producer Sylvia Massy (Tool, Prince, The Melvins, Red Hot Chili Peppers) was visiting a studio in Berlin and made a public social media post with a video about her experience showcasing a rare Tree Audio tube console [Massy, 2018]. Among the reactions (which were mostly positive in nature) was a negative comment from Nashville studio owner Adam Morgan Leeds, who quipped, "Is it just me or does Sylvia Massey [sic] appear to be a complete moron, I mean whose [expletive] did she have to [expletive] to get where she is?" Within a couple of hours, Massy retaliated with her own, single word expletive and eventually someone deleted the comment. However, before it was taken down, the post went viral when William Mohler shared a screen capture of Leeds' statement [Mohler, 2018]. By the next day, the screenshot was shared 77 times and received hundreds of comments decrying misogyny and chauvinism in the industry. A few female users pointed to the comment as "typical" of what women have had to endure in the industry. Sympathetic comments characterized this behaviour as typical of days past, while others said it still happens and our industry which "has a long way to go" [ibid.]. Women were moved to share their own experiences of macro- and microaggressions on Mohler's post. Some of these comments echo the comments of the women who responded in the Music Industry survey (see 3.2.2, "Discrimination in the Music Industry"). For example:

> *"I'm soooooo sick of this [expletive] sexist [expletive], I really am … And just to be fair, I'm not a man basher by any stretch ... but we're nowhere close, IMHO."*
>
> *"Wow, as another woman in audio I used to get this crap when I lived in L.A... fortunately haven't had to deal with it much for a couple of decades"*
>
> *"How many creeps just aren't stupid enough to be honest, like this guy, and keep their misogynistic thoughts to themselves?"*
>
> *"i had stuff like this lobbed at me on the reg. people telling me to my face they dont hire women because they can't do the job. getting mansplained every time i go into guitar center* [a retail pro audio store in the US] *even though i have a masters degree in music tech and have been supporting myself as an engineer for 12 years. it sucks" [Mohler, 2018].*

And finally, from the same thread, a quote from a woman whose experiences of sexism and misogyny were so bad she left the industry (or "leaked out" of the industry, see 3.3, "The "Leaky Pipeline") due to her negative experiences:

> *"It was so horrific for me when I was trying to work in the industry. Leaving was a good idea … in this current climate I could end some big careers. I won't but it's nice to feel like it at least matters that it happened. The last credited record that I worked on was lovely though. So I had a nice final experience. There was nowhere for me to go after that though [emphasis added]" [ibid.].*

It is also important to say that the public shaming of Leeds was extremely harsh. Although it is encouraging that many people spoke out against this behaviour, Leeds was ostracized by the recording community and endured scathing public criticism and harassment. There were several rumours that Leeds sued or threatened to sue for defamation. As of this writing, his studio's webpage and social media pages no longer exist.

3.2.5.2 Microaggressions in University Music Tech and Audio Programmes

Natasha Blakemore, a student at the University of Surrey, presented the results of a study she authored with Rosie Nieder and Diana Nemyrovska at a DEI (Diversity, Equity, and Inclusion) meeting for the Department of Music and Media in December, 2021. Their "Report based on Equality, Diversity and Inclusion Survey for the Tonmeister Course" [Blakemore et al., 2021] included examples of microaggressions experienced by women in the programme, such as:

> *"If there's a man in the room, they are always approached before me for technical stuff, and no one assumes that I'm there to do the job I'm there to do"* (see 6.4.1)
>
> *"There have been some lecturers as well who have made me feel uncomfortable about comments they have made about women during their lectures, even if it was meant as a joke. When getting my placement, some people in my year spread the rumour that I only got accepted [because] I was a girl, even though that was not the case."*
>
> *"There have been incidents of people on the course using derogatory language about minorities, including many people using the ableist slur beginning with R, and one person using the N-word on two occasions, and defending his use of it despite being asked not to say it by a Black person. I have experienced similar things in the industry [...] There is a general atmosphere that when women are present in the audio industry it is due to the good will of men* (see 6.4.6) *and that therefore the representation of women will always be controlled by men so women have to be grateful and easy to get along with, instead of calling out sexism and mistreatment"*
>
> *"Most strikingly for me when I was on the course was being a "female Tonmeister" [...] it was undoubtedly damaging to be constantly reminded that I statistically shouldn't really be there. And it was constant: everything I did was as a "female Tonnie" [Blakemore et al., 2021].*

These comments generally coincide with what we saw in the table of microaggressions published by Sue et al. (see 3.1.2, "Microaggressions"): themes of second-class citizenship ("men are approached before me", "female Tonnie") and myth of meritocracy ("I only got accepted because I was a girl"), in addition to being insulted outright with the N-word, a serious macroaggression.

Other examples of microaggressions experienced at the university level are given in Sarah Raine and Catherine Strong's book *Towards Gender Equality in the Music Industry: Education, Practice and Strategies for Change* [Raine et al., 2019]. Although women generally find their courses to be "collaborative and friendly", the behaviour of males was at times described as "toxic", as in this example from a young woman with the pseudonym "Jessica":

> *"They were all quite misogynist, a lot of rape jokes and I had to go to the college at one point 'cause they were really intimidating. I'd be in the studio with thirteen boys all joking about raping a girl " [Raine et al., 2019]*

This could be considered sexual harassment as defined by Fitzgerald, Gelfand and Drasgow (1995), who state "sexual harassment can take both milder forms, such as hearing suggestive or offensive jokes, and more intrusive forms like being sexually coerced or touched" [Takala, 2018].

Author Mavis Bayton refers to technical language as a "power strategy" to exclude women, making a distinction between active exclusion by men and lack of self confidence in women [Bayton et al., 2004]. Consider, for example, this quote from "Olivia":

> *"I remember I didn't know what one thing was on the [mixing] desk … I asked him [a male classmate] and he goes, 'How do you not know that?' … There was a part of me that felt like, 'Aw okay, you just think I'm just some stupid girl.'" [Raine et al., 2019]*

Further examples are given in Chapter 6:. These comments help to justify the need for safe spaces where UGs can learn skills, and perhaps also the need to prepare UGs for "real world" scenarios outside of safe spaces.

3.2.6 Data on Microaggressions in the Recording Industry

Anecdotes such as the one involving Massy and the young women studying in university music technology courses are commonly recounted in women's audio and tech groups on social media where a sense of privacy and safety allow women to share their experiences. But can the pervasiveness of microaggressions and their impact be backed up with data, and how does audio compare to other industries? Researchers Ky Brooks et al. set out to do just that with their study of the problem in an article published by the *AES Journal* in 2021. Titled *Do We Really Want to Keep the Gate Threshold That High?* [Brooks et al., 2021], the researchers surveyed 387 industry professionals in 46 countries and uncovered the following:

- Cisgender women experience more sexually inappropriate comments and comments about physical appearance than cisgender men.

- Cisgender women are more likely to face challenges to their authority.

- Recording studio workplaces score 33% worse than other STEM (Science, Technology, Engineering and Mathematics) disciplines on the silencing and marginalization of women, gender-related workplace microaggressions, and sexual objectification.

In the case of the recording studio study, Brooks et al. [2021] focused their research on individuals who had "worked as producers, engineers, or studio assistants on other people's music in the last ten years". The microaggressions studied were each assigned an acronym: Assumptions of Beauty and Sexual Objectification (SOB); Silenced and Marginalized (SAM); Stereotyped (STE); and Workplace Microaggressions around Gender (MGEN), Age (MAGE), Race/ethnicity (MRET), Culture (MCUL), Sexual Orientation (MSOR), and Disability (MDIS). Participants supplied demographic categories based on their gender, sexual orientation, race, disability status, migrant status, age, and the gross national income of their country of residence. Respondents were also asked to indicate their tasks in the studio, daily (income) rate, credits, whether they were AES members, and whether they were aware of the AES Diversity and Inclusion Committee (the AES questions may have been asked in part due to AES' in-kind support for the study). Statistical analyses were performed to show how demographic categories intersected with experiences of microaggressions [Brooks et al., 2021].

In terms of microaggressions, the report found that:

- Gender was the "strongest predictor of experiences of discrimination and microaggressions in the recording studio", especially for SOB, SAM, STE, and MGEN;

- "Non-heterosexual participants reported experiencing significantly more microaggressions from factors SOB, SAM, MGEN, MAGE, and MSOR"; and

- "Participants who were both BIPOC (Black, Indigenous, People of Color) and part of a racial/ethnic minority in their place of work reported experiencing significantly more microaggressions from factors SAM, MGEN, and MRET than participants who were not" [Brooks et al., 2021].

		N	GEN	SOR	RET	DIS	MIG	GNI	AGE	
			p (χ^2)						p(R^2)	Slope
Daily rate	DRA	135	0.01	0.96	0.09	0.47	0.43	0.29	5.86E-06	3.74
Properly credited	CRE	373	1.05E-03	0.11	0.005	0.01	0.01	0.64	0.01	0.01
AES membership	AESM		0.27	0.43	0.31	0.24	0.29	0.05	0.49	2.19E-3
Aware of D&I committee	AESD		0.43	0.34	0.92	0.39	0.26	0.15	0.50	4.46E-3
Sexual objectification	SOB	283	1.20E-16	5.05E-04	0.14	1.68E-03	1.00	0.34	0.01	-0.01
Silenced and marginalized	SAM	284	1.26E-13	0.03	0.03	0.01	0.44	0.20	8.68E-05	-0.02
Stereotyped	STE	281	4.96E-11	0.15	0.56	0.02	0.81	0.03	0.14	-0.01
Gender W.M.	MGEN	234	3.15E-25	3.15E-05	0.01	0.02	1.00	0.99	4.26E-03	-0.02
Age W.M.	MAGE		2.28E07	0.04	0.64	0.08	0.96	0.24	4.73E-04	-0.03
Sexual orientation W.M.	MSOR		1.06E--06	2.99E-08	0.10	0.00	0.66	0.50	0.11	-0.01
Cultural W.M.	MCUL		0.02	0.73	0.09	0.01	0.01	0.02	0.97	-2.10E-4
Disability W.M.	MDIS		4.35E-04	0.07	0.34	2.26E-04	0.78	0.68	0.01	-0.02
Racial W.M.	MRET		0.05	0.52	0.01	0.04	0.51	0.01	0.42	-3.99E-3

Large Effect | Medium Effect | Small Effect | Positive relationship with age | Negative relationship with age

Table 3-7: Table showing the prevalence of experienced microaggressions based on individuals' characteristics at greater or less than chance using P-values for χ^2 values (one-way Kruskal-Wallis tests; GEN/SOR/RET/DIS/MIG/GNI) and R^2 values (linear regressions; AGE), color coded by effect size. Entries with background in dark grey/red indicate large effect size (η^2 >= 0.1379 or R^2> 0.26), entries in medium gray/orange indicate medium effect size (η^2 >= 0.0588 or R^2>0.13), entries in light gray/yellow indicate small effect size (η^2 >= 0.0099 or R^2>0.02). Non-significant entries are in white with gray text. Slope entry color indicates direction of relationship of dependent variable with AGE (light gray/pink positive, dark gray/blue negative) [Brooks et al., 2021]

In Table 3-7, red is used to indicate a large effect size, followed by orange and yellow for medium and small effects, respectively. Females were more likely to report sexual objectification (SOB), silencing and marginalization (SAM), stereotyping (STE), and workplace microaggressions (W.M.) around gender (MGEN) [Brooks et al., 2021]. At first glance, it seems that the types of microaggressions experienced by each group fits an assumption of what each group usually experiences; but the larger point is that no one should have these experiences to begin with – thus providing compelling evidence and the impetus to begin to make changes.

As increases, the daily (pay) rate increases, as does being properly credited for work. This is likely to do with the fact that experience, contacts, and respect that come with age. Similarly, factors such as SOB, SAM, STE, MGEN, MAGE, and MSOR are reported less, but Brooks et al.'s research also shows that as women get older, they tend to leave the industry (or "leak out") after ten years or so; there are far more men in their 50s, 60s, and 70s who remain in the industry [ibid.].

3.2.7 Economic BEDIs

Assuming anyone with access to the proper training can be taught to use the tools, we might assume that the technology itself is not a barrier. However, access to those tools can be problematic.

The article, "The Quest for Digital Equity" [Quaintance, 2018] defines digital equity as "whether people can access and effectively use the technology necessary to participate in modern society". Another phrase, "digital inclusion," denotes efforts to remedy deficits in digital equity [ibid.]. In the case of immersive audio, although software is sometimes free, computers, loudspeakers, and headphones are not, and we must be mindful that not everyone can afford the basic tools many industry professionals take for granted.

Just as Avid has a free Pro Tools version, Dolby offers free webinars for interested engineers, and Dolby Production Suite is available for a free demo (as long as you are using Pro Tools Ultimate). However, the cost of building a Dolby Atmos certified studio may cost upwards of £48,000 (British Pounds) for the necessary equipment (based on one conversation with the researcher's vendor, Jigsaw 24, in 2020). Table 3-8 shows the capabilities of the Dolby Atmos Mastering Suite, required for studio certification, compared with the Production Suite:

	DOLBY ATMOS MASTERING SUITE (DAMS)	DOLBY ATMOS PRODUCTION SUITE (DAPS)
Use	Multi-system workflows for complex content productions (cinema, Blu-ray and OTT productions)	Single system workflows for OTT productions and others (editorial, sound design and premixes) NOTE: System support will vary based on the single system CPU used, and project complexity
Availability Workflow	Dolby approved vendors Supports multi-system workflows where dialogue, FX, and music tracks are on dedicated Pro Tools | Ultimate™ systems	Avid Marketplace Does not support multi-system workflows
Components	Software and hardware components Includes Dolby Atmos Renderer and 3x licenses for Dolby Atmos Production Suite	Software only Dolby Atmos Renderer only
External	Yes. Requires external system with MADI or Dante I/O Supports Pro Tools® | SYNC HD™ and ability to lock to external sync, LTC and video reference	No. In-the-box solution, runs on the same system as Pro Tools | Ultimate Does not support external sync or video reference. Supports positioning via LTC plugin within Pro Tools | Ultimate, and the Dolby Audio Bridge
CPU/Rendering	External system allows CPU/rendering load to be offloaded without affecting Pro Tools | Ultimate	CPU/rendering load is from the same Pro Tools | Ultimate system
Operating support	Supports Windows and Mac	Supports Mac only
Routing requirements	Uses physical output via MADI or Dante	Uses software-based routing with Dolby Audio Bridge or send/return plugin mode
Dolby Atmos Remote support	Yes	No
EQ and room calibration	Yes	No

Table 3-8: Comparison of Avid Dolby Production Suite versus Dolby Mastering Suite [Avid, 2020].

The question is not whether certification is necessary (it is not), but whether certified studios have an advantage when seeking a higher-paying clientele (they probably do). As of 2023, the Dolby Atmos Renderer includes "mastering suite" functionality, but studios still must be certified to take on certain types of work.

However, during a conversation about getting a room certified for Dolby Atmos, Netflix' Scott Kramer (Manager, Sound Technology / Creative Technologies & Infrastructure) informed the researcher that certification is not required to mix content for Netflix, and remarked that he only had $800 worth of speakers in his room; he also referred the researcher to online content she could use for training purposes. He pushes back against the notion that content creators need to invest thousands of pounds or dollars into equipment.

Another example of affordable resources with hidden costs is the Dante certification offered by Audinate. Dante is used in some audio post-production workflows at larger facilities using Dolby Atmos. Level 3 certification is quite challenging, and in order to have the proper background to digest its technical coursework, a prospective student is required to have good prerequisite knowledge of signal routing – which requires experience, which may in turn require monetary investment.

On the gaming side, middleware such as Wwise has tutorials and software is free, but one must have some sort of social capital (see definition in section 4.2, "Pull") in order to be recruited to a programming team. For example, GameSoundCon looked at 100 job descriptions from April to July, 2020 and concluded, "Not unexpectedly, the most frequently listed requirement was experience. Companies are looking for someone who can hit the ground running and is familiar with what it is like to work on a game project" [Schmidt, 2020].

The AES Audio for Virtual and Augmented Reality (AVAR) conference was presented in 2020 virtually due to the pandemic, with options for attendees to watch on YouTube. However, to experience the immersive content would have required a typical computer to have upgrades totalling £950 ($1,325) comprising of a Radeon graphics card (£300) and perhaps a new power supply (£75). The VR headset (Oculus Rift-S) cost £600 (at the time).

3.2.8 Internships and Job Training

In an article by Michael McDowell titled *'Pro Tools proficiency' may be keeping us from diversifying audio*, Los Angeles Times podcast producer Shannon Lin explains, "producers of color historically haven't been given the same opportunities (like working in larger shops that have access to more resources like Pro Tools), and their resumes reflect that" [McDowell, 2021].

With this in mind, pointing to free tutorials on YouTube ignores the fact that students need to be competitive with their degree-seeking peers. Although Avid offers a free version of Pro Tools, training to operate Pro Tools could be costly; a certification course at Berklee in the US costs $6,000 [ibid.]. while a 4-year degree at the same university costs over $44,000 per year [Berklee College of Music, 2021].

In the McDowell article, EEOC (Equal Employment Opportunities Commission) attorney Aaron Konopasky explains that employers who require Pro Tools experience are in a grey area. "Establishing whether a hiring practice is discriminatory isn't only about taking into account those who applied and weren't hired, but those who were discouraged from applying in the first place because of the requirement — those who, perhaps, never applied at all" [McDowell, 2021].

Talk show host Jon Stewart has a diverse production staff now for his show, "The Problem with Jon Stewart", but recalls a time when it was not that way:

> *"…even if you look around now and you [say], 'Oh, it's a pretty diverse workplace.' Ten years ago? Not even close to this. And a lot of it was, you didn't realize the internships weren't paid. …if your parents weren't already ahead, you couldn't get an internship. You couldn't afford to take a job for no money and live in the city. And then when the [television] show was hiring, who would they choose from? The interns. So it perpetuated. And until you started paying the interns, and changing the tributaries … right? Think how many ways that is manifested. Think about financial institutions who they hire from certain colleges. And then those colleges, though, are feeders and they look in other places. And that's two examples of thousands" [Kerr, 2023].*

The "intern economy" could shed light on this inequality, which mirrors a report by the Strategic National Arts Alumni Project (SNAAP). The report found that "Black and Hispanic/Latino alumni were less likely to have done internships than their White and Asian counterparts," and "more likely than White alumni to have done unpaid internships." Family support also plays a factor, according to SNAAP: unpaid interns who have family support are higher in number than those who did not; meanwhile, the number of unpaid internships increased between 2009 and 2013 [Frenette, 2015]. In audio engineering, internships are very important; they are often a way to get "a foot in the door" [Prospects, 2022], [Brtish Broadcasting Corporation, 2022], [Biederman et al., 2013].

3.3 The "Leaky Pipeline"

The "pipeline" is the path from school, through university, and into a career. In Figure 3-8 a pipeline of progress from kindergarten through adulthood is shown, illustrating "cracks" repaired with tape to symbolize where leaks need to be addressed.

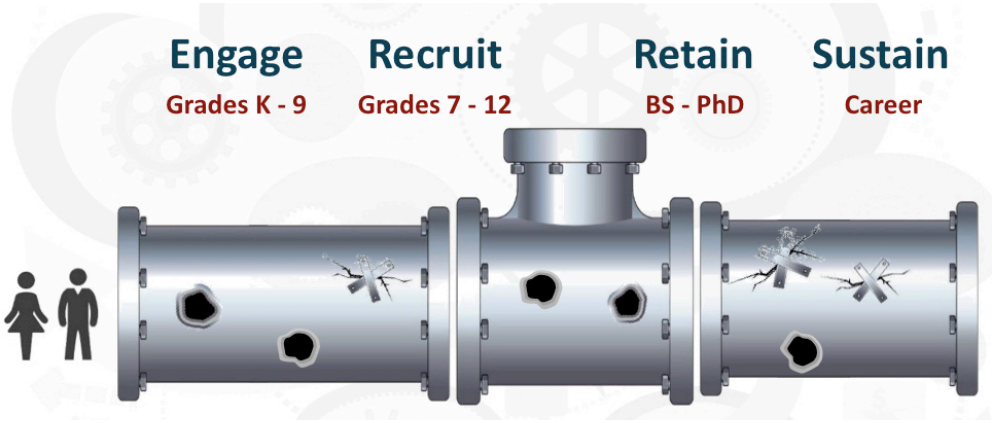

Figure 3-8: Cracks are shown in a pipeline of progress from kindergarten until an adulthood career choice is made [Pekar, 2022].

3.3.1.1 The Leaky Pipeline for Elementary Girls in STEM

The entrance for the "pipeline" is elementary school, where these stereotypes are sometimes reinforced. Thus, if we are to believe that women "aren't interested", one could argue the pipeline leaks occur because girls and women "aren't interested" or "lose interest". In fact, research shows evidence to the contrary. Master et al. [2021] conducted a study to determine

whether the presence of a stereotype has a causal effect on the performance and interest of girls in a given STEM task. In the study, one group of boys and girls were given the task and told that "girls are less interested in STEM", while another group of boys and girls were given the same task, but *not* told that "girls are less interested". The results in Figure 3-9 show that in the absence of the stereotype ("nonstereotyped activity"), girls tended to be more "really interested" (a bit more than 5 on a scale of 1-6) when not presented with the stereotype; as opposed to merely "interested" (4 out of 6), whereas the interest of boys was closer to "really interested" (5 out of 6) in both cases [ibid.].

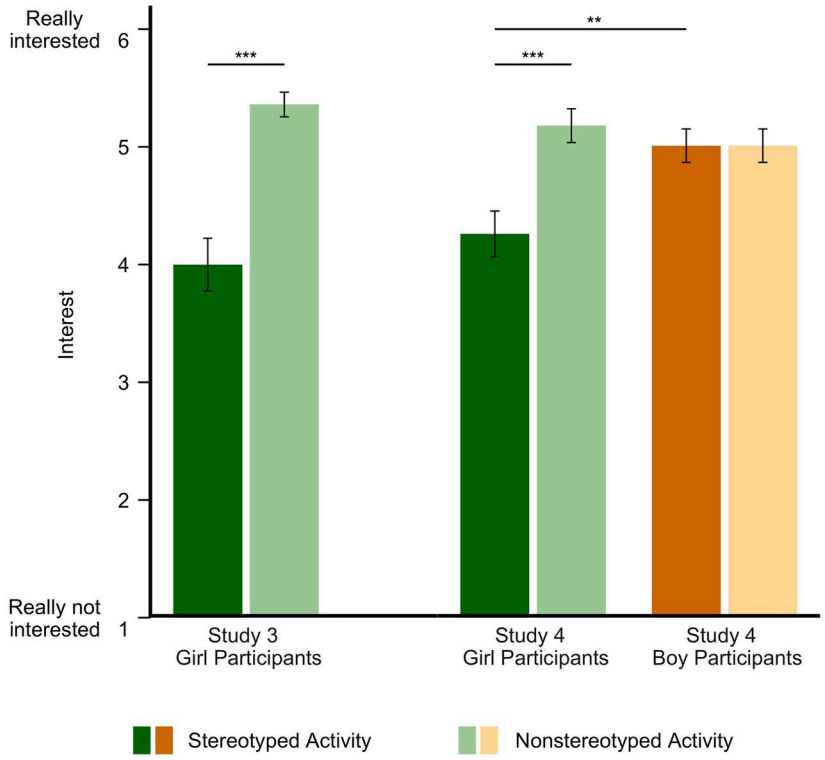

*Figure 3-9: Interest by gender and presence of stereotype. Interest in an activity that was randomly assigned through an experimental manipulation to be described with a gender-interest stereotype present (darker bars) or absent (lighter bars) for girls (green bars) and boys (orange bars) is shown. Error bars represent 61 SE. **P < 0.01 and ***P < 0.001 [Master et al., 2021].*

3.3.1.2 The Leaky Pipeline for Women in STEM

By the time girls leave secondary or high school, we see another crack in the pipeline. In 2006, Jacob Clark Blickenstaff summarized the general stages where students "leak out":

- when applying to a university, a student formerly interested in a science career might change their mind;
- some students change majors while in university;
- university graduates with a STEM degree might select another career.

However, Blickenstaff observed that "women leak out more than men do" [Clark Blickenstaff, 2005]. He calls this "differential leaking":

> *"The effect of differential leaking is to create a sex-based filter that removes one sex from the stream and leaves the other to arrive at the end of the pipeline.* ***No one in a position of power along the pipeline has consciously decided to filter women out of the STEM stream, but the cumulative effect of many separate but related factors results in the sex imbalance in STEM that is observed today****."* (emphasis added) *[Clark Blickenstaff, 2005]*

Blickenstaff points to a 1998 study by Mary Stewart which showed that female A-level physics students outperformed their male counterparts [Stewart, 1998], but that "girls still end up leaving science" [Clark Blickenstaff, 2005]. Clark Blickenstaff concludes that this is due to "layers in a sex-based filter": a combination of intertwined variables. Some of the hypotheses (and in some cases, myths) that he explores include the absence of female role models; the pedagogy of science classes which favours male students; a "chilly climate" which exists for girls and women in science classes; even cultural pressure on girls/women to conform to traditional gender roles. "Some proposed explanations are without merit and are in fact dangerous," Blickenstaff warns, "while others do play a part in a complex interaction of factors. It is suggested that the very nature of science may contribute to the removal of women from the 'pipeline'" [ibid.]. Blickenstaff's multi-faceted solution is discussed in Chapter 4: "Removing Barriers".

3.3.1.3 The Leaky Pipeline for Blacks and Hispanics in STEM

In 2015 the United States Department of Education (DoE) sought to expand the use of technology in education with the National Education Technology Plan (NETP), which "focuses on using technology to transform learning experiences with the goal of providing greater equity and accessibility" [Thomas, 2016]. However, in the last decade, more minorities earned degrees in the field but are not employed in the same field. A New York Times article, *Why Tech Degrees Are Not Putting More Blacks and Hispanics Into Tech Jobs,* found that more Black and Hispanic students major in computer science and engineering than hold jobs in technology [Bui et al., 2016].

The article pointed to research by Maya Beasley at the University of Connecticut, who found that stereotype threat (the anxiety caused by the expectation of being judged based on a negative group stereotype) played a role in the attrition of women and minorities from science, math and engineering majors [Beasley et al., 2012].

To illustrate this, Bui et al. juxtaposed the number of computer science degree holders with technical employees at Google, Microsoft, Facebook, and Twitter.

Race	Computer science and engineering graduates with bachelor's or advanced degrees	Average percentage of technical workers at Google, Microsoft, Facebook and Twitter
White	57%	56%
Asian	26%	37%
Hispanic	8%	3%
Black	6%	1%

Table 3-9: Percentage of degree holders compared to technical workers at major IT companies (based on data by Bui et al. [2016])[5]

Although these larger corporations have diversity and inclusion statements, the low numbers of Black and Hispanic employees hinder recruitment. "Any student of color looking at the numbers from the tech giants is going to be turned off and wary about taking a job there because it tells you something about what the climate is," according to Beasley [ibid.].

3.3.1.4 Leaks at the Workforce and PhD level

Another look at another pipeline shows attrition at the workforce and PhD level in the US from 2000 to 2010. Figure 3-10 shows two pipelines; the one on the left, "a", shows non-URM (Underrepresented Minority) graduates, and the one on the right, "b", shows URM graduates.

[5] Note: the data does not add up to 100%, but the article does not account for the missing 3%.

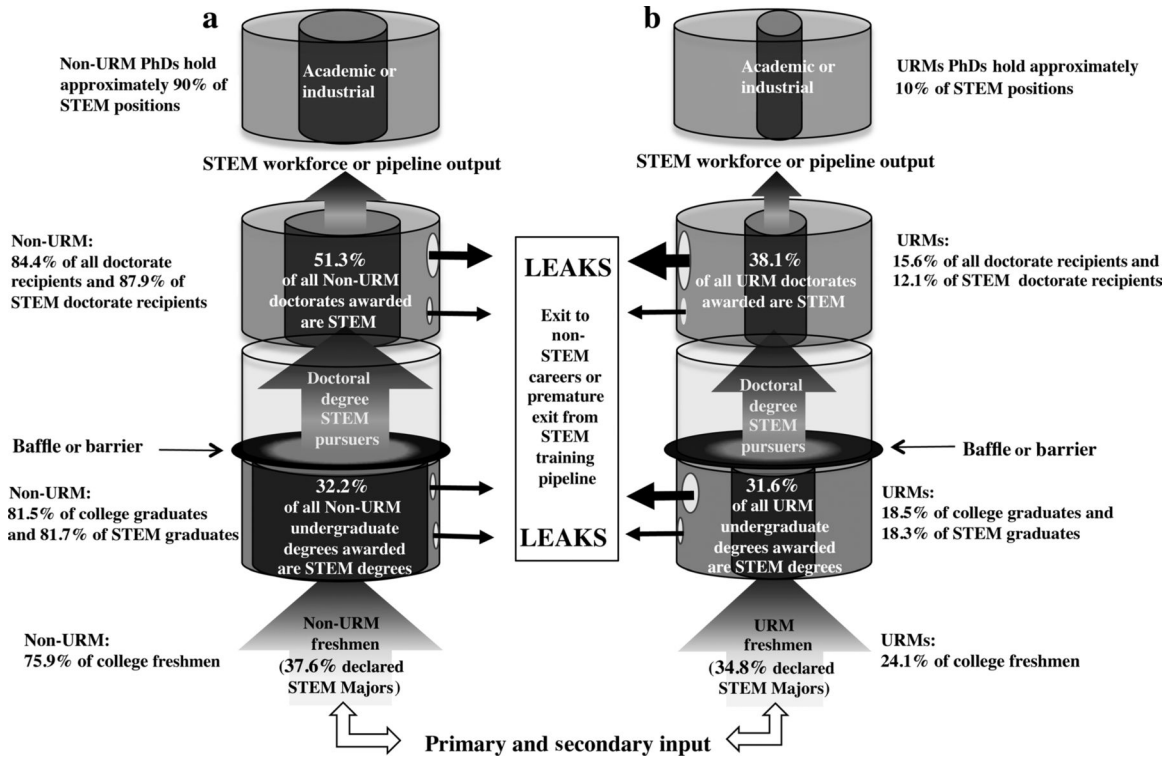

Figure 3-10: STEM pipeline for US underrepresented racial and ethnic minorities (URMs) and nonminorities: the progression of non-URM and URM trainees from undergraduate to postdegree career training stages. The shaded upward arrows indicate advancement through the STEM training pipeline. The disc-shaped baffle between the undergraduate and graduate segments of the pipeline highlights the greatest barrier to the advancement of STEM training. Gaps or discontinuities between segments illustrate that the pipeline can be discontinuous for trainees who take breaks before advancing. Leaks represents trainee attrition. [Allen-Ramdial et al., 2014]

Although both pipelines begin with a similar number of students (37.6% Non-URM freshman and 34.8% declared URM freshman), the output of the pipeline show that Non-URM PhDs hold approximately 90% of STEM positions. "In order to increase STEM field success," the authors state, "greater efforts are needed to retain trainees already in the pipeline and to change perceptions of the pipeline, itself" [Allen-Ramdial et al., 2014]. Some of the remedies to those leaks will be discussed in Chapter 4: "Removing Barriers".

3.3.1.5 The Leaky Pipeline in Audio and Music Technology

The myth that "women and girls just aren't interested" persists in the world of audio and music technology. A comment on a Facebook post by Lindsay Stirling (a popular musician with over 4 million followers) illustrates how this myth manifests: in 2019, Stirling posted, "I've committed to making the music industry more inclusive. Join me and Recording Academy / GRAMMYs in taking a first step to ensure more women are considered for producing and engineering positions" [Stirling, 2019]. The post was shared 206 times. However, the first visible comment was from Dave Sego, who replied, "Nobody stopping women from becoming producers or engineers. Maybe women just aren't choosing these career paths?" The comment received 868 reactions: 796 "likes", 49 "loves" (hearts), 15 "laughs", six "angry faces", one "surprised face", and one "sad face". The number of "likes" is also revealing; many women gave the comment a "thumbs up" [Stirling, 2019].

Sego's comment could be taken more than one way; was he empowering women by saying, "no one is stopping them"? Or was the comment an unintended microaggression, the "myth of meritocracy" which promises "men and women have equal opportunities for achievement?" [Sue, 2010]. The fact that many women endorsed this comment might show the reinforcement of a harmful stereotype which feeds into the meritocratic myth that women just "don't choose that path". As Master et al. [2021] explain: "the more that individual girls endorse genderinterest (sic) stereotypes favoring boys in computer science and engineering, the lower their own interest and sense of belonging in these fields."

Consider the research presented by Born et al. [2015] which found that "the proportion of students aged 5 to 16 choosing 'music technology' as their instrument is about 40 per cent female (sometimes more). After age 16 this figure drops to 25 per cent, while among Music Technology (MT) A-level entries the fraction of young women is 18 per cent. And, finally, at university enrolment on MT degrees they represent approximately 10 per cent" [ibid.]. As one possible explanation for this, Born cites Victoria Armstrong's "Technology and the Gendering of Music Education" which proposes that music technology is "situated in a very male-dominated environment," were "girls may feel less comfortable inhabiting such spaces as there is a perception that computer rooms are 'male territory'" [Armstrong, 2011]. The factors contributing to the leaky pipeline is further evidence that the myths of women "not being interested in tech" and that "no one is stopping them" need to be dispelled.

3.4 Chapter 3 Summary

This chapter asks the question, "what are the barriers to entry and discouraging influences (BEDIs) which exist in immersive audio (RQ2)?" Given that participation is not equal, we have sought to establish the degree to which this is true and discover the possible causes of the problem; that way we have an understanding of what needs to be improved.

To answer this, evidence was sought from academic sources looking at industry- and non-industry-specific fields, and accompanying examples from within the audio industry were presented. These sources show that both audio and STEM fields have similar BEDIs, including:

- gender- and race-based discrimination;
- microaggressions;
- gatekeeping; and
- economic factors including access to technology via educational programmes.

A survey by the Motion Picture Editors Guild focused on the technical side of film and television shows 76.6% of men and women believe there is discrimination in their field. In the music industry, 30% of women polled believe discrimination is a barrier to career advancement. In Born et al.'s discussion of "the gendered studio," studios are seen as a "male space" and cater to men. An example of a macroaggression aimed at a high-profile woman engineer was given, followed by experiences of microaggressions at the university level, all of which is supported by data about macro- and microaggressions in the recording industry supported by a study by Brooks et al [2021].

The discussion of access and digital equity focused on the delineation between access to "free" software like Wwise versus receiving professional training in the software and developing employable skills; the cost of participating in immersive spaces; and the emergence of increasingly popular and relatively affordable tools such as Dolby Atmos (not the only tool, but a very popular and widely used one). The disparity between access to software and receiving training from an expert in the field echoes the studies from STEM showing that students who can learn from experts in the field have an advantage over students with inadequate resources [May et al., 2003], [Treisman, 1983]. In a related issue, inequity in internships and job training are discussed along with a troubling statement that we don't have data on "the ones who don't bother to apply" – another gap in the literature.

Finally, the phenomenon of the "leaky pipeline" was discussed wherein we see young girls and minorities "leak out" of career "pipelines" faster than white men. Factors such as the four given above (discrimination, microaggressions, gatekeeping, and access) contribute to this problem. Although we have data that shows the amount of attrition in STEM from 2000-2010, there is little equivalent data to be found for audio engineering; Born et al. only discuss traditional music and music technology degrees, for example. However, there are some strategies for addressing these leaks in STEM that could provide some useful answers. Those strategies are discussed in Chapter 4: Removing Barriers.

Chapter 4: Removing Barriers to Entry and Discouraging Influences (BEDIs)

Having established current participation and representation data in audio in general and immersive audio in particular, and having also revealed the barriers to entry and discouraging influences (BEDIs) of discrimination, microaggressions, gatekeeping and access in STEM as well as the larger audio industry, we now seek to somehow remove or reduce those obstacles and apply those remedies to the field of immersive audio, perhaps even providing clues on how to repair the "leaky pipeline". Therefore, this chapter asks the question, "how might these BEDIs be removed? (RQ3)".

Fortunately, there are a number of successful initiatives in STEM and medicine, as well as audio and music technology, that use educational programming as a tool for change. These include training, workshops, and mentoring targeted at UGs at the university, post-graduate, and professional level. First, the concept of social capital is explored (4.2); followed by reviewing programmes in STEM and medicine that enable the recruitment and retention of underrepresented residents for the benefit of their patient population, as well as initiatives in STEM such as computer coding "boot camps" (4.3). Finally, initiatives in audio and music technology are discussed (4.4).

The motivation and impact of these initiatives are reported in this chapter in order to position these findings in a wider context for their impact in immersive audio and beyond.

4.1 Caveat

There is a risk in oversimplifying the relationship between removing BEDIs and creating workplace equity. For example, Adam Fairclough [1990], reminds us that there are "subjective political, emotional, religious, and psychological dimensions" to consider, and that "the desire for "neat chains of cause and effect" ignores the complexity of the many dynamics at play in the fight for social justice throughout history. For example, the successes of affirmative action initiatives in the United States 1970s were followed in the 1980s by fear of "reverse discrimination", which is still a contentious topic. This evolution set up a dynamic wherein "diversity has become the back door for advancing integration: it was not the front door through which civil rights advocates had intended to march" [Laird, 2017]. In the case of this study, it may be unwise to assume that there is a turnkey solution to the problem of representation when diversity and inclusion initiatives still seem to be couched within this context.

Nonetheless, in the field of audio, women and minorities have shown that many barriers can be overcome through networking and mentoring (such as the feminist collectives documented by Dobson, as discussed in 4.4, "Education and Training in Audio"); that role models must be made visible in the media as well as at academic conferences and trade shows; and that education and training among peer groups is empowering. Therefore, it is important to engage in this work because change, although incremental, still reaps tangible and lasting rewards.

4.2 Social Capital

Pierre Bourdieu [1977] discussed interaction of different forms of *capital* in shaping social life and social inequality, while James S. Coleman [1988] developed this ideas into the concept of "social capital". For Coleman, social capital is "anything that facilitates individual or collective action, generated by networks of relationships, reciprocity, trust, and social norms" [ibid.]

However, when people are disenfranchised from a lack of social capital, they prefer to work outside of the system, and create their own. In a panel discussion on "Critical Discourse in Design", moderator Azeez Alli-Balogun states:

> *"When we talk about inequity, it's something that we divest from. It's not something you fix. You divest from a system of inequity, and you start to build systems of equity for yourself" [Iddris Sandu, 2020].*

In her book, *Pull* [2006], author Pamela Laird addresses this kind of disenfranchisement and documents a long history of women- and Black-owned groups in the United States working to support themselves in medicine, architecture, advertising, and other industries. Laird underscores the need to build social capital: in other words, connections or personal references. For example, having a prestigious university on a CV or a person who can vouch for a graduate are examples of social capital. The following are necessary ingredients for UGs to build social capital:

a) role models (successful people to emulate who share the same race, ethnicity, and gender as the aspirant);

b) networking (a group of people in the same industry who can connect graduates to potential employers, opportunities, or mentors); and

c) mentoring (someone who can offer one-one-one guidance or skill sharing) [Laird, 2006].

Looking at the participation data mentioned earlier, it would seem there are not many UGs participating in STEM, but when looking at more specialized groups, we see a phenomenon where culturally excluded groups are making inroads for themselves and defining what technical and artistic creative spaces should look or sound like, and how they thrive economically and thus creating a different kind of social capital. Researcher Erin Barra also spoke about looking outside of traditional industries to find where women are supporting themselves and each other (see 4.4, "Education and Training in Audio").

In the case of STEM, medicine, and the audio industry, it is important to consider where this "pull" comes from for underrepresented groups and how they can access it, thus enabling them to participate and thrive in their respective industries and careers.

4.3 Education and Training in STEM and Medicine

Jacob Clark Blickenstaff, having looked at a number of plausible and non-plausible BEDIs for women in STEM (see 3.3.1.2, "The Leaky Pipeline for Women in STEM"), developed a list his own suggestions for ameliorating the underrepresentation of women in STEM:

1. Ensure students have equal access to the teacher and classroom resources.

2. Create examples and assignments that emphasize the ways that science can improve the quality of life of living things.

3. Use cooperative groups in class, or at least avoid dividing students by sex for class competitions or in seating arrangements.

4. Eliminate sexist language and imagery in printed materials.

5. Do not tolerate sexist language or behavior in the classroom.

6. Increase depth and reduce breadth in introductory courses.

7. Openly acknowledge the political nature of scientific inquiry.

The suggestions, though well-intentioned, seem to be short-sighted; one could argue that he has described a typical, modern-day classroom with a good code of conduct.

However, Byars-Winston [2014] points to research which finds that "African American high school girls' interests in STEM school subjects are *higher* than those of their White counterparts, intentions to major in STEM are similar between racial/ethnic minority undergraduates and White undergraduates, and ability is not a primary factor in STEM persistence or attrition given that highly capable students leave STEM." However, the stigma or myth persists that UGs lack "ability, drive, or interest" [ibid.]. Unlike Blickenstaff, Byars-Winston sees that the interest is already there and seeks to explore socio-cultural themes including access.

As a remedy to this, she cites partnerships and opportunity development as an important component, adding education and training to her prescribed courses of action, focusing on Career Development Professionals who offer opportunities to under-resourced groups:

> *"Career Development Professionals can support access to opportunities by partnering with industry, professional societies, foundations, education and training institutions, as well as civic and religious organizations connected to reaching individuals traditionally underserved in STEM [emphasis added]" [Byars-Winston, 2014].*

Similarly, the success and necessity of training programmes focused on UGs is documented by K. M. Moorning [2018]. Similar to Byars-Winston, Moorning found discrepancies between the interest and ability of UGs and their retention and success in STEM fields. “The formal college curriculum has proven inadequate in closing the STEM workforce gap”, Moorning concludes. In response to this, she provides tools for institutions to critically examine their practices and “capture cultural cues that identify personal barriers amongst UGs.”

One of these tools is a “STEM Center”, a “specialized lab for developing skills beyond the formal curriculum and closing the professional practices gap” [ibid.]. She defines three types of STEM centers for different audiences:

- A “Youth in STEM Lab” for ages 12-17 which provides exposure to STEM subjects and addresses academic inequities. Students would work on app development with software and Arduino kits, engage in “hackathons”, and collaborate with their peers.

- A “STEM Learning Lab” for undergraduate female and minority students seeking additional credentials. Students could code computer programs, create portfolios, and earn industry recognized credentials.

- A “Workforce Development Lab” aimed at working professionals who “seek persistence in STEM labor markets through credentialing” [ibid.].

In doing so, institutions can “influence STEM interest by designing compelling learning activities in learning spaces where skills are mastered without encumbrances” [Moorning, 2018]. In other words, the space or environment where learning takes place through bespoke activities is identified as a vital part of insuring student success; and although she does not define the encumbrances to which she refers, she expects them to be discovered through “coordinated efforts with external stakeholders … about equity and access challenges” based on her research framework [ibid.].

The combined minority-centric and education-centered frameworks described by Byars-Winston and Moorning are exemplified by several strategies and initiatives, as illustrated in the following sections.

4.3.1 Effective Strategies in Medicine

The health of patients from underrepresented backgrounds is improved by having a physician workforce that reflects the patient population [Meeks et al., 2018], [Greenwood et al., 2020], [American College of Physicians, 2004]. Thus, “increasing the number of underrepresented minority (URM) physicians, particularly within medical school faculty, is a key component to reducing health disparities” [Peek et al., 2013]. This finding is echoed in the UK, where a report by the NHS Race and Health Observatory released in February, 2022 found “some ethnic minority people delayed or avoided help seeking for health problems due to past experiences of racist treatment by healthcare professionals or due to similar experiences of their friends and family” [Kapadia et al., 2022].

4.3.1.1 An Initiative to Increase Residency Program Diversity

Despite the need for trust building and representation in medicine, there had been a downward trend in this regard: according to the study "An Initiative to Increase Residency Program Diversity" [Hoff et al., 2021], Black and Hispanic faculty were "more underrepresented in 2016 than in 1990 at the assistant, associate, and full professor level among US clinical medical faculty in nearly all specialties."

To this end, Hoff et al. set out to increase the percentage of URM residents in the paediatric residency programmes at Nationwide Children's Hospital from 5% to 35% in order to "achieve demographic parity" with the patients in the Columbus, Ohio area. They hypothesized that "URM recruitment would increase if applicants were exposed to physicians with whom they can identify, illustrating a culture of inclusive excellence" [ibid.]. Their strategies included:

- applicant interviews with URM faculty;
- interview dinners with URM residents;
- visibility at academic conferences for URM trainees;
- development of targeted marketing materials; and
- a visiting student program supported by networking with URM residents.

As seen in Table 4-1, each of these activities corresponds to certain themes:

Description	Theme
Interviews with URM faculty	Role models
Dinners with URM residents	Networking
Visibility at conferences	Role models
Development of marketing materials	Role models
Visiting student program with networking	Networking

Table 4-1: The "Increasing Resident Program Diversity" categorized by themes.

The results of the initiative were impressive: over the course of four years, the percentage of URM residents increased by an average of 22% as seen in Figure 4-1:

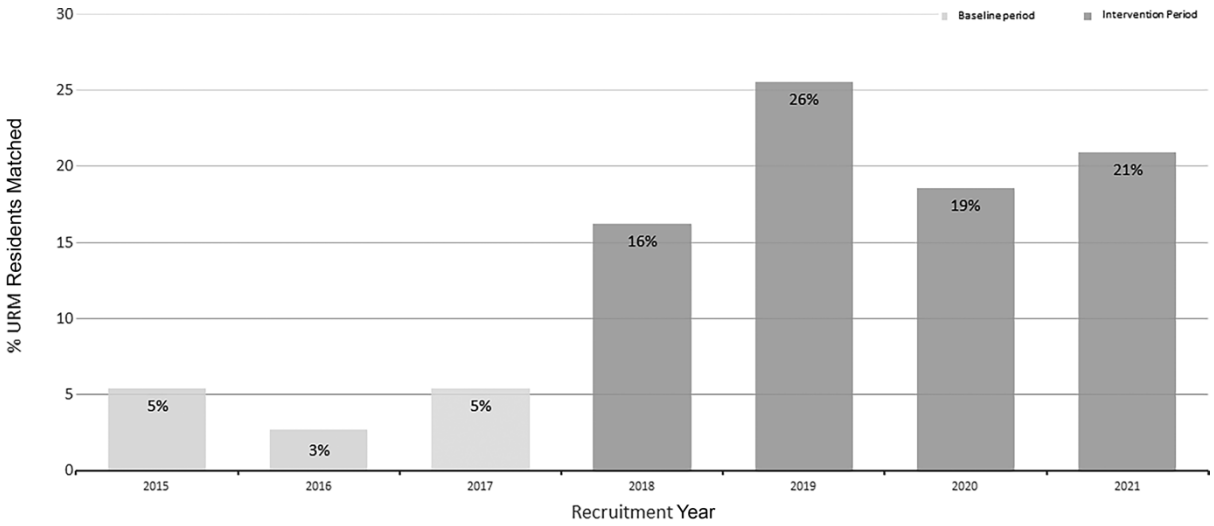

Figure 4-1: Percentage of URM residents matched per recruitment cycle. After implementation of targeted initiatives beginning in 2018, the percentage of URM residents who matched increased from 5% (2 of 37) in 2015, 3% (1 of 37) in 2016, and 5% (2 of 37) in 2017 to 16% (6 of 37) in 2018, 26% (11 of 43) in 2019, 19% (8 of 43) in 2020, and 21% (9 of 43) in 2021 [Hoff et al., 2021].

4.3.1.2 Faculty Retention in Medicine

In another example from medicine, workshops and mentoring were key components of a faculty development program at the University of California, San Diego (UCSD). As alluded to in the example from the Nationwide Children's Hospital, Daley et al. [2006] cited the benefits of having a diverse faculty, stating "increasing diversity at academic health centers may also inform the research agenda; introduce new kinds of scholarship to the institution; and increase and strengthen bench research, translational research, clinical studies and interventions that address health disparities".

The goal of the study was to increase the diversity of faculty at the UCSD School of Medicine (SOM). Based on statistics by Fang et al. [2000], "URM faculty remained less likely to be promoted compared with white faculty". As a result, some URM faculty are "stuck" at the rank of assistant professor, whereas non-Hispanic whites advance to the level of full professor [Castillo-Page et al., 2005]. A report by the New England Journal of Medicine confirms this was still the case in 2020, as shown in Figure 4 2 below:

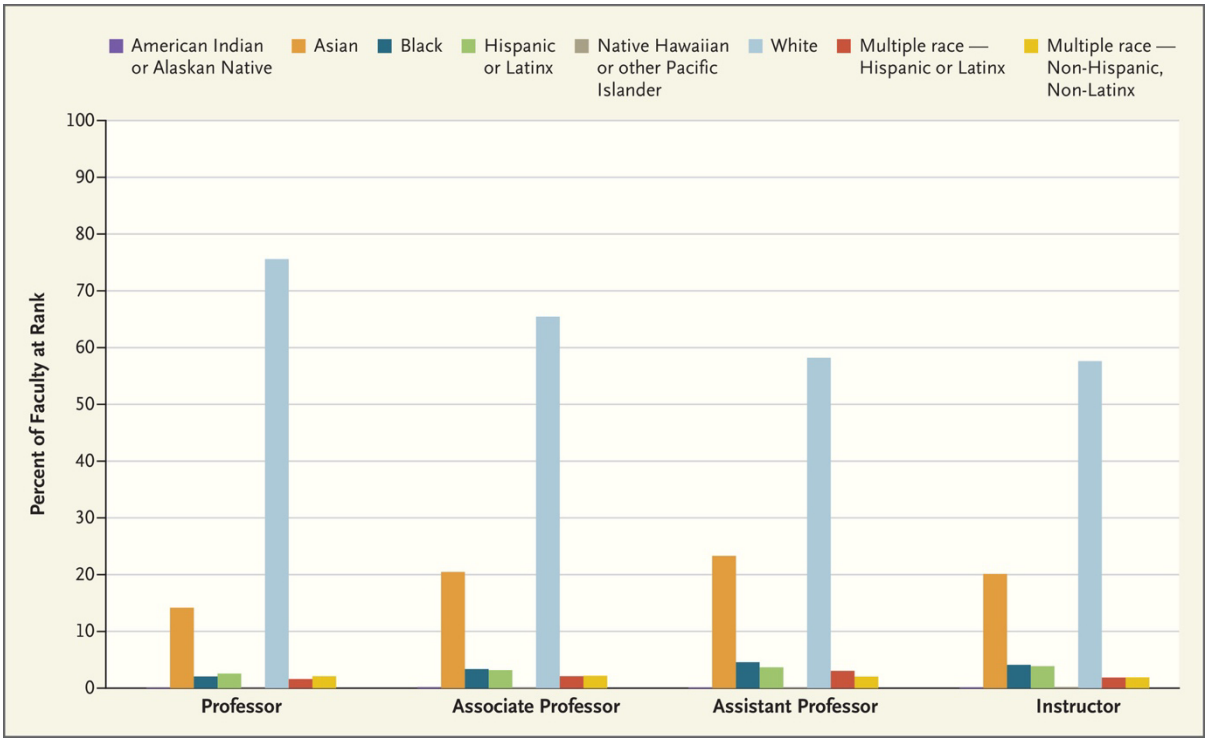

Figure 4-2: Percent of faculty grouped by rank, showing the distribution of ethnicity within each rank. [Rotenstein et al., 2021]

In order to address this disparity, the UCSD SOM established the National Center for Leadership in Academic Medicine (NCLAM), which is a "structured mentorship program that addresses the professional development needs of junior faculty by providing the knowledge, attitude, skills and resources necessary to make the transition to successful careers in academic medicine" [Daley et al., 2006].

NCLAM participants were required to complete:

- twelve half-day faculty development workshops on goal-setting and preparing the academic portfolio, principles of teaching and learning, leadership styles, negotiation skills, stress management, UCSD academic resources, UCSD grant resources, grant-writing, conflict resolution, curriculum development, performance evaluation, and effective presentation skills;

- a structured seven-month, one-on-one instrumental mentoring program averaging 12 hours per month;

- a two-hour academic performance counselling session; and

- a professional development project [Daley et al., 2006].

The words "workshops", "mentoring", and "project" are emphasized to show the common themes beginning to emerge which support the hypothesis that this type of training and education is beneficial. Table 4-2 categorizes them as follows:

Description	Theme
Developmental workshops	Workshops and Training
Mentoring program	Mentoring
Counselling session	Mentoring
Professional Development Project	Workshops and Training

Table 4-2: Themes from the study "Improving the Retention of Underrepresented Minority Faculty in Academic Medicine" [Daley et al., 2006].

4.3.2 Effective Strategies to Increase Diversity in STEM Fields

"Is there research evidence to support the efficacy of commonly adopted intervention strategies?" asks Tsui et al. in their review of "Effective Strategies to Increase Diversity in STEM Fields" published in the Journal of Negro Education in the fall of 2007. They undertook this question to review "evidence of the effectiveness of an array of strategies that are frequently used in efforts to increase minority participation in STEM fields" [Tsui, 2007].

The BEDIs faced by underrepresented minorities are "cultural (social expectations for different groups), structural (historical laws and regulations that barred the entry of minorities into education and employment), and institutional nature (discriminatory policies and practices)" [Tsui, 2007]. These are similar to the four presented in 3.1, "Non-industry-specific BEDIs" as compared in Table 4-3:

Barriers to Entry and Discouraging Influences (BEDIs)	
Tsui	**Gaston-Bird**
Cultural (social expectations for different groups)	Microaggressions; unconscious bias
Structural (historical laws and regulations that barred the entry of minorities into education and employment)	Discrimination; gatekeeping
Institutional nature (discriminatory policies and practices)	Discrimination

Table 4-3: Comparison of BEDIs found by Tsui [2007]. and the ones summarized by the researcher.

To remove these BEDIs, the review presents 10 "Major Intervention Strategies" which are commonly used and for which there exists supporting academic research [Tsui, 2007]. They are:

1. "Pre-college[6] summer bridge programmes: designed to help students from lower performing schools transition into university life academically and culturally.

2. "Mentoring programs: one-on-one interaction with a supportive mentor and role model can help with self-confidence and student retention.

[6] "College" in the US corresponds to "University" in the UK.

3. "Research Experience: the opportunity to participate with a faculty member in a hands-on research exercise outside of class has a positive effect on student retention and the uptake of post-graduate opportunities. Sometimes paid research experiences are available and can help students financially and academically.

4. "Tutoring: both students who are tutored and students who offer tutoring benefit from the experience. Although students who are tutored do not necessarily earn higher grades than students who do not receive tutoring, it does aid with retention. Students who tutor experience benefits from having to learn the material well enough to teach someone else.

5. "Career Counseling and Awareness: being aware of career options in STEM helps recruit STEM students; for Black students "personal contact with a scientist was identified as the major factor affecting students' science-related career decisions." Role models are also cited as an effective way of "familiarizing students with a wider spectrum of college majors and career fields".

6. "Learning Center: designed to help with retention, learning centers offer "instructional resources and media, learning skills enhancement, tutoring services, and pedagogical development".

7. "Academic Advising: some programmes require students check in for advising, and some academic advising systems "flag" students who do not regularly check in.

8. "Curriculum and Instructional Reform: as indicated by Byars-Winston and Moorning at the beginning of this section (4.3), and as discussed in section 3.1.3.1, "Gatekeeping classes / courses" there is a systemic "weeding out" that eliminates talented students, and this process points to the lack of a "tyranny of technique"[7] rather than engagement, support, and adaptability. The quality of preparation in calculus is one area of great concern.

9. "Workshops and Seminars: described as "academic enhancement activities", Tsui et al. acknowledge a research gap in this area, but they highlight the Mathematics Workshop as exemplary (see 4.3.2.1, "The Mathematics Workshop).

10. "Financial Support: as one might surmise, there is a direct correlation between access to funding and retention. Although it does not affect academic performance, it does enable academic persistence" [Tsui, 2007].

[7] *Technique* was defined by Jacques Ellul as "any complex of standardized means for attaining a predetermined end". Cummins, R. E. (1979). 'The Tyranny of Technique', *Journal of Thought,* 14, 1, 4-7. The "tyranny" of technique is lamented because "behavior modification, career education, competency-based instruction, modular teaching, all based on classic principles of Technique dominate educational thought, not as measures of altruistic control which guide and nurture students' learning, but as devices which encapsulate it. All embrace the world as it is; none question its inanities and inequities. All reject the mote in man's eye; none forgive him his fallibility. All assess his quantity; none evaluate his quality. All cherish efficiency; none condone the waste concomitant to creative process. All fixate on means, now ends, having eliminated the end, man himself." Ellul, J. (1964). *The Technological Society,* New York, NY Vintage Books. In other words, the "tyranny of technique" values process at the expense of substance.

Of these, the strategies that were the most-researched (as of 2007) were "research experience" (#3) and "mentoring programmes" (#2). However, although the other programmes were not written about as extensively, "their popular use would suggest that educators implement them might be judging them [as] effective through informal study or casual observation" [Tsui, 2007].

In terms of successes, one of the programmes highlighted by the study was the Mathematics Workshop Program represented by the "Workshops and Seminars" (#9) intervention strategy, because of its impact upon other universities who chose to follow their model.

4.3.2.1 The Mathematics Workshop

Uri Triesman, who developed the programme at the University of California at Berkeley in 1978, sought to address the "rate of failure of Black and Hispanic students in Calculus … Calculus was then, and remains today, a major barrier for minority students seeking to enter careers that depend in an essential way on mathematics" [Treisman, 1992]. The cause of these deficiencies stemmed from:

- low academic standards in the high schools from where the students graduated;
- lack of access to / uptake of informal study groups; and
- the stigma of university "counselling", which for minority students had negative connotations with high school "counselling", which was often remedial or disciplinary in nature [Treisman, 1983].

To remedy this, the Mathematics Workshop offered the following functions:

- build an academic community of minority freshmen;
- provide minority students with "extensive orientation and academic advising";
- monitor academic progress and acclimation;
- provide supplementary instruction and encourage independence; and
- link with high school and undergraduate affirmative action programs [Treisman, 1983].

As a result, the program reported that:

- the average grade of the 42 workshop students was a B- while the average grade of the non-workshop students was D-;
- every workshop student completed their math classes, while almost half of non-workshop students failed to complete the course;

- workshop students "out-performed their classmates in every section of mathematics in which they were enrolled"; and
- all students who participated in the workshops stayed at Berkeley, whereas there was a 30% attrition rate among minorities outside of the workshops and within other majors [Treisman, 1983].

Examples of programmes which follow this model include the ...the Emerging Scholars Program at the University of Texas at Austin; the Academic Excellence Workshop at California State Polytechnic University, Pomona; the Merit Workshop Program at the University of Illinois at Urbana-Champaign; and the Wisconsin Emerging Scholars Program at the University of Wisconsin. Documented positive effects for students include:

- higher grades;
- lower rates of course repetition;
- greater chance of enrolling in further mathematics coursework; and
- choosing and persisting in a STEM major [Tsui, 2007].

4.3.2.2 The Meyerhoff Program

Another study highlighted by Tsui was The Meyerhoff Program at the University of Maryland, Baltimore County (UMBC). The programme was established in 1989 and is still operating today. In a 1995 study by Maton et al. focused on African American students attending UMBC, qualitative observation and questionnaire data highlighted the importance of mentoring, community, study groups, and scholarships, among other factors.

Early results were that participants in the programme achieved a higher average grade point average (GPA) than non-participants; 3.5 versus 2.8, respectively [Maton et al., 1995]. As of 2022, over 1,400 students have graduated from the programme, and alumni have earned over 367 PhD degrees, over 180 MD or DO degrees, and "students were 5.3 times more likely to have graduated from or be currently attending a STEM PhD or MD/PhD program than those students who were invited to join the program but declined and attended another university" [Meyerhoff Scholars Program, 2022].

4.3.2.3 Computer Coding "Boot Camps"

In 1984, many women were choosing careers in computer science: at that time, over 35% of computer science majors were women. However, that number began to drop sharply in the following years. Figure 4-3 illustrates the steep decline:

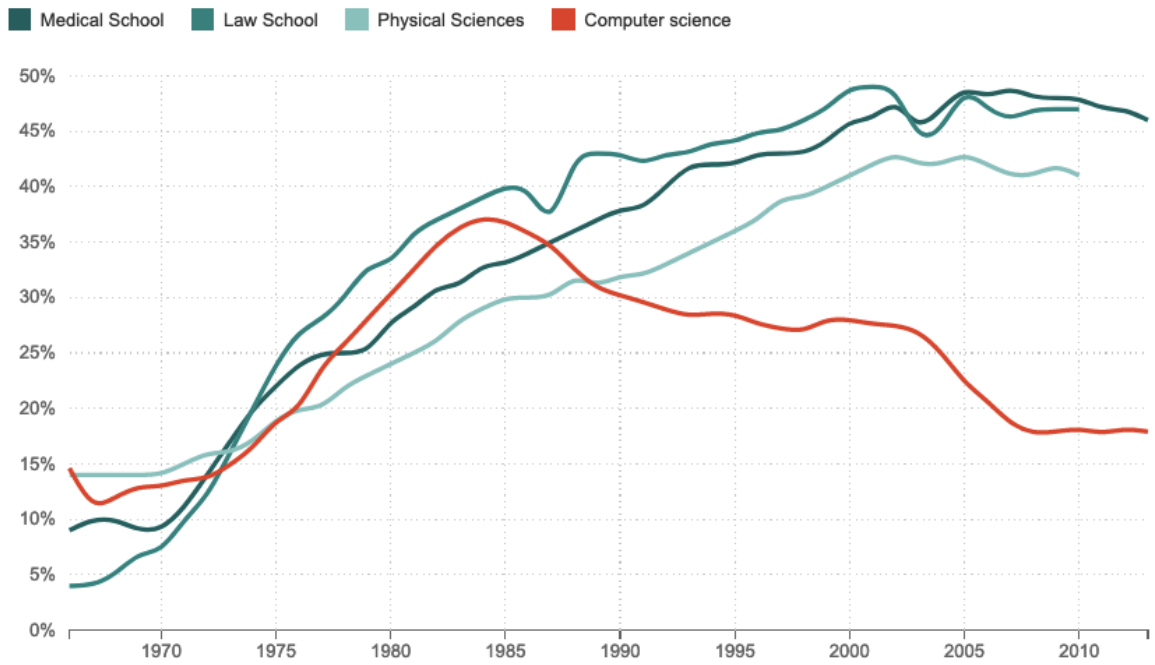

Figure 4-3: The number of women majoring in the disciplines or medicine, law, the physical sciences and computer science given as a percentage of all majors [Henn, 2014].

The phenomenon is connected to the marketing of computers as "toys" that were heavily marketed to boys, followed by Hollywood's creation of "awkward boy genius" movies such as *War Games, Weird Science,* and *Revenge of the Nerds* [Henn, 2014]. The scholarly literature endorses this theory; for example, authors Jane Margolis and Allan Fisher [2002] in their book *Unlocking the Clubhouse: Women in Computing* observe that "…boys have already been recruited into computer science. Public image, media, and marketing of computers have been specifically focused on boys. The gender stereotypes associated with computing tend to pull boys in and push girls away. To balance the influences, a concerted campaign to recruit girls is necessary."

As part of this recruitment strategy, a number of organizations offer "boot camps" to young girls and mid-career women. These experiences focus on "workforce readiness" by

- recruiting instructors from industry;
- providing a project-based, hands-on, and skills-focused curriculum;
- making strong efforts to connect students with industry"; and
- offer training in the latest tools and technology [Lyon et al., 2020].

4.3.2.4 Coding camps for girls

The first things visitors to the webpage GirlsWhoCode.com in the US see is a statement in all caps:

> *"WE'RE BUILDING THE WORLD'S LARGEST PIPELINE OF FUTURE FEMALE ENGINEERS" [Girls Who Code (USA), 2022].*

In the United Kingdom, visitors are greeted with:

> *"WE'RE ON A MISSION TO CLOSE THE GENDER GAP IN TECHNOLOGY IN THE UK" [Girls Who Code (USA), 2022]*

Both declarations are reminiscent of the Women's Audio Mission's slogan at WomensAudioMission.com which announces they are:

> *"CHANGING THE FACE OF SOUND" [Women's Audio Mission, 2022]*

The bold statements are also action statements, moving beyond data gathering and into data changing. In their annual report, Girls Who Code state they have served over 450,000 girls in the US, India, Canada and the UK with clubs, an online Summer Immersion Program (SIP), and "Code From Home" downloadable coding activities. More than half the girls in SIP are Black, Latinx, or low income. Perhaps the most personally compelling statistic is that 90,000 girls have so far participated in the program (graduates are known as "Girls Who Code alumni"); and "that number is three times the number of women who graduated with computer science and related degrees in the US in 2019" [Girls Who Code, 2020]. In other words, the programme has a large impact as a pipeline entryway.

In a survey of media reports about these types of camps, Mauk et al. [2020] find the information is mostly positive; that these camps are "essential to the future labour market" and they serve as "solutions to gender parities in Computer Science fields, and as a way to create confident girls for the future workforce".

However, Mauk et al. are not entirely laudatory; they find that media celebration around these kinds of initiatives misses some subtle messages. For example, the idea that getting girls into coding is up to the parents, who are expected to buy "robotics (engineering) Barbie™ dolls" and enrol their daughters into coding camps, actually takes the responsibility for discrimination and gatekeeping *away* from industry perpetrators. "The 71 news articles analyzed in this paper contribute to a powerful discursive field around girls and technologies that draws on neoliberal ideologies of easily surmountable solutions to workplace discrimination," they conclude [ibid.].

> *"This leads to the … logic – that empowering girls to code is a simple solution to the 'pipeline problem' of the lack of women in STEM careers as well as the potential crisis in the labour market. In this logic, girls' lack of interest in STEM fields is due to their lack of confidence in addition to a low representation of women in these fields. We have shown how this logic is a distraction to real, structural challenge. A lack of girls learning to code is not the problem, and our goal here is not to dissuade or devalue coding initiatives for girls. The issue arises when this is the only rhetoric that becomes visible and therefore distracts from dialogue about broader systemic problems of misogyny and toxic masculinity of the tech industry" [Mauk et al., 2020].*

To summarize the statement above, getting girls into coding should move beyond "trendy solutions" and begin to tackle the real issues facing the tech industry: those of misogyny and toxic masculinity. We have seen examples of such "toxic masculinity" in section 3.2.4, "Microaggressions in Audio" where women have had their experience called into question (to put it politely), or had to endure classmates joking about rape in a recording class; on the more extreme end, the hostility faced by women advocating for change in (video) "gamer culture" has included death threats and other violence [Todd, 2015]. Based on these examples, it is reasonable to conclude that these types of behaviour would be part of the "toxic" environment described by Mauk et al.

4.3.2.5 Women seeking career progression

Lyon et al. [2020] performed a qualitative study in which they found that in coding boot camps, 36% of participants were women, as opposed to 17% of women in 4-year computer science degrees. To find out more about this, they set out to discover:

1) "Who are the women attending coding boot camps, and why a boot camp?

2) "What are women's pathways into these settings, and why did they not major in CS (Computer Science) at college?

3) "How are women prepared for the workforce at coding boot camps, what are their job entry pathways and outcomes, and what role (if any) does a college degree play in their success?" [ibid.].

In their study, the median age of enrolees was 29, and most had around 6 years of work experience. All of the participants except one held a bachelor's degree. "Having tried to teach themselves to code using online free platforms," they reported, "these women decided that their learning progress would be accelerated through a more formal program" [ibid.]. This comment reinforces the fact that access can be a barrier despite the existence of free software. One participant stated:

> *"...my progress was going really slow. I thought it was worth doing a boot camp for that structured curriculum . . . and also the teachers and the assistants . . . I felt like it was a greater ROI (Return on Investment)" [Lyon et al., 2020].*

To discover pathways to the programme, researchers considered at what life stage women in the study were exposed to computer programming. For example:

- "K-16 exposure" (kindergarten through grade 16, equivalent to final year of a 4-year program); and
- "post college (university) exposure".

Those who had no exposure to computer science during the K-16 years did not major in computer science; those who learned of the field in college had already chosen their majors and stuck with them; those who learned of the field earlier also did not choose to enrol in computer science. However, all groups found their way to the boot camps; thus, the study brings attention to the lack of data regarding the camp "pipeline": how women find their way to the camps, and then from the camp into the workplace. Gleaning this data would provide insight into how 4-year computer science programmes might attract and retain women to study within their institutions [ibid.].

Boot camps do lead to jobs: employers who hire boot camp participants do so because these graduates have the familiarity with "cutting edge technology" and the "ability to adapt quickly". Employers also value the diversity of students who participate in these programmes [ibid.]. Participants feel as though the programme gives them an advantage over a 4-year degree because of the hands-on training:

> *"…the biggest distinction between [the Long-Term Boot Camp] and, like, a university CS degree or whatever is, like, all of this hands-on experience that we're getting because I mean it's a direct correlation between how the industry works … They're shaping the products or the projects to make sure that we're keeping up with industry standards and that kind of thing. That's just a much, much slower process at, like, a higher education institution" [Lyon et al., 2020].*

The job search process for graduates was made easier by the network of alumnae from the program, and by an internship programme that led to jobs for many of the graduates [Lyon et al., 2020].

4.4 Education and Training in Audio

Similar to the initiatives for STEM and medicine, there are education and training opportunities for UGs in the field of audio. Liz Dobson catalogued over 70 such groups on her website, "70+ (and growing) All-women and feminist sound/music tech collectives, co-ops, non-profits" [Dobson, 2018b]. A few of them are listed below, along with their activities and impact.

4.4.1 Women's Audio Mission

Women's Audio Mission (WAM) trains thousands of girls and women from minority ethnic backgrounds each year in the field of audio by providing workshops and continuing education programmes in recording and mixing. Founder and executive director Terri Winston estimates that number was 4,000 per year from 2020-2021, and around 1,500 per year prior to 2020 [Winston et al., 2021]. In fact, not only does Women's Audio Mission have a large network of alumnae, companies such as Apple, Sony, Google, and Pandora often seek to recruit talented women from WAM [Women's Audio Mission, 2021]. In addition, their graduates "have been placed in positions at Dolby Labs, Pixar, Electronic Arts, Google, Sennheiser, NPR, Pandora, SFJazz, Sterne Grove Festival, Animal Planet, Comedy Central, Rickshaw Stop, El Rio and many other professional venues as well as securing credits on recordings by Mary J. Blige/Hillary Clinton Interview, Kronos Quartet, St. Lawrence String Quartet, Angelique Kidjo (Grammy win), Soundtrack to the film 'Dirty Wars' (Academy Award nomination), Pamela Z, [and] Sean Dorsey Dance" [Women's Audio Mission, 2022].

The impact of WAM's presence is enormous, and in Winston's words has "transformed a city":

> *"It's transformed the city of San Francisco … so much so that the dear allies in our life, the male allies in our life, think there's no problem anywhere, because in San Francisco they'll say, 'but there's women at all the venues, Terri'. And I respond, 'we place them there'. And then they say, 'Oh, my God, yes, you're right. I forgot'. We do have women at every studio venue, you name it, Dolby, Pixar, everywhere. So I think they feel like it's fixed now. … but it's not even fixed here. But at least it's a model of 'this is what it should look like, where a male musician would think that everything's gender balanced here" [Winston et al., 2021].*

To summarise the quote above, WAM's efforts in getting women placed in live concert and studios in San Francisco have been so successful, many in the industry feel as if the problem of underrepresentation has been "fixed" (although it hasn't, according to Winston).

The academic literature supports this anecdotal evidence of WAM's impact on San Francisco in the context of "career intervention" as prescribed by Byars-Winston [2014] in section 4.3, "Education and Training in STEM and Medicine." WAM hosts a number of training opportunities, some of which are listed on their website. Such opportunities include:

- Girls on the Mic: "WAM uses music and media to attract and connect 3,000+ underserved Bay Area girls (ages 11-18) every year to free STEM/creative technology training, mentoring, and career/educational counselling";
- WAM Core Training for Adults: "WAM provides hands-on training in audio engineering, the recording arts and creative technology to over 350 women every year in a world-class recording studio with award-winning women instructors"; and

- Internship Program: "Women's Audio Mission selects interns 2-3 times per year. Interns are mentors to the girls in our Girls on the Mic program and assist on recording sessions in our recording studio as well the live sound for our events." [Ibid].

4.4.2 Beats By Girlz

Erin Barra, founder of Beats by Girlz and researcher (see 3.2.3, "Discrimination in the Music Industry"), highlights themes of empowerment as a rationale for the training and workshops. She spoke about how the training offered by Beats by Girlz came to empower their students:

> *"…we started with one classroom in New York City in 2013 inside of another non-profit called the Lower East Side Girls Club, and today we just opened our third chapter this year across four continents. So in 2021, we just opened in El Salvador, Colombia, Turkey and Malawi. So we've experienced a lot of growth over the past eight years. And we're empowering women through music and technology, not only to be creative, but powerful in whatever capacity they are interested in: pursuing jobs of the future, careers of the future. And I like to describe it as like an echo chamber of 'yes': We're just telling each other, 'Yes, you can. Yes, I will help you. Yes, I see you. And let's do this together.'" [Winston et al., 2021]*

According to their website, as of 2022, Beats by Girlz now has 37 chapters across the world which represent 15 countries across 4 continents [GGM Staff, 2021].

4.4.3 Gender Amplified

Ebonie Smith, founder of Gender Amplified, had hoped to begin a "brick and mortar" location for what she would have called the "Gender Amplified Institute", but the restriction on personal movement brought on by the pandemic inspired her to come up with a web series called "Studio Cribs". At the "Women in Audio: Today's Leaders" panel discussion at the AES Spring European Convention (held online in 2021), Smith described more about the events:

> *"Studio Cribs has been a phenomenal experience because we reached out to women who produce and we've asked them to take us into their home studios and show us a little bit about their process, and show us their gear in hopes of empowering folks who are at home, who are limited, who can't get out to the studios, who can't get out to the clubs, who in some cases might not be able to even travel locally in their communities. So I've wanted to use this series to expose these incredible women who are making amazing music out of their homes and their studio facilities that they own, but also to hopefully encourage folks who are trying to get into the craft or don't necessarily think that they have what it takes" [Winston et al., 2021].*

Thus, this innovative approach to addressing the restrictions of the pandemic resulted in the showcasing of role models.

4.4.4 MAMA Youth Project

MAMA Youth is an organization in the UK devoted to providing hands-on, real-time training in film and television for participants. They have industry support from Warner Brothers, The Farm, and Sister Pictures to guarantee placements for their graduates [MAMA Youth Project, 2022b].

Their ethos is to "create training programmes that equip young people with the skills to become work ready and gain employment within the broadcast and media industries" [MAMA Youth Project, n.d.]. Additionally, they provide professional and personal development support [ibid.]. MAMA Youth has trained 612 young people from underrepresented backgrounds, and over 100 of their alumni have worked for production companies. The percentage of students in sustained employment a year of completing training is 96% [MAMA Youth Project, 2022a]. The initiative is focused on television and film, but they do have opportunities for sound recording.

4.4.5 Saffron

Also in the UK, Saffron Music is an emerging organization "taking an intersectional approach to redressing the gender imbalance in the industry" [Saffron, 2022]. They began offering courses through the Saffron for Sound project in 2022, focused on music making in "traditional" stereo. Their mission is to increase the number of women, non-binary and trans people working in the music tech industry by "creating safe spaces for learning, community and progression" [ibid.]. Their four main activities are:

- "Providing accessible music tech courses and workshops;
- Nurturing supportive connections, bringing people together to cultivate safe spaces with opportunities for musical collaboration;
- Elevating diverse role models, with an intersectional approach to removing barriers to access across the gender spectrum; and
- Advocating for industry change in a constructive and long-lasting way, providing pathways towards greater diversity in professional spaces" [ibid.].

In these ways, the activities undertaken by Saffron mirror the recommendations by Laird and others regarding building social capital with networking, role models, and mentoring.

Chapter 4 Summary

This chapter asks the question, "how might these barriers be removed?" (RQ3) Fairclough [1990] offers a caveat that removing barriers is only part of a complex web of social change initiatives. Nonetheless, certain STEM, medicine, and audio industries are creating positive change as indicated by initiatives such as mentoring, networking, and educational initiatives including workshops.

Women and minorities are *no less capable* or interested than others, and sometimes *even more capable* and interested [Byars-Winston, 2014]. In the field of medicine, peer groups, networks, and role models are used to retain and promote medical residents [Hoff et al., 2021], [Daley et al., 2006]. In STEM disciplines, mentoring, workshops, and training are used with great success in improving student performance. For example, the Mathematics Workshop is an educational program which provides mentoring and peer groups to underrepresented minorities in order to insure success [Daley et al., 2006], [Treisman, 1983].

Computer coding bootcamps like Girls Who Code provide statistics on their graduates compared with the industry at large [Girls Who Code, 2020]. Women who enroll in coding bootcamps mid-career do so because they were sometimes intimidated early on, but come back to it once they have had experience in the workforce. Their desire is to gain additional skills, and employers value these programmes [Girls Who Code, 2020].

In audio engineering, several organizations cater to UGs; for example, Dobson documented over 70 focused on women [Dobson, 2018a], [Dobson, 2018b]. The impact of the Women's Audio Mission can be seen on the US West Coast with a high number of internship and job placements for companies mostly based in California [Women's Audio Mission, 2017] .

The evidence in this chapter from STEM, medicine, and audio has shown that removing barriers with the use of role models, mentoring, and workshops can effectively encourage wider diversity. In immersive audio, it is still important to investigate the experience of UGs to examine the wider context of these studies; thus Chapter 5 discusses the methodology used to embark on a GT study to discover the main concerns of UGs who participate in workshops in immersive audio, and how they process those concerns.

Chapter 5: Methodology

As discussed in Chapter 2: "Participation," the participation of UGs in immersive audio is low, and a number of discouraging influences have been identified in Chapter 3: "Barriers to Entry and Discouraging Influences" (BEDIs) including:

- gender- and race-based discrimination;
- microaggressions;
- gatekeeping; and
- economic factors including access to technology via educational programmes.

Remedies (as exemplified by studies in STEM, medicine, and audio) to these factors are covered in Chapter 4: Removing BEDIs, which include education programmes featuring:

- role models,
- mentoring, and
- training (including workshops) in safe spaces.

Evidence for successful interventions utilizing these tools for UG in STEM and medicine have been provided in Chapter 4. Based on this evidence, it is reasonable to conclude that the decision to launch educational workshops that incorporate these features will similarly function as a remedy to removing or reducing these BEDIs in immersive audio.

This study is being done in a time-limited manner and does not track the career progress of participants, which could be part of a longer study. Instead, a GT methodology will aid in discovering the main concerns of workshop participants (RQ4a) and how they process those concerns (RQ4b). It is the *behaviour* of women and minorities during their career journey that is studied in GT. Perhaps some "leak out" (3.3) by quitting or becoming discouraged; but what do they do, and why? What are they thinking? How do they cope, succeed, and/or survive? A GT study provides insight into these questions which is important in order to understand the social dynamics at work. GT uses an iterative and rigorous process which involves coding, analytical memoing, constant comparison, and theoretical sampling, all of which enable a deeper understanding of the phenomena under investigation. With this information, industry advocates who are interested in changing the situation will have better insight into various factors at play.

Therefore, this chapter:

- provides a definition of GT (5.1);

- discusses how GT methodology is employed for this study (5.2);
- discusses data analysis (5.3) including coding, memoing, constant comparison, saturation, and theory development;
- describes parameters for evaluating the quality of a GT study (5.4); and
- provides an overview of workshops in immersive audio ("Immersive and Inclusive Workshops") which were held in person and online (5.5). Components of this overview include a discussion of recruiting strategy (5.6) and workshop design (5.7).

5.1 Grounded Theory

Grounded theory (GT) is a rigorous and widely used qualitative research method used to develop theoretical explanation of human behaviour grounded in data collected from those exhibiting that behaviour [Creswell, 2013].

> *"A study based on grounded theory is likely to begin with a question, or even just with the collection of qualitative data. As researchers review the data collected, ideas or concepts become apparent to the researchers. These ideas/concepts are said to 'emerge' from the data. The researchers tag those ideas/concepts with codes that succinctly summarize the ideas/concepts. As more data are collected and re-reviewed, codes can be grouped into higher-level concepts and then into categories. These categories become the basis of a hypothesis or a new theory" [Allan, 2003].*

In GT, the "yield is just hypothesis": the product of the research is "a theoretical formulation or integrated set of conceptual hypotheses about the substantive area under study" [Glaser, 1992]. Further, GT studies do not use pre-defined theoretical frameworks [Ash, 2023]. Together, these statements mean that the output of a GT study is meant to develop a theory from data rather than trying to impose preconceived notions.

The benefits of adhering to the specific process prescribed by classic GT and avoiding layering are explained by various scholars. For example, researcher Helen Scott [2007] explains "the stringent and emphatic rules that govern the development of a GT are designed to protect the data from being forced into a particular form and to enable the student researcher to tease out the shape of the theory from flat data". Other methods may involve the testing of a hypothesis, but GT simply enables a strong theory to emerge. "The need to preconceive is strong when there is no trust in the discovery of a problem", writes Barney Glaser. "The researcher need not be concerned whether or not the data should be collected quantitatively or qualitatively or in what combination, as required when studying a preconceived problem. Once choosing the GT methodology, this debate is moot" [Glaser, 1992]. GT is used to generate concepts and relationships between those concepts "that explain, account for and interpret the variation in behaviour … hinged around processing a problem for the subjects" [ibid.]. This is done through coding, memoing, and theoretical sampling (see 5.3, "Data Analysis").

In Chapter 4, examples of impactful workshops from STEM and medicine were given. Each study took different approaches to achieve this impact and/or describe emergent theories as summarized in Table 5-1:

Study	**Type**	**Tools**
Study: Mathematics Workshop [Treisman, 1983]	Mixed: qualitative (GT) and quantitative	Interviews, observation, data on grade point averages (GPA)
	Emergent Theory	**Impact / findings**
	Stigmatized "counselling"; lack of access to / uptake of study groups	Improved GPA; course completion and retention
Study	**Type**	**Tools**
Study: Meyerhoff Study [Tsui, 2007]; [Meyerhoff Scholars Program, 2022]	Qualitative	Observation, questionnaire data
	Emergent Theory	**Impact / findings**
	Importance of mentoring, community, study groups, and scholarships	Improved GPA; improved likelihood of graduating
Study	**Type**	**Tools**
Study: Women in coding boot camps [Lyon et al., 2020]	Qualitative (case study)	Interviews
	Emergent Theory	**Impact / findings**
	Access to education – despite the existence of free software – can be a barrier.	"…participants in this study who attended CS classes at the university in some cases reported discouragement … due to barriers reported in research on women in computing, such as stereotypes and the masculine nature of the field or impostor syndrome and discomfort in asking questions"…"The existence of boot camps indicates the desire for intensive, short-term, job-focused training, particularly by career changers." The job search process for graduates was made easier by the network of alumnae from the program, and an internship programme that led to jobs for many graduates [ibid.].
Study	**Type**	**Tools**
Digital Audio EcoFeminism (DA'EF): The Glocal Impact of All-Female Communities on Learning and Sound Creativities [Dobson, 2018a]	Qualitative	Interviews
	Emergent Theory	**Impact / findings**
	The "idea of Digital Audio Ecofeminism (DA'EF) [refers] to a particular set of values … providing women with alternative spaces for learning and creating in digital audio domains."	"DA'EF communities have a glocal presence, prioritising social equality, inclusion and power-sharing, in ways that build from a local knowledge of and about obstacles that marginalise people, while simultaneously providing social, cultural and economic capital" [ibid.].
Study	**Type**	**Tools**
Examining youth participatory action research (YPAR) as a context to disrupt implicit bias in African American (AA) adolescent girls [Duke et al., 2022]	Qualitative	Interviews
	Emergent Theory	**Impact / findings**
	(Theory): "AA girls are vulnerable to internalizing societal biases associated with their race and gender." (Hypothesis): "if the girls had a space to work together in a positive environment … conflict and negative perceptions would be reduced" [ibid.]	"During their participation in the YPAR project, their perceptions became more positive towards working with others who share their race and gender. Acknowledging competence, recognizing within-group diversity, and exposing girls to counter-narratives, challenged internalized biases and led to a deeper respect as they worked to complete their YPAR project" [ibid.].

Table 5-1: Summary of notable studies and their impact / findings

In each of the studies above, research methods include the gathering of indicative data, and outputs include the formation of theories based on interviews and observations: for example, discoveries regarding the dispositional changes of African American girls in the YPAR study and the common characteristics of DA'EF communities.

Other commonalities include the reduction or removal of barriers: these programmes were delivered to women or minorities exclusively, reducing the undesirable influences of discrimination, microaggressions, and gatekeeping. For example, Duke et. al. [2022] explain that African American girls are "still vulnerable to internalizing societal biases associated with their race and gender". Dobson reminds us that "research examining gender and engagement also shows that social environment influences learning in ways that benefit boys, particularly where staff and students exhibit an unconscious bias linking technology with masculinity" [Dobson, 2018a].

The programmes encouraged access and affordability, although in the case of college retention programmes the participants were freshmen with the means to attend college [Tsui, 2007]; in the case of computer boot camps, there was a cost but participants articulated it was more affordable than getting a second degree [Lyon et al., 2020].

Treisman, in recounting the establishment of the Mathematics Workshop, provided some insight into how GT was at work in their study:

> *"The study was supposed to take ten weeks, but after four months we still didn't have a clear picture of why, as a group, the Black students were failing calculus while the Chinese excelled. We were advised by some graduate researchers in the social sciences to step back and question our hypotheses; this was really useful.* ***Instead of looking at what happens when students get stuck on a problem, we were encouraged to look more globally at their lives.*** *We went up to Lake Tahoe with hundreds of hours of unedited videotape. In a weekend all of our hypotheses fell apart.*
>
> *"Let's look at motivation. It is not as if our Black students thought to themselves, 'Well, there's nothing happening on the streets, so let's go to Harvard, Caltech, Princeton or Berkeley.'* ***These students were admitted to one of the premier research universities in the United States, and we had presumed that their problem was motivation!*** *Many of the inner-city students were socially isolated throughout high school; they paid a very, very high price to get to Berkeley. These kids were motivated! Unfortunately,* ***we had been mistaking 'disorientation' for lack of motivation****" [Treisman, 1992]. (emphasis added)*

As indicated by the statements in bold, discovery begins with observation. The discovery by Treisman and his colleagues about motivation versus disorientation is an example of an emergent theory. As stated by Hillary Engward [2013], "Grounded theory is a systematic research approach involving the discovery of theory through data collection and analysis. In particular, **the focus is on uncovering patterns in social life** that individuals might or might not be aware of" (emphasis added).

Based on the success of Treisman's GT approach, it is reasonable to conclude that an approach based in GT will facilitate the development of an emergent theory based on the analysis of interviews.

5.2 Employing GT methodology for this study

In this study, the overarching aim is to come up with a clearly articulated theory by discovering the main concerns of participants in immersive audio workshops (RQ4a) and how they process those concerns (RQ4b). As Milliken and Schreiber write [in Aldiabat et al., 2011], the task of a grounded theorist is to "understand the socially-shared meanings that underlie individuals' behaviours and the reality of the participants being studied."

In other words, the study has moved beyond generalizations based on quantitative data (e.g., "how many?", "how few?") and seeks instead to derive a theory grounded in qualitative data.

The main features of such a study are:

1) "The researcher focuses on a process or an action that has distinct steps or phases that occur over time. Thus, a grounded theory study has 'movement' or some action that the researcher is attempting to explain. A process might be "developing a general education program" or the process of "supporting faculty to become good researchers" [Creswell, 2013].

In the case of this study, the process is "offering affordable workshops in a safe space for participants to discover their main concerns and how they process those concerns".

2) "The researcher also seeks, in the end, to develop a theory of this process or action. There are many definitions of a theory available in the literature, but, in general, a theory is an explanation of something or an understanding that the researcher develops. This explanation or understanding is a drawing together, in grounded theory, of theoretical categories that are arrayed to show how the theory works" [Creswell, 2013].

The theory presented in Chapter 7 emerges from the data through the process of coding, constant comparison, analytical memoing, and theoretical sampling.

3) "Memoing becomes part of developing the theory as the researcher writes down ideas as data are collected and analyzed" [Creswell, 2013].

Although coding, memoing, and theoretical sampling are the main components of analysis, it is the memoing stage where ideas are "elevated to the theoretical level" [Glaser, 2002]. The researcher uses NVivo and MaxQDA software, as well as a personal journal to capture memos.

4) "The primary form of data collection is often interviewing in which the researcher is constantly comparing data gleaned from participants with ideas about the emerging theory. The process consists of going back and forth between the participants, gathering new interviews, and then returning to the evolving theory to fill in the gaps and to elaborate on how it works."[Creswell, 2013]

This is the process of constant comparison: codes and categories are continuously evolving through an iterative process until a point of saturation is reached.

5) *"Data analysis can be structured and follow the pattern of developing open categories, selecting one category to be the focus of the theory, and then detailing additional categories (axial coding) to form a theoretical model. The intersection of the categories becomes the theory (called selective coding). This theory can be presented as a diagram, as propositions (or hypotheses), or as a discussion" [Corbin et al., 2008].*

For this stage, the researcher develops codes and categories and selects one category to be the focus of the theory (the "core category"), and detailed additional categories through axial coding. This process allows the researcher to form a theoretical model, with the intersection of these categories forming the basis of the theory. This structured approach to data analysis provides a systematic and organized way to develop and present the theory *grounded in the data* (5.3).

5.3 Data Analysis

Data analysis is a phase in GT where the researcher engages in a rigorous examination of the collected data (in this case, transcripts of interviews) in order to develop an understanding of the behaviours of participants.

This process involves several key components, including open coding, analytical memoing, and theoretical sampling performed in iterations as described below.

5.3.1 Open Coding

Open coding begins with looking at the interview data and assigning codes. Several hundred codes can be generated during this phase depending on the number and length of interviews. The goal is to use the codes to guide the selection of a core category (5.3.3). As GT methodology often involves a substantial number of codes generated during the analysis, it is important to clarify that the intention is not to inundate the reader with an exhaustive list. Instead, the aim is to convey to the reader the underlying principles and methodological rigour that guided the coding process, ensuring transparency and adherence to established practices. By focusing on the broader patterns, themes, and relationships that emerged from open coding and subsequent analytical memoing (5.3.2), the study will provide a clearly articulated account of the insights that lead to the identification of the core category (5.3.3). The codes used in this study can be found in Appendix B.

It is important to note that the *process* of making choices during the coding process is an inherent part of the methodology as discussed in the works of Glaser (5.1), Creswell (5.2), and Charmaz (5.3, 5.4) cited throughout this chapter and made relevant to the current study in Chapter 6: "Data Analysis". The *rationale* behind each choice is to "grasp the core idea of each part [of the interview] and develop a code to describe it" [Vollstedt et al., 2019]. At this stage, the researcher goes through each interview line by line, coding along the way.

Most importantly, as scholar Philip Adu [2018] states, "There is no application of existing theory: you are not going in [to the analysis process] trying to *apply an existing theory,* you are going in *allowing the data to speak to you* … the analysis should be data-driven. [Ultimately], your theory should represent the data that you have". This is why the codes are done line by line, as objectively as possible. This is the uniqueness of GT, which is grounded in the data.

5.3.1.1 But why these codes?

The reader might want to know why the researcher has chosen certain codes, and how the researcher knows they have the "right" codes. Charmaz [2006] advises researchers to "stick closely to the data. Try to see actions in each segment of data rather than applying preexisting categories to the data. Attempt to code with words that reflect action … this method of coding curbs our tendencies to make conceptual leaps and to adopt extant theories *before* we have done the necessary analytic work". For example, in a study about pets, an incident might be, "when I walk my dog I try to prevent him from interacting with other pets." This could be coded as "dog walking", "prevention", and "interaction".

Glaser, in his book *The Discovery of Grounded Theory: Strategies for Qualitative Research* [1967] provides a clear philosophy in this regard:

> *"Researchers using grounded theory methods do not aim for the 'truth.' Rather, those researchers try to conceptualize what has been taking place in the lives of study participants".*

Glaser states that the discovery of meaningful relationships and theoretical insights is not done while coding, but happens during the constant comparison process (5.3.3, 6.3.4). Therefore, it is the researcher's *reflection* on these codes (analytical memoing) and *connections* between codes (constant comparison) that provide the foundation for the emergent theory.

5.3.1.2 But what about bias?

Just as the reader wonders about the rationale behind the chosen codes, they might also wonder about bias. Glaser states,

> *"The data is what it is and the researcher collects, codes and analyzes exactly what he has…There is no such thing as bias, or objective or subjective, interpreted or misinterpreted, etc. It is what the researcher is receiving (as a human being, which is inescapable). Data is what the researcher is constantly comparing with tedium, to be sure, as he generates categories and their properties. Remember again, the product will be transcending abstraction, NOT accurate description" [Glaser, 2007].*

In the previous quote, Glaser says "there is no such thing as bias", which might seem counterintuitive or even controversial. Actually, Glaser does acknowledge and even value researcher bias; the distinction lies in how these biases are managed throughout the research process. Here, Glaser is referring to the idea that GT researchers should strive to collect and analyze data without distorting the information to fit their preconceived notions. In other words, the *research itself* is not biased. Glaser stresses the importance of "staying open" to the data. In GT, researchers adhere to the data rigorously to allow the emerging theory to develop.

For example, suppose a researcher had a preconceived idea that women in the male-dominated audio industry might lack confidence in their abilities. During the GT process, it is possible the data could reveal that women are actively developing strategies to overcome such challenges and have a strong sense of self-confidence. By staying open to the data and not forcing it to fit their initial assumptions, the researcher develops a more accurate and nuanced understanding of the participants' experiences grounded in the data.

5.3.1.3 Positivism vs Constructivism

Positivism and constructivism are theoretical frameworks which are often used in research and which situate a researcher's view of reality: either an objective reality that can be discovered through observation of cause-and-effect (positivism) or constructed subjectively from within (constructivism) [Creswell, 2013]. Although Glaser positions Charmaz' interpretation of GT as constructivist, he cautions against the constructivist framework she proposes, and instead embraces the researcher's bias. Bias, he seems to imply, is a significant variable which is part of the constant comparison process:

> *"It appears that constructivism is an effort to dignify the data and to avoid the work of confronting researcher bias. Remember bias is just another variable and a social product. If the researcher is exerting bias, then this is a part of the research, in which bias is a vital variable to weave into the constant comparative analysis. It happens easily in 'hot' or 'passionate position' issue oriented research, such as political, feminism, or abuse type research or in research on inviolate control structures, which cannot tolerate implicit subversion. This aspect of default remodeling, that is covering bias up for what it is - another variable - is a vital loss to GT" [Glaser, 2007].*

Therefore, in classic GT it is accepted that the researcher's bias is part of the coding process and part of the research, which is one reason that revealing that bias is part of a qualitative study (as done in 6.1, "Researcher Reflexivity and Bias"). The "vital loss" mentioned in the quote above happens when researchers do *not* address their biases, seeking perhaps to assure the reader that the research is not "subverting science" in some way as Glaser implies. As the researcher constantly compares and generate categories and properties, a theoretical framework emerges that captures the essence of the experiences of the people being studied. Through the rigorous methodology described in this chapter, the impact of inherent bias becomes less significant as the focus shifts towards the emergence of a theory through saturation and triangulation of the data (or "fit," see 5.3.9 and 6.3.10).

5.3.2 Analytical memoing

Memoing is a crucial part of the GT process. If coding and analysis are done without memoing, then the researcher "is not doing grounded theory" [Glaser, 2002]. According to Glaser, memos serve the following functions:

- "exhausts the analyst's ideation;
- raises the data to a conceptual level;
- develops the properties of each category;
- presents hypotheses about connections between categories; and
- begins to locate the emerging theory" [Glaser, 2002].

In these memos, "researchers build detailed descriptions, develop themes or dimensions, and provide an interpretation in light of their own views or views of perspectives in the literature" [Creswell, 2013]. Examples of memos used in the current study are given in Table 6-4, Table 6-8, and Table 6-9.

5.3.3 Constant Comparison

Constant comparison is done whereby the researcher compares codes from interview to interview or data source to data source in order to discover a core category. The constant comparison process may yield multiple incidents from among interview subjects that could include various anecdotes, stories, or statements about their interactions. In the example about pets (5.3.1.1), such incidents might result in larger categories such as "health concerns", "socialization," "behavioral development," and so on.

5.3.4 Iterations

The processes of coding, memoing, and constant comparison are *iterative*, as shown in Figure 5-1:

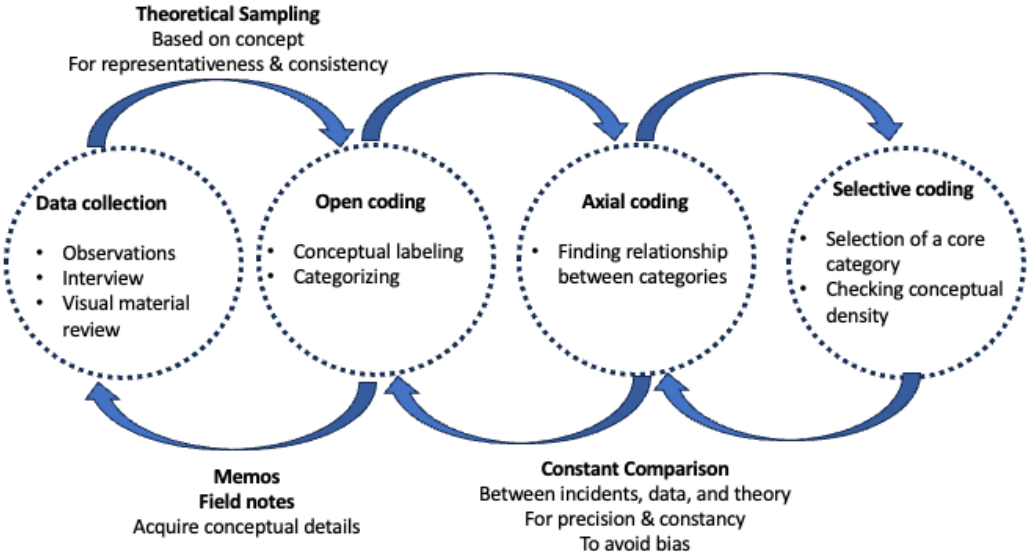

Figure 5-1: Data analysis procedure of GT method. [Cho et al., 2014]

In the current study, the researcher held four workshops after which she interviewed participants, and therefore at least four iterations of analysis along with constant comparison as described in 6.3.5, "Iterations". However, constant comparison happens simultaneously, making it challenging to reveal clearly defined stages. As Ji Young Cho [2014] writes, "The researcher does not wait until data are completely collected to begin data analysis; instead, data collection and analysis occur simultaneously so that the analyzed data guides subsequent data collection".

In other words, the researcher obtained initial interviews, coded them, and gained initial insights through memoing and constant comparison from one interview to the next. Data was sourced from conferences, memos, and field notes. Insights from that initial process fed into the next iteration of interviews, and so on. This iterative approach ensured the researcher's analysis was informed by (or "grounded in") the data. The researcher carried on in this way until the data was *saturated*, as discussed in 5.3.7. Thus, in order to illuminate the various stages of the study, the researcher provides *milestones* (6.3.5) that show the progression of the analysis.

5.3.5 Axial Coding

Axial coding is a way of relating categories and subcategories, by converting codes into concepts [Charmaz, 2006]. It involves organizing and relating codes to their subcategories or dimensions, seeking connections and relationships between concepts. This step enables the researcher to make sense of the data and develop a more systematic coding framework by organizing the data "into more coherent, hierarchically structured categories and subcategories that add nuance and dimension to emergent concepts and their potential relationship to other framework elements" [Scott et al., 2017].

For example, using the fictional "pets" scenario again, during the axial coding phase the researcher examines the data for subcategories, such as "health concerns: positive (exercise)" and "health concerns: negative (contagions)"; these in turn might intersect with "socialization" as dog owners might see socialization as a motivator or deterrent, respectively.

Figure 5-2 shows what axial coding looks like in Delve, a computer-assisted qualitative data analysis software (CAQDAS) tool:

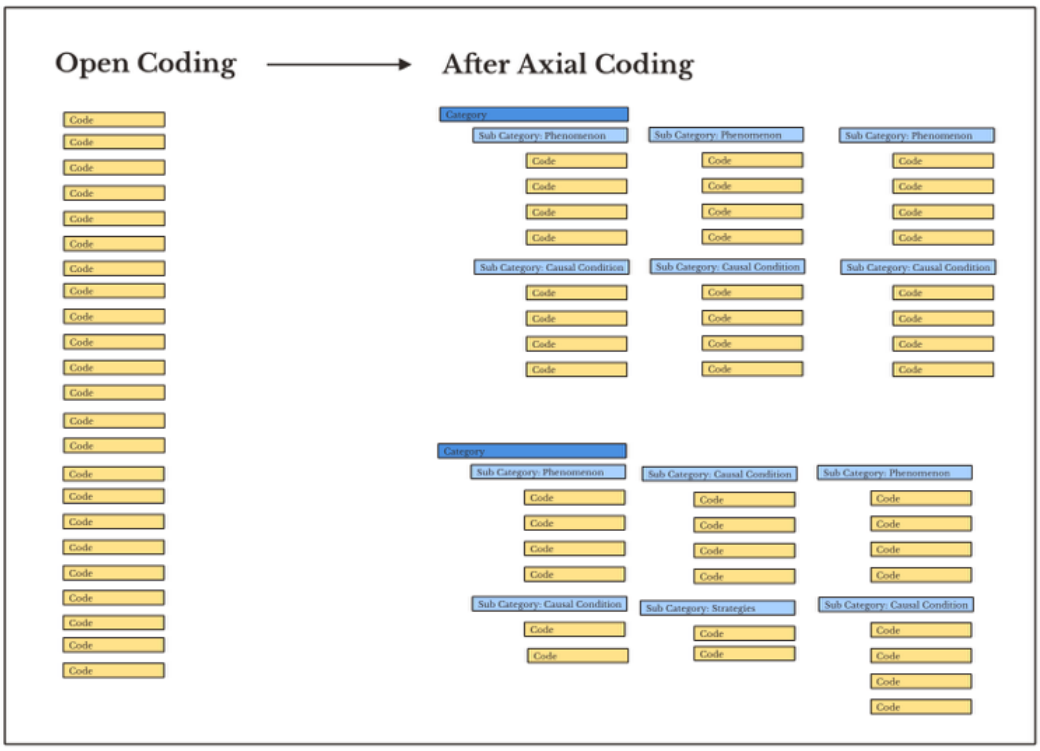

Figure 5-2: Open coding and axial coding as shown in Delve, a qualitative data analysis software tool [Delve, n.d.]

Because several hundred codes can be generated in a study, other diagrams can be useful for visualizing the relationships between codes as connections are made.

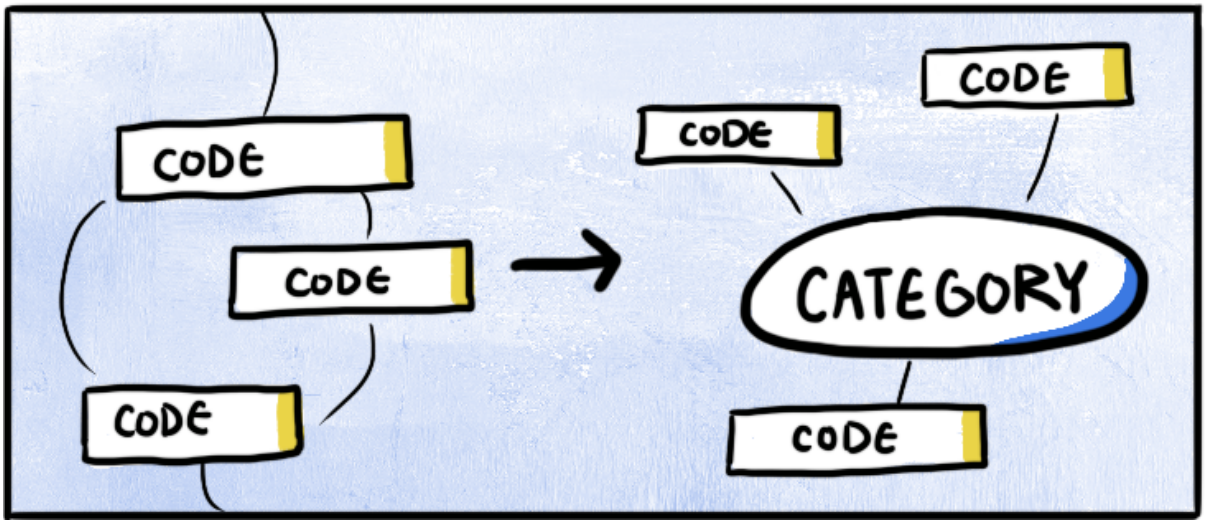

Figure 5-3: A visual representation of axial coding as codes are connected to categories [Delve, n.d.]

Figure 5-3 shows how those codes and categories can be visualized in a different way. For the current study, axial coding is visualized the diagram in Figure 6-6.

5.3.6 Theoretical sampling and Selective Coding

During this stage of the study, the researcher compiles the codes, analyses the data, and decides what data to collect next in order to "develop his [sic] theory as it emerges" [Glaser, 2002].

Helen Scott states that "Theoretical sampling means that further data collection is focused on obtaining data relevant to the core category and related categories" [Scott, 2007]. Along with saturation, the study is therefore delimited in such a way that "the data need not be overwhelming" [ibid.].

The theoretical sampling stage refines the emerging theory by seeking out data that can confirm, challenge, or change the existing concepts and relationships. If the existing concepts change, then saturation has not been reached; if they cannot, then theoretical saturation has been achieved (5.3.7).

Selective coding is the penultimate iteration of coding which "begins only after the researcher has identified a potential core variable. Subsequent data collection and coding is delimited to that which is relevant to the emerging conceptual framework" [Holton, 2010].

5.3.7 Saturation

Saturation is reached when:

- no new data emerges;
- variations in a category do not change the essential properties of that category; and
- the relationships between categories are established. [Boychuk Duchscher et al., 2004]

This is made possible through "constant comparison" which enables certain incidents or themes to emerge [Sebastian, 2019]. Scholar Philip Adu states simply, "if the data doesn't cause you to change the theory, then you have reached saturation" [Adu, 2018]. This concept differs from *data* saturation, in which a researcher fails to find new data from interview subjects; instead, it refers to *theoretical saturation*, wherein "all of the main variations of the phenomenon have been identified and incorporated into the emerging theory" [Guest et al., 2006].

In their paper "Code saturation versus meaning saturation: how many interviews are enough," authors Hennink, Kaiser, and Marconi suggest that "*code saturation* [open coding] in GT could be reached at nine interviews, when researchers 'heard it all,'" and that "*meaning saturation* [theoretical coding] could be reached between 16-24 interviews, when researchers 'understand it all.'" [Hennink et al., 2017] The point of saturation can also be supported with the use of **triangulation** (5.3.9, 6.3.9) which incorporates various perspectives and bolsters confidence in the identification of a saturation point. [Aldiabat et al., 2018] So although there is a degree of subjectivity in determining what it means to "understand it all", GT offers a rigorous process to accomplish this; not just by settling on repetitive categories, but by continuing with iterations until no new theoretical codes surface (5.3.10). In this way, the GT methodology ensures a structured and rigorous approach, minimizing subjectivity in determining saturation.

5.3.8 Core Category

During data analysis so many descriptive codes emerge that the listing of categories might become distracting. In this case, a point of saturation will guide the researcher towards a **core category**. As explained by Barney Glaser:

> *"The goal of grounded theory is to generate a theory that accounts for a pattern of behavior which is relevant in problematic for those involved. The goal is not voluminous description, not clarification. The generation of theory occurs around the core category. Without a core category an effort of grounded theory will drift in relevancy and workability. Since a core category accounts for most of the variation and a pattern of behavior, this has several important functions for generating theory.* ***It is relevant and works****. Most other categories and their properties are related to it, which makes it subject to much qualification and modification because it is so dependent on what is going on in the action" [Glaser, 1978].*

Thus, as articulated by Glaser, it is the core category which plays a crucial role in generating theory, not voluminous description and clarification [Glaser, 1978] , [Glaser et al., 1967].

5.3.9 Fit vs. Triangulation

Another measure of quality is "fit", a term which Glaser prefers to "triangulation". Triangulation is a feature of most qualitative studies wherein researchers "make use of multiple and different sources, methods, investigators, and theories to provide corroborating evidence" [Creswell, 2013]. "Fit," on the other hand, is another word for "validity": As Glaser describes it, "fit is continually sharpened by constant comparisons" [Glaser, 1978]. The primary goal is to generate theories that are grounded in the data (constantly compared through iterations of coding and analysis and memoing) rather than relying on pre-existing concepts or theories (referred to as *forcing* the data). Data collection and analysis are guided by the emerging theoretical insights.

5.3.10 Sorting, Memoing, and Theory Development

During this final stage, the researcher reviews and rearrange the codes, categories, and their relationships to identify the most relevant and significant categories that contribute to the development of the theory. According to Charmaz, "sorting serves [the] final theory" by giving the researcher the "means of creating and refining final links" [Charmaz, 2006]. Memos are elevated to the theoretical level and expand upon the researcher's thoughts and interpretations, aiding in the development and refinement of the GT. Finally, the sorted data, memos, and categories are synthesized to construct the theory.

5.4 Evaluating the quality of a GT study

In many studies, it is desirable to determine the measure of success before a study is undertaken. For example, will x% more women decide to pursue immersive audio? Will the audio industry become more tolerant? Will discrimination disappear? Answers to these questions, although desirable, would be very hard to obtain within the timescale of a PhD study; however, these very answers encapsulate the desired outcome to "fix" underrepresentation in the industry.

The desire to articulate an easy answer based on a preconceived idea of the nature of the problem is an example of "forcing" the data. Glaser and GT co-founder Anselm Strauss had differing views on this: Glaser strongly felt the theory "rises directly and rigorously out of the data, is returned to the data for verification, and emerges victoriously devoid of interpretivism," and he criticized Strauss for "fracturing" data through "directive questioning that forces a preconceived conceptual description". Even though that description might be significant and valid, Glaser argued it was not "emergent GT" [Boychuk Duchscher et al., 2004]. It is the researcher's stance that an "unforced", emergent theory will be a powerful tool for informing RQ4a and RQ4b, and for this reason she is inclined to follow Glaser's philosophy.

Instead of a "measure of success", Charmaz and Thornberg's checklist provides a measure of quality for a GT study [Charmaz et al., 2021]. Charmaz and Thornberg claim this checklist is compatible for various styles of GT (for example, "Glaserian" for Barney Glaser's strand, or "Straussian" for Anselm Strauss), which are written in second person as a guide to researchers:

- communicate the rationale for choosing your topic and methodology, including the version of GT you have adopted;
- work with a mentor if possible;
- keep an open mind about existing literature (whether following a "Glaserian" GT or "Straussian" GT) and not treat it as "truth";
- gather rich data: stories and experiences of people who might be different than you;
- be transparent about how your study was conducted and how participants were chosen;
- engage in constant comparison and analysis;
- tolerate ambiguity in the data;
- ask progressively focused questions;
- look for multiple theoretical explanations and check them;
- collect sufficient data (saturation), compare them, and connect them;
- always treat codes and categories as provisional;
- after your analysis, compare it with the literature with perspectives you did not address; this allows the opportunity to "show how your analysis fits, extends, or challenges leading ideas in your field" [Charmaz et al., 2021].

This checklist served as a useful guide during the researcher's study, and is summarized in the following table:

Charmaz and Thornberg's Checklist	**Researcher's response**
Communicate the rationale for choosing your topic and methodology, including the version of GT you have adopted	The motivation for the project was covered in 1.3, "Motivation". Classic GT is the method being used as described in 5.1, "Grounded Theory".
Work with a mentor if possible	The researcher worked with Dr. Helen Scott (a protégé of Bernard Glaser); Dr. Pamela Laird, historian and professor emerita of the University of Colorado; and Dr. Michelle Fine, distinguished professor at The City University of New York (CUNY) as detailed in 5.9, "Mentorship".
Keep an open mind about existing literature (whether following a "Glaserian" GT or "Straussian" GT) and not treat it is "truth"	Throughout the writing process, the researcher chose terms such as "perceived to be", "possibly", and "seems" and avoided declarations such as "is" or "must be."
Gather rich data: stories and experiences of people who might be different than you	The 23 interview participants come from varying backgrounds as described in 6.2, "Population under study."
Be transparent about how your study was conducted and how participants were chosen	5.8, "Recruitment" describes how participants were chosen.
Engage in constant comparison and analysis;	The researcher used MaxQDA for constant comparison and analysis as detailed in 6.3.4, "Constant Comparison."
Tolerate ambiguity in the data	The researcher treated some ambiguity as questions to be answered in "future work."
Ask progressively focused questions	By interacting with the data and posing increasingly specific and targeted questions, the researcher explored emerging themes, and refined her understanding of the phenomena under investigation as detailed in 6.3.4, "Constant Comparison."
Look for multiple theoretical explanations and check them	The researcher categorized the data in multiple ways, allowing for the exploration of various theoretical explanations. This was an iterative process of comparing and contrasting different structures which aided the development of a GT as detailed in 6.3.6, "Axial Coding" and 6.3.8, "Theoretical Sampling and Selective Coding."
Collect sufficient data (saturation), compare them, and connect them	As interviews progressed, the researcher began to saturate the data as detailed in 6.3.8, "Theoretical Sampling and Selective Coding."
Always treat codes and categories as provisional.	The researcher actively engaged in the iterative process of analyzing the data and revisiting the codes and categories she had initially identified. The researcher recognized that the initial coding structure was not "set in stone" and remained open to making adjustments as she gained deeper insights into the data.
After your analysis, compare it with the literature with perspectives you did not address; this allows the opportunity to "show how your analysis fits, extends, or challenges leading ideas in your field."	Discussed in Chapter 6: Data Analysis and **Error! Reference source not found. Error! Reference source not found.**.

Table 5-2: The researcher's comparison of Charmaz and Thornberg's "quality" [Charmaz et al., 2021] *with her own process.*

5.5 Online and in-person course delivery

In order to reduce or eliminate BEDIs, the researcher held online workshops, built and fitted a 7.1.4 immersive studio[8] which was (and still is) meant to be a safe and inclusive space, and invited women and other underrepresented groups to attend workshops and training in that space. This at least reduced and possibly removed many undesirable influences in the following ways:

1) Online workshops (see 5.7, "Workshops / Invitation"): this facilitated participation by UGs in various geographic locations. An immersive experience over headphones was accomplished by streaming stereo and binaural audio from Dolby Atmos over Zoom using its stereo streaming capability. Some participants were also able to use Audiomovers software to listen to a 5.1 downmix of the Dolby Atmos material. Through trial and error, the researcher settled for binaural mixes using Zoom because of the necessity to keep the course delivery as simple as possible and not require an additional browser (e.g., some participants used their phones to listen to the lecture with Pro Tools running on a non-web-enabled computer, etc.).

2) Creating an accessible space: the researcher created a laboratory for immersive audio in Brighton, England. Travel and lodging were supported with a grant from the UK Research and Innovation (UKRI) "Women in Innovation" fund. Two students accepted the invitation to participate in person and were able to experience the sound of multiple loudspeakers rather than binaural or stereo audio. Perhaps equally as important, those students were not "the only women in the room".

3) Making a safe space: the researcher limited the participants in that space to women and minorities. The perceived threat of microaggressions and discrimination perpetrated by white males was removed, and an "anti-harassment policy" and a code of conduct was provided on the website in order to set expectations. Participants were invited to contact the researcher if they experienced any undesirable behaviour during the class.

4) Providing access to training: students were able to take the workshops at a reduced cost, or completely free (with scholarships from SoundGirls and travel bursaries supported by funding from the Women in Innovation grant, although some participants paid without applying for a scholarship). Thus, the economic barrier to training was removed or lessened. Also, students participating in person had access to a laboratory with the required software and loudspeakers. In the case of students having to study remotely, a suitable demonstration with headphones was achieved, and students received a one-year license for Pro Tools Ultimate. The license for Dolby Atmos had to be purchased separately, and some students used the demo version of the software.

5) Featuring role models and networking: in addition to training, role models and networking are seen as key in removing and reducing barriers. Having a member of a UG (the researcher, a woman of color) present the workshops and courses was integral to that philosophy.

[8] The surround format 7.1.4 refers to seven (7) loudspeakers in the horizontal plane, one (1) subwoofer, and four (4) loudspeakers in the ceiling.

While efforts were made to provide a safe space and to mitigate economic barriers by offering grant-funded workshops and access to the necessary software and equipment, there were still potential barriers that may have persisted. For example, access to the internet, a laptop, and an iLok (a hardware device that authenticates Pro Tools software) could have posed challenges for those to whom the workshops were promoted. While the Audio Girl Africa workshops did provide iLoks, these technical requirements may have impacted the ability of other individuals who wished to participate in the workshops. Future studies (8.4) could explore strategies to address these remaining barriers, such as providing loaner equipment or partnering with local libraries or schools to ensure access to the necessary resources.

5.6 Sponsorship

Early in the research process, the researcher was accepted into "Conception X Cohort IV", a programme "for PhD students interested in developing their business skills". As part of the programme, the researcher developed a pitch deck that could be used when talking to potential sponsors. With her pitch deck, the researcher approached Avid (distributor of Pro Tools software, a digital audio workstation for audio engineers) to discuss her plans to offer workshops in immersive audio. The research piqued Avid's interest, as they were beginning a DEI (Diversity, Equity, and Inclusion) sponsorship. The Immersive and Inclusive Audio programme was chosen to be one of the first to receive the sponsorship.

The sponsorship gave the researcher the opportunity to be trained as an Avid Certified Instructor (ACI) for Pro Tools and Dolby Atmos. With this certification, she would be able to offer workshops leading to certification for students, an outcome she saw as a potentially valuable incentive to attract participants.

The researcher was also a recipient of Innovate UK's Women in Innovation award, a £50,000 grant which allowed her to outfit a studio with loudspeakers as described in 5.5 and provide scholarships to students, thus reducing a BEDI of economic access.

5.7 Workshops / Invitation

Students in a university-level audio programme might have different access to equipment than professionals for whom immersive audio was not taught during their time in school. Similarly, career professionals and freelancers are motivated by different factors when considering immersive audio; for example, the desire to expand their skillset and find additional streams of income.

In acknowledging the various skill levels and career progression among participants, the researcher offered four different classes. This allowed the researcher to cater to entry-level and professional students as well as levels in between, ensuring that the material covered was neither too advanced nor too basic and allowing the students to choose the level that suited them.

Therefore, the final offering of workshops was:

- Intro to Immersive Audio: a 2-hour course geared toward students with little or no prior training in immersive audio, but who were curious. No hands-on component was available for this class.

- Immersive Audio Mixing / Immersive Audio Intensive: a 3-day course offered to students who have intermediate to advanced audio skills who wanted to create immersive content in a studio environment or on their laptops.

- Pro Tools 101 and Pro Tools 110 (Pro Tools User Certification): Avid's hands-on coursework culminating in the "Pro Tools User" certification, and a prerequisite for the Dolby Atmos class.

- Pro Tools 205D and 210D (Pro Tools Dolby Atmos Operator Certification): Avid's hands-on course covering the Dolby Atmos renderer and culminating in the "Dolby Atmos Operator" certificate.

5.8 Recruitment

GT studies focus on carefully selected populations who engage in specific activities or share common environments, circumstances, or areas of study. As Creswell [2013] states, "participants in the study would all have experienced the process, and the development of the theory might help explain practice or provide a framework for further research," for example, a study of police responding to domestic abuse calls ([Ash, 2023]) or Black women seeking to lose weight ([Harley et al., 2009])

Participants were recruited through partner organizations such as SoundGirls (International), Black Sound Society (UK), Women's Audio Mission (US), and Audio Girl Africa (Nigeria). By inviting a subset of participants within these affinity groups based on their interest in immersive audio workshops, the researcher sought to understand the unique experiences, perspectives, and desires of these individuals, which in turn allowed for the exploration of a range of experiences and perspectives related to RQ4a&b: "What are the unique concerns of UGs in audio and how do they process those concerns?"

Despite the initial focus on a small group with diverse backgrounds, emergent GT holds the potential for broader application across different contexts. According to Glaser and Strauss [2014], "application of a GT is based on conceptual fit and relevance, even if the area is different." This supports the idea that the emergent theory can contribute to a broader understanding of the experiences of underrepresented groups in the field of audio, even when beginning with a smaller group.

At the beginning of the workshops, the researcher informed students about the PhD study, and that after the workshop they could email her about taking part in an interview. At the conclusion of each workshop, the invitation was extended again, and the researcher's email address was displayed on the PowerPoint presentation.

Altogether, 81 students participated in workshops, and 23 students contacted the author to be interviewed.

5.9 Mentorship

The researcher consulted with the following mentors during the study:

- Dr. Pamela Laird provided guidance with early drafts of the confirmation report, commenting on organization and structure as well as places to find data related to women in STEM.

- Ky Brooks lent support by looking at the early coding in NVivo and recommending codes.

- Dr. Michelle Fine emphasized the importance of studying the context and interactions of individuals, rather than focusing on traditional societal frameworks. For example, she pointed the researcher to helpful articles about women in academia, including aspects such as mentorship, recognition, and the challenges they face. She encouraged the researcher to explore the obstacles, strategies, and gifts of underrepresented groups in the field, challenging conventional mentoring approaches and encouraging a look at issues regarding gatekeeping.

- Dr. Helen Scott hosted a workshop through the Grounded Theory Institute, and provided one-on-one mentoring with the researcher. She recommended several books by Barney Glaser published by Sociology Press, and encouraged the researcher to articulate her findings in terms of core categories and main concerns, often tempering the researcher's enthusiasm with pointed questions about adherence to method, and offering a balanced perspective and ensuring methodological rigour.

These interactions served as triangulation, which adds support to the reliability of the study. Also, each mentor brought a different background and area of expertise, which helped the researcher gain a more comprehensive understanding of the data and develop confidence in her conclusions.

5.10 Chapter 5: Summary

Based on the findings in Chapters 3 and 4 for RQ2 and RQ3, BEDIs can be mitigated with the use of role models, mentoring, training, and workshops to reduce factors of discrimination, microaggressions, access, and gatekeeping. Therefore, RQ 4 asks, "What are the main concerns of participants in immersive audio workshops (RQ4a) and how do they process those concerns (RQ4b)?"

This chapter described in detail a GT framework for the qualitative aspect of the research design. Examples of successful studies by Tsui, Treisman, Lyon, Duke, and Dobson were given, along with their emergent theories which were derived using grounded methods. A definition of GT was given, along with the various iterative stages of coding (open, axial, and selective), analytical memoing, and theoretical sampling. An explanation of coding was given, along with how bias is mitigated. Codes described actions and were in turn compared to each other and elevated to memos. They were then checked with theoretical sampling and validation ("fit"). A way of measuring the quality of the study and its emergent theory was given by way of a checklist designed by Charmaz and Thornberg.

In Chapter 6: Data Analysis, the researcher summarizes the findings and presents the emergent themes.

Chapter 6: Data Analysis

Chapter 5: "Methodology" explained the use of the qualitative method classic GT and discussed its usefulness in discovering answers to the questions, "What are the main concerns of participants in immersive audio workshops (RQ4a) and how do they process those concerns (RQ4b)?". In explaining the methodology, Chapter 5 also provided important information about how and why the researcher selects codes, writes memos, and engages in "constant comparison" of the data to ensure relevance.

This chapter discusses the analysis of data (primarily interviews as well as field notes) gathered using that methodology to answer RQ4a and RQ4b.

This chapter is organized as follows:

- Researcher reflexivity and bias (6.1);
- Population under study (6.2);
- Data collection and analysis (6.3); and
- Emergent themes (6.4).

First, the researcher provides a look at her biases by providing her background, and situates her experiences in the context of the issues surrounding the present research. Next, a look at the population under study is described, along with a look at subsections of that population. Following that, the data gathered according to methodology given in Chapter 5 is provided, during which the process of analysing the data in order to arrive at the core category and main concern are revealed. Finally, the emergent themes are presented.

6.1 Researcher Reflexivity and Bias

The researcher is a Black woman from the USA in her 50s who holds a master of science degree in recording arts. In childhood, her parents provided her with a Montessori education (a private school), and she attended a private high school. This may have given her certain socioeconomic and educational advantages. She has over 30 years of professional experience as an audio engineer and educator. She is now a 3rd year, self-funded PhD student (and as such part of a trend wherein Black and Hispanic women in the US have incurred more debt than their white counterparts.[9]

[9] The report, "The Perfect Storm", found that "Black women (41%) and Hispanic women (43%) are far more likely to pay for school with federal student loans than white women (28%)" American Association of University Women (2022). 'The Perfect Storm'. Washington, D.C.: AAUW. Available at: https://www.aauw.org/app/uploads/2022/08/PerfectStorm_NYC-Student-Debt-Survey-Report_Aug-2022.pdf (Accessed 5/13/2023). .

During her career, she has been involved with feminist audio collectives, including SoundGirls and Women's Audio Mission. She has also served in leadership capacities in other audio organizations such as the Audio Engineering Society, Association of Motion Picture Sound, Motion Picture Sound Editors, and Cinema Audio Society. Within the Audio Engineering Society, she organized the Diversity and Inclusion Committee in 2016. The researcher is also author of the books, *Women in Audio* [2020] and *Math Fundamentals for Audio* [2020]. In these ways, the researcher demonstrates her personal values which include networking, scholarly dialogue, community, giving visibility role models, and empowerment.

The research presented has been conducted through a "feminist lens," meaning that the researcher subscribes to the theory that "patriarchal structures have limited women's choices, voices, and visibility" [Denker, 2022]. However, the researcher considers herself to be an audio engineer first, and prior to this study would not have classified herself as a scholar in ethnic studies or women's studies (academic majors that can be found in many universities). Thus, this research is her first foray into these concepts.

The researcher has also experienced some of the discouraging biases and barriers mentioned in this research such as microaggressions, discrimination, ageism, and racism. As such, the researcher also acknowledges that Critical Race Theory (CRT) could be another lens through which data is viewed. Mackensie Minniear and Megan E. Cardwell, in their book chapter *Critical Race Theory: Dismantling Racial Oppression Through Interpersonal Communication* [2022] state that CRT is meant to "identify and change systems of racism embedded in society," and that "we need to make sure this research is benefitting the people it needs to, rather than only existing in the cycle of publish-or-perish". In this case, the researcher considers CRT as part of the larger interpretive framework of social justice in order to shed a light on the disparities between the populations under study and the industry as a whole; to use this information to benefit marginalized populations as well as the industry at large; and to foster positive change.

6.2 Population under study: Subgroups

The results are based on data from all participants, but it is useful to identify subsets of participants. Some are entering their careers, some are established; some are men, some are women; some commonalities are based on geographical area.

A total of 23 participants accepted the invitation to be interviewed by the researcher. Twenty-one were women, and two were men. Six women were based in Africa, seven in Europe, and eight in North America. One man was from North America, and the other man was from Europe (Table 6-1). Nine women and one man had been working in the field for more than 10 years and were considered to be "established" in their careers (Table 6-2).

Location	Women	Men	Total	Percentage
Africa	6	0	6	26.10%
Europe	7	1	8	34.80%
North America	8	1	9	39.10%
Total	21	2	23	100%

Table 6-1: Participants and location

Gender	Early Career	Established
Women	12	9
Men	1	1

Table 6-2: Established participants

The participants are grouped into five categories:

- Audio Girl Africa
- Women in Europe
- Women in the US
- Minority Men
- Established Participants

6.2.1 Audio Girl Africa

This group of women took the Pro Tools 101 / 110 class to achieve Pro Tools Fundamentals certification[10]. One also took the "Intro to Immersive" class.

Many women in the Audio Girl Africa cohort first became interested in sound at church:

> *"…my first foray into the sound was through the church. I was in the choir but enjoyed being in the control room more. I was 10 years old and the engineers would let me move faders. And was enamoured of how making slight changes like bringing the tenors up would make the congregation cry." Participant 23 (P23)*

[10] Note: At this time, the researcher was operating under the premise that a sequence of courses was necessary to take the Atmos certification. Later, Avid specified that "Avid Learning Partners" with a "professional" designation (as is the case with Immersive and Inclusive Audio, CIC) can use their judgement to allow applicants with professional experience to enrol in the Dolby Atmos class.

> *"So when I got into production I realize it's not just making music there is the live sound part of it. So at my church I was doing that and showed interest in it." P7*

A few women then began working with a male congregant to learn the system.

> *"He taught me how to set up sound for church – nothing big, the amplifier, speaker, the microphones, nothing big, just simple." P9*

> *"I was using adobe audition and studio one to mix at church." P8*

However, some of their parents discouraged them from pursuing a career in the arts.

> *"I was proving myself to my dad – I'm not going to be useless." P7*

> *"I wanted to go study for it. But I didn't have enough money. I got into SAE London in 2014 but my parents didn't understand what I wanted to do so I had to forfeit that admission." P10*

Interestingly, some parents valued a STEM education over artistic pursuits such as music and the arts:

> *"Here In Africa, if parents don't hear 'doctor' or 'engineer' they think they child is not smart enough. I would have gone into the arts … Because here the belief has been that kids studying the arts … if you want to be a musician, guitarist, then you won't make your parents proud. So breaking that barrier there was friction when I decided what I want to do." P5*

The women in Audio Girl Africa are aware of audio production schools, but good ones are hard to find and very expensive:

> *"You go there and you realize they don't know what they're talking about. I am focus on doing something the right way." P5*

> *"There are audio schools but they are very expensive. Not everyone can afford it." P9*

However, one woman was able to get into an academy based on a referral from a male colleague:

> *"I went to [a prominent school with industry connections]. I studied sound for television and film. We did practical work, shot a movie …Hands on experience to follow the process of filming." P10*

One woman worked her way up from a janitorial position. But it took creative thinking, patience, and male advocacy ("male authentication") because she was not immediately accepted or taken seriously:

> *"I came in as a cleaner or janitor here 2011 to work and that was after as my what you call high school, but I needed to save money to get into school. I record poetry … So I went on stage to do my poem and the owner said 'who is this intelligent young lady' and they said ' she is just a cleaner,' but he said 'she is too intelligent to be a cleaner' … so I had wanted to do an internship before, but this time the owner of the company brought me here like an apprentice, or trainee (but that's not the word I am looking for). So when I got into production I realize it's not just making music there is the live sound part of it." P7*

Another woman also found a way in:

> *"I had a friend working at a radio station and started an internship in the production dept. I didn't want to be the "coffee intern". I said "I want to learn". P5*

But even though they "got in," they both lamented they did not feel a sense of belonging and were initially excluded.

> *"Some people block others from seeing what they are doing so it is hard work to do what I do. I am saying that from the perspective of effort not pride. A lot of people do not want to be your colleague. Some people don't accept the cleaner sitting next to them. So I had to grow on people … somehow I always find favor with these people I am with." P7*

> *"In 2019 I was hired as head of production at that radio station. But because I was not a well-travelled person my boss did not trust me. He just wouldn't listen – not because the ideas are not great. So those are the barriers I faced." P5*

Meanwhile, the other women had to find a different path and began teaching themselves.

> *"…a friend sent me a link to [a] podcast and I became obsessed with podcast. I started trying to make my own and encourage my friends to make their own podcasts that I would edit for them. I knew there was something for me in the podcasting space. And I knew that one day there would be lots of podcasts so I was training myself, watching YouTube videos, doing trial and error. And I am still learning on my own …" P5*

> *"This is Nigeria, you have to be self sufficient. I am introverted and I like to keep to myself." P9*

6.2.2 Women in Europe

Compared with the women in Nigeria, it seems easier for women in Europe to find universities at which to study. In fact, six of the seven women based in Europe who participated in these interviews hold master's degrees, and one is completing her master's degree at time of writing.

However, the stages of the journey are similar: from aspirations and seeking to being taken seriously and gaining trust.

The women who live in Europe were able to attend a university and had encouragement from their parents:

> *"My parents wanted me to have a 4 year degree." P2*

> *"…my dad had a sound system and my kind of very early experiences of interaction happened through sound; like I learned bonding with my dad through sound and the sound system." P13*

During their time in undergrad, there was an opportunity to work with others and explore various sound engineering careers, sometimes with guidance from a professor:

> *"I was an undergrad in a fine arts course and I wanted to record interviews. There was someone at the art college who did this a lot. I talked to him and he gave me a DAT machine and sent me out. He got stuck one day and he knew I knew how to do this and asked if I could interview an American sculptor. [He] said he would teach me to edit." P1*

> *"I got into audio by an arts school. I studied fine art. I think it was a research topic that made me record interviews." P16*

> *"It was practical: camera editing, sound, all analog tape. And I loved sound and somehow there are very few people in film school who love sound so I always ended up doing it on projects." P11*

> *"Professors for sound design and film had their own studios for post-production for film. So they would hire us to assist. It was a paid job but still working as an assistant." P21*

Many had excellent grades and made swift progress:

> *"I got distinction in all my modules; for Module 1 for Post-Production, 5.1 mixing … Audio Theory" P4*

> *"…for the music and technology study I studied there from 2004-2007 so in 3 years I did my bachelor's and master's." P19*

They decided to pursue sound engineering as a career. They had access to technology and internships:

> *"The facilities here at [name redacted] with S6 consoles are amazing … a focus on immersive audio and particularly focused on immersive. And focus on spatial audio is awesome." P4*

> *"…my thesis … was about surround sound: what works, doesn't work, and for whom. There was a [large sound studio] … that was used for Atmos. I was an intern there and they let me use the stage and listen to DVDs. For instance I did [a major motion picture]" P19*

But after graduation, some had difficulty locating a mentor:

> *"When I thought I wanted to do post-production, no one would train me. I was looking when I was 34. They wanted to take someone on who was younger … I was told I was the wrong type of person; I hadn't come through ranks." P1*

> *"I tried to sit in on mixes whenever I could but it wasn't tolerated because of the directors and personnel coming in." P19*

A few women became desperate and willing to work for low pay, at risk of "leaking out":

> *"So now I am at a moment when I am saying I need to quit this. I really like [freelancing] but it either needs to pay better or I need to just stop … And when you are starting out you are so eager and you just want to present yourself to the world." P19*

> *"..at that point of time I was willing to be poorly paid." P1*

> *"For years I applied to all the major studios; you start questioning yourself. I had the expertise. I would even go in and roll cables just to get into the facility." P4*

> *"I need paid projects. I would take myself seriously if I was getting paid. I had someone shadowing me who is getting paid who said I was better than her." P16*

Some decided to look for opportunities elsewhere, commuting longer or even emigrating to another country:

> *"I studied 5 years in [my country] but in order to get a full time job I would need to wait for 5 years. But in some departments people had political connections and could get in without waiting for someone to retire (or leave). That's why I came to the UK so I didn't have to wait… I knew I wanted to move and go somewhere abroad." P21*

> *"About 2-3 years ago my partner [wanted to emigrate] to Canada or UK … is because the industry is so much bigger… there are jobs available. It's more diverse but not as much as it should be; and Vancouver is a hub for post." P4*

> *"I had to work in [another city], and it's 1 hour drive there and another hour back home, plus 8 hours of work."*

6.2.3 Women in the US

Like their European counterparts, the interview subjects in the US had access to music tech and recording arts at universities, although there were dozens more sound engineering programmes in the US in every state, and students could make more of a tailored choice to suit their needs.

> *"…Continued into [my university] and their recording tech program. There was [a trade school], and a couple other tech schools but [my university] was only one doing 4 year degree." P2*

> *"I studied EE and CS in college with a theater minor and graduated in 2020." P15*

> *"I really did want to go to [1st choice university], I liked it there, I liked college. But what I didn't like about the program was that when you were majoring in audio you had to have a focus on an instrument … So then I went to [2nd choice university]." P20*

Like their European counterparts, their grades were high and they were ambitious.

> *".. did it in 3 years. I had very, very, very busy semesters. I was taking 18 credit hours. I graduated in winter of 2017 but with the class of 2018. That's when I walked but I got my diploma winter 2017." P20*

> *"I stuck with it 4 years. Graduated with honors, I was one of the top students. I think one of the few people to graduate on time with that degree." P18*

But looking for an internship, these American women were on their own.

> *"I was looking at studios and didn't feel [I had] enough to offer them. That's when I needed a mentor to talk me through that. I didn't work in audio for a whole year. When I was looking for a job I didn't know what I was doing. So I did video at NFL (National Football League) for a year. [I thought], 'This is not my passion, I'm messing up' … the pay was decent but there was recording studio – a home studio in [my city], so I hit them up for an internship." P18*

> *"After graduating I kind of had to find my own way. When we were on campus there was an internship class. We met as a class and recorded the ensembles around the campus as 'the work for the internship'. Then there was a more senior member who helped facilitate and helped you do the internship work but that was a class. All of the internships I did I found on my own. And there's been no career help from [my university]... sometimes there's Facebook and [alumni] post job opportunities, but not much from the actual university". P20*

One woman was able to find freelance work, but felt exploited to some degree:

> *"I was at a job that was "perma-lance" (full time work with no contract). They owned my schedule without the benefits of having a full time job … Because I'm young and female and don't have family or kids people felt they could take advantage of my time. I felt like I couldn't say no because it was made clear [they'll] just find someone else. … You'd think if people feel free to call you at 2 am they'd pay you a livable wage." P20*

Eventually she found a staff job, and was fortunate that the employer knew about another gig she had worked on.

> *"And I got the [nationally televised broadcast] job based on my remote work … we did a 14-person group remote record. Even when I did the interview, the interviewer knew about the project." P20*

Other women also found some paying gigs; some involved having someone "vouch" for them, some were willing to take a cut in pay:

> *"...he already had a crew of people around him at the studio and another engineer brought me in for a session" P2*

> *"... I have a one-track mind and was really focused. It was a major pay cut but I felt better about life and purpose." P18*

6.2.4 Minority men

Two of the participants were non-white males. Participant 14 is Black and lives in the UK; Participant 17 is Hispanic and lives in Mexico.

Participant 14 is a freelance production sound mixer looking to upskill. Like his female counterparts in Europe and the US, he studied sound at a university:

> *"I went to primary / secondary school then did a BTech course at A levels. That's the first time I did video production, photography, that was my start in sound for video. And then I went to study TV production at university and they give you the opportunity to try to specialise in different areas – you might be a producer, sound, it's a way of you finding your avenue." P14*

He knows the power of networking but is not naïve about inclusion in the industry. His opportunity came from another Black colleague:

> *"I wouldn't say the degree put me at an advantage to anyone else .. you might be so-and-so's nephew or son who knows someone else. I did a trainee job for 2- 3 years and then I got sound assistant job with [a member of a Black sound collective] obviously." P14*

He has insight about how to navigate the industry, and the various factors that give someone a "leg up".

> *"Film & TV on set is dominated by middle class white people who perhaps their home environment and upbringing was more conducive with a positive mindset perhaps? But if you are a minority, as you move up it becomes much less diverse and it's important to have a strong set of values and self-worth. And that is important to someone's confidence as well. If your family and upbringing was two parents, solid, structured, routine, not crazy ... no issues at home .. it's interesting the trajectory of someone's life from being a child that will ... perhaps guide someone in different directions. The start you have in life is very important." P14*

Participant 14 is hard-working and feels taken seriously, but gives the thought additional consideration:

> *"I have never felt like I haven't been taken seriously, but I have always wanted to be that person who shows I can go the extra mile.... maybe I do that because I want to be taken seriously?" P 17*

Participant 17 travelled abroad for his education, unable to find the right school for him in Mexico at the time.

> *"..my first approach to music and sound … was in the USA. I did my senior year in high school in Vancouver, Washington. And they had a class of music. And for me that was amazing … [I] enjoyed it for a whole year, we went to a recording studio." P17*

> *"But after that, I was 18 and I came back to Mexico there was no career, no BA in music, no audio engineering. It didn't exist at that time: 1999. It was 32-33 years ago … so… I decided to study a totally different thing. So after my BA I signed up to do a year for music at Leeds university. After that I came back to Mexico. I had problems, I couldn't afford Leeds anymore, so I started to work in whatever I can find." P17*

> *"And while I was working at different jobs I studied at a conservatory [in Spain] in music. And so I was kind of getting more and more into it. And I think at that time, 2007, there was now some courses in Mexico at different unis for BA in music and engineering, but for me it was like going back in time because I didn't have that early foundational learning." P17*

Participant 17 made the decision to get a master's degree, hoping it would help him get a job. He was aware that people abroad were reluctant to hire him because he was a foreigner:

> *"After my master's degree I wanted to get a job right away and wanted to get a job in a company related into sound. It didn't matter to me what they did as long as it was related to music business. I sent resumes all over the place. You name it. Phone calls, visits, and I actually did it being in the UK and for me I knew one limitation was that I was foreign. I knew that because I was in Spain, Leeds, I know how it goes. But I didn't get any job over there so I went back to Mexico and I kept going. I applied everywhere: manufacturers, music, advertisement." P17*

Now Participant 17 owns his own business, having made some observations about the industry and becoming an expert in the field of audio branding where he has found a niche:

> *"I did my dissertation in audio branding … that's why I founded my company because I think there is a gap between the offers and the actual skills that you get from a course, because it's not that all companies need sound design. And all the advertisers in theory do need sound design, but they don't know they need it." P17*

6.2.5 Established participants

A few of the participants in the interviews were further along in their careers. They live in Europe and the US. Some teach full-time, and some are freelancers. Some do both and are involved with education and working on creative projects.

There were various pathways into teaching and reasons why they sought to teach:

> *"I have a personal investment in my own education, and then began looking at teaching to progress my own interests."*
>
> *"I was teaching post sound in [Canada] but I moved to [Europe] and started doing independent work in films here just on my own at home – not with a facility." … "So I feel pretty happy with my position now that my main paycheck is as an instructor…" P11*
>
> *"I was doing workshops for primary age children and bring in the speaker, preamp, microphone, and teach them about my sound system. It would usually be around Black history month. And so that's what I used to do." P13*
>
> *"[A woman from a feminist audio collective] asked me randomly if I wanted to learn about Dolby Atmos and teach it. I didn't know the setup. Sometimes I need that push, or pressure, and I'll do it and that'll let me know how to learn it to the point where I could teach it … In my particular case, it was the request to teach it that prompted me to learn it, I don't know when I would have taken the plunge." P18*
>
> *"I was producing at a local radio station when the engineer was teaching lots of classes and need help with his teaching load. So I was an adjunct and then … Now I am [at an HBCU[11]] teaching. This is the first place where I got that kind of support developing my own style." P23*
>
> *"I got the master's degree and [my professors] were impressed with me and asked me to teach. I applied once, didn't get it and I applied the second time and got hired as an assistant professor."*

These women have some insights into male privilege, encouraging all students to learn about sound for film, and the importance of bringing industry knowledge to the teaching role.

> *"I have students who are graduating who are willing to go in at a low level and be trained but they are coming out with PT 200 certification, they are not at the beginning. And I have had 2-3 students offered jobs – women – in London, making tea. And I had one guy go into a company, skipping out on making tea! …That guy gets a job as an editor straight off … and he didn't do 200 level." P1*
>
> *"I wonder about how to facilitate a space where those who are quieter can speak up. And this big question about how to get film students into sound. I remember I taught a sound class in the film class. The music students could also enroll. And they loved it! They dove right in. And felt good for me to have students who understand sound and wanted to learn about it from a film perspective. The school I'm teaching in now divides the students. The music students don't learn about film sound, and very few film students are interested in film sound. So this is always been a question" P11*

[11] HBCU: Historically Black College or University

> *"Most of the teachers I admire … know how things are now and for me it is the same. It's more hands on and less conceptual; you have the experience of working with clients, what worked & what didn't. And that has to go through a process and not all people have that. For example when I was teaching audio recording most of the teachers over there finished their course and started teaching. That was the path. But you need to go out, you need to go see what is out there so you can give the students more broad feedback. Everything is not 'pink'* [as in 'seeing the world through rose coloured glasses'] *there are a lot of 'greys and blacks'. I am following my students because they are not doing what they love to do." P17*

6.2.6 Subgroups Summary

To summarize, the five subgroups within the study are Audio Girl Africa, Women in Europe, Women in America, Minority Men, and Established Participants. These subgroups represent participants at varying stages of their careers in different places around the globe with diverse backgrounds and challenges.

The women in the Audio Girl Africa group share a common interest in sound production, often sparked by their involvement in church activities. Although the way in was difficult, these women did not give up. However, they faced discouragement from their parents and had limited access to formal training in audio production. And even once hired on staff, building trust and being taken seriously did not come easy for these women.

The Women in Europe subgroup, on the other hand, had relatively easier access to universities and pursued degrees in sound engineering. However, finding mentors and opportunities for advancement remained a challenge for them. Even though there was access at the university level, mentoring opportunities were hard to find. Some women had to commute long distances or move away from their home country.

Meanwhile, the Women in the US often had to rely on their own initiative. They had their choice of programmes but didn't feel like they knew how to navigate the career landscape after graduating. They were resourceful but found low paying jobs and sometimes felt taken advantage of. Eventually, one woman found a full-time job, while the others are freelancing.

The Minority Men subgroup, although a small sample, discussed advantages such as familial support and upbringing, and disadvantages such as stereotypes and having an immigrant status. The benefitted from networking with affinity groups, and both showed their resilience by utilizing their talent, passion, and resourcefulness to overcome BEDIs.

Established Participants in this study are both teaching and working to keep their industry knowledge current so that they can help their students. They are also paying attention to what happens to their students when they graduate, noticing the difference between the paths of their male and female students. They make decisions on curriculum based on what they observe happening in the industry.

Overall, the stories told by these subgroups share some commonalities as revealed through the data collection and analysis process (6.3).

6.2.7 Gender assumptions and limitations

The gender and ethnicity of participants is based on self-identification provided by participants during interviews, and by visual cues. The researcher acknowledges the limitations of making assumptions about race, gender, and ethnicity. These assumptions were made for the purpose of data analysis within the constraints of the research process. Specifically, this was done to respect privacy and confidentiality of participants throughout the research process. As a result, these assumptions do not fully capture the complexity and diversity of each participant's identity and are subject to the researcher's bias.

However, this is not unusual in a qualitative study. In her paper, "A Grounded Theory of Liberated Identity: Lesbians transcending oppression", Amy Russell [2011]writes of her study of lesbian women that "…screening for race, age, and other variables within an oppressed group was problematic in that asking a participant to divulge sensitive information about her identity seemed insulting". Put another way, such questions can be construed as an invasion of privacy or even be seen to lead the participants (members of an "oppressed group") away from answers that capture their lived experiences. Further, such questions might invoke in participants the urge to give the researcher "what she wants to hear" - something that would be construed as "forcing" the data. "Forcing" is strongly discouraged in a classic GT study (see also Interview Questions). [Creswell, 2013]

To mitigate these limitations, the researcher also engaged in triangulation validating the data with interview subjects (5.3.9).

6.3 Data Collection and Analysis

The following section will discuss the data collection and analysis of the results that were obtained while exploring the questions, "What are the main concerns of participants in immersive audio workshops? (RQ4a)" and "how do they process those concerns (RQ4b)?"

First, the initial interview questions are given. Then, using the GT methodology discussed in Chapter 5, the results of coding, analytical memoing, constant comparison, and theoretical sampling performed over various iterations with significant milestones are given. (Note that most explanations about each stage of the methodology can be found in the previous chapter, which largely mirrors this one.)

6.3.1 Initial Interview Questions

In a qualitative process (which includes GT), themes emerge over time. Questions are open-ended and carefully designed to allow the interviewee an opportunity to reflect on their experiences (semi-structured interviews with open-ended prompts). Interview analysis using GT allows the use of coding meanings into categories and developing theories [Kvale et al., 2009].

For example, in Dobson's DA'FX research, the interview methodology is as follows:

> *"I asked: how their community began, about their challenges, concerns, and their relationships with other communities (in education and industry). These conversations took place in homes, offices and studios, each lasting roughly one to two hours" [Dobson, 2018a].*

Dobson's study revealed "three most prominent themes that emerged from our conversations: how the minority centres the marginalised, DA'EF learning and creativities, and the challenging economics of DA'EF organizing" [Dobson, 2018a].

Similarly, the researcher crafted questions to focus the answers on BEDIs and access (based on her research done to that point in time) to allow further analysis of these dynamics, although through mentoring that focus was changed to allow a wider, "unforced" scope (6.3.5.1, "Milestone 1").

The first question was framed in terms of immersive audio to allow deeper understanding of dynamics within the field in particular (e.g., exposure to the technology). That first question was, *"When pursuing your education in audio recording, have you faced any barriers to entry (i.e., microaggressions, discrimination, gatekeeping and/or access) that would prevent you from pursuing training, education, or career opportunities? If so, please describe them. If not, why not?"*

The second question was: "*What is your ideal learning environment? Describe the classroom or studio, the teacher, your classmates, and lab activities."* The rationale for this question came early in the research process during a stage when the researcher was also interested in curriculum design for the workshops.

The third and fourth questions were: *"What interests you about immersive audio?"* and *"Have you listened to immersive audio before?"* These questions were meant to discover from each participant their experience with immersive audio, and help the research move away from the assumption that there is a barrier to access when there might not be. In fact, some participants have multichannel setups at home, and the concerns they are trying to resolve may be the same or different from participants with no access to equipment.

The researcher also asked the subject whether they had any questions for her, or anything they wished she had asked. This allowed the conversation to continue, and if something came up for them that they really wanted to share, it was a great opportunity to delve deeper into issues that are "unknown unknowns" from a research point of view.

6.3.2 Open Coding

The first coding pass was done with 4 participants after an Intro to Immersive session with students who were offered the class through a partnership with Women's Audio Mission. The researcher transcribed each interview in real time. After each interview the researcher began the open coding process using a computer-assisted qualitative data analysis software (CAQDAS) tool called Nvivo, which provides a user interface for highlighting words, sentences, and paragraphs and adding codes.

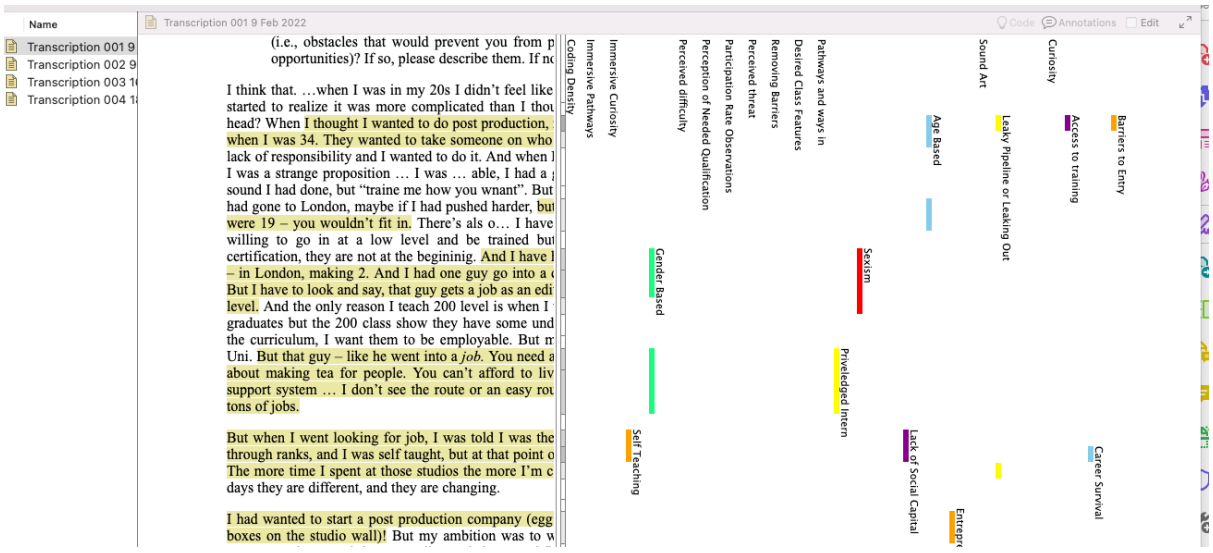

Figure 6-1: Early coding with NVivo.

Figure 6-1 shows the NVivo interface with some early codes, such as "leaky pipeline", "true desire", "seeking women's affiliation", and "freelancing". Examples of statements that were coded as "seeking women's affiliation" include:

> *"But my ambition was to work with women; maybe early career women, and we work in our studios and share workflow. Maybe we work with early career filmmakers. But because I couldn't guarantee pay for anyone, I thought a collective would work." P1*

> *"But I also have had the pleasure of post and recording studio where the people are primarily not men and those sessions absolutely feel different." P2*

> *"I went to a film festival that was a women film festival, and to WAM conference, and any time I am in that environment I can let out a deep long breath where I hadn't realized my shoulders were tensed (metaphorically) and you can relax." P3*

"Coding is the first step in moving beyond concrete statements in the data to making analytic interpretations", says Charmaz [2006]. "We aim to make an interpretive rendering that begins with coding and illuminates studied life". Therefore, the code "seeking women's affiliation" was selected because it was explicit in the statement "…my ambition was to work with women", and then made more relevant as it emerged as a recurring sentiment. Altogether, these quotes show how the participants regard working with women as important.

At this very early stage there were 45 codes. Table 6-3 displays the number of initial codes generated for each interview in the Codes column. Some codes were assigned more than once, as indicated in the References column which shows the total occurrences of code assignments in each interview transcript.

Interview	Codes	References
Participant 1	31	58
Participant 2	11	16
Participant 3	20	29
Participant 4	17	26

Table 6-3: Early open coding

The small number of initial codes shows how at this early stage the researcher was becoming familiar with the process, and when contrasted with the number of codes in later stages, shows how important the process of constantly comparing data is to the analysis.

6.3.3 Analytical memoing

Memos and field notes are part of the data. In fact, Glaser's mantra is "all is data:" interviews, observations, and documents. [Glaser, 2007]

It is through comparing information (constant comparison) and finding patterns and categories that the researcher creates a deeper understanding of the observed phenomenon through "transcendent abstraction" [ibid.]. As described in Chapter 5, the value of GT is elevating these codes through memoing and constant comparison to generate new insights, as described in the following sections.

The researcher created early memos in the margins of each transcript. In these memos, "researchers build detailed descriptions, develop themes or dimensions, and provide an interpretation in light of their own views or views of perspectives in the literature" [Creswell, 2013].

Table 6-4 gives an example of what memoing looks like in its earliest stage: the left column shows a transcript of an interview, and the middle column are interview memos, followed by codes on the right. The question posed was, *"When pursuing your education in audio recording, have you faced any barriers to entry, for example obstacles that would prevent you from pursuing training, education, or career opportunities? If so, please describe them. If not, why not?"*

Transcript	Memos	Codes
"I haven't faced anything that is very clearly, overt sexism (1,A); I have working theories for things but if you ask someone point blank they would say "no that's not it" (2). I have been lucky to experience things that are subtle, grey area (3); So there is a studio I haven't worked at in a while. Run by a musician; he already had a crew of people around him at the studio and another engineer brought me in for a session (B). The studio was his personal studio. I started working on his projects and kind of would get called in for other bands he knew… I know he had his "crew" he had been working with for a decade. I know he enjoyed working with me. (4) I was in MN, it wasn't as easy for me to get there (to WI), So I'm not sure why I didn't get frequent gigs (5). And all the other engineers were white dudes (6). So I could never prove it.(7,D) I interviewed for a job at [a large media company], one of 3 candidates and flattered and honored to get through to interview (C), they ended up hiring a white guy . I don't doubt he was qualified but I am also very qualified (D) (8) obviously something at [a large media company], they want to hire top notch, most qualified; but also you would hope they are looking at 3 candidates equally qualified or closely qualified maybe we can look at different factors and maybe we cannot just keep hiring white men (9) (D). NOT THAT I WANT TO BE THE DIVERSITY HIRE (emphasis added) (E) (10). The things I have experienced, they impact the work environment, but I am not being sexually harassed daily (11); but some people I work with will go in for a hug from me but not from other male producers, (G) (12) "I didn't know our relationship was on that level" this was a professional context. Like I said I am grateful and lucky to not have faced that (13). But I also have had the pleasure of post and recording studio where the people are primarily not men and those sessions absolutely feel different (14) (F). Especially when you are recording music where it's raw emotion (as opposed to a commercial), I sometimes wonder if I was a man (15) if people weren't recognizing different sex … I have heard men refer to women as "girls" (16), I can't stand that (I)! I'm thinking of the early days of my internship where I was more susceptible because I'm trying to get my foot in the door … I don't know… It's hard to know when it's subtle." (17) (H)	(1) Makes a distinction between "overt" and "covert" (2) sexism is hard for non-scholars to identify or define (3) considers the experience of "subtle" sexism to be "lucky" (vs. "covert" sexism) (4) seems to be justifying his behaviour, laying groundwork (5) seems to be questioning whether being passed over was discriminatory (6) establishes herself as minority (7) seems to be framing this as a possible complaint in a legal sense? Something she could have fought for? (8) confident in her abilities, does not seem to want preferential treatment (9) states that she wants status quo to change but (10) does not want to be a token hire; wants equality not special treatment (11) seems to consider "daily" harassment the "real problem" vs her own experience, setting up her justification for… (12) …hugs, which she doesn't consider to be sexual harassment but recognizes she is not being treated equally (13) again says she is "lucky" and that there are worse things (14) differentiates an all-female environment in terms of feeling / vibe (15) establishes different treatment and experiences of men, women (16) microaggression: "women /girls" are lesser beings" (17) reiterates subtlety of sexism, microaggressions	(A) sexism (B) work experience (C) validation (D) discrimination (E) tokenism (F) Seeking women's affiliation (G) touching (H) overt / covert (I) Microaggressions

Table 6-4: Coding and early memos from an excerpt of an interview with Participant 2

6.3.4 Constant Comparison

As each interview was conducted, the researcher engaged in constant comparison of codes and memos from one interview to the next. CAQDAS software (first with NVivo and subsequently MaxQDA, as described below) facilitated smooth handling of the data by dragging and dropping, rearranging, memoing, and merging codes as the researcher worked with the emerging themes and categories. Figure 6-2 shows how this looked at an early stage.

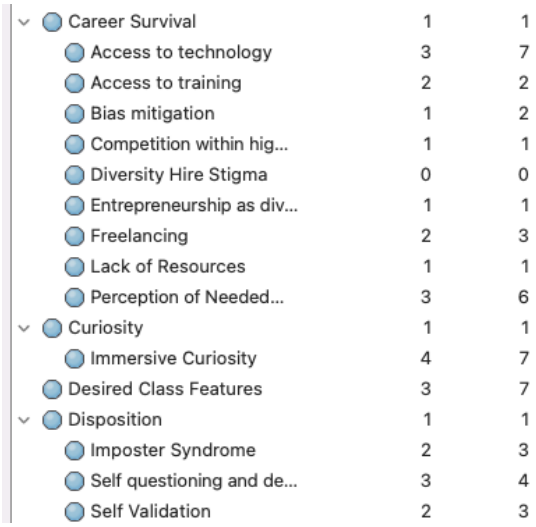

Figure 6-2: Early creation of categories for codes

In this figure, certain codes such as "access to training" and "freelancing" were categorized as "career survival"; other codes were categorized as "disposition" including "self-questioning" and "self-validation". These categories continued to change and evolve during the analysis process.

6.3.5 Iterations

The process of coding and memoing happen in an iterative manner during the constant comparison of data. Altogether, there were four workshops and four rounds of interviews, during which the data was coded, memos were being written, and data was being compared.

To this point, the initial stage of coding and memoing have been described. However, due to the constant comparison approach, it is challenging to present the data in its distinct stages over the rounds of workshops and interviews. Instead, the researcher employed an *ongoing and simultaneous* process of data collection and analysis, engaging in comparative analysis and sorting of categories on the fly from one interview to the next. This approach allowed for the emergence of a natural progression from the beginning to the end of the study (recall Cho's statement in 5.3.4: "The researcher does not wait until data are completely collected to begin data analysis; instead, data collection and analysis occur simultaneously so that the analyzed data guides subsequent data collection," [Cho et al., 2014]). Following that process, this method involves analyzing data *as it was collected*, thus enabling insights to inform subsequent data collection. Initial interviews were coded and memoed, and the resulting insights were fed into the next iteration of interviews, fostering a continuous and informed analysis grounded in the data.

Nonetheless, it is possible to discuss and provide an account of *milestones* that led to various refinements.

[START FULL PAGE]

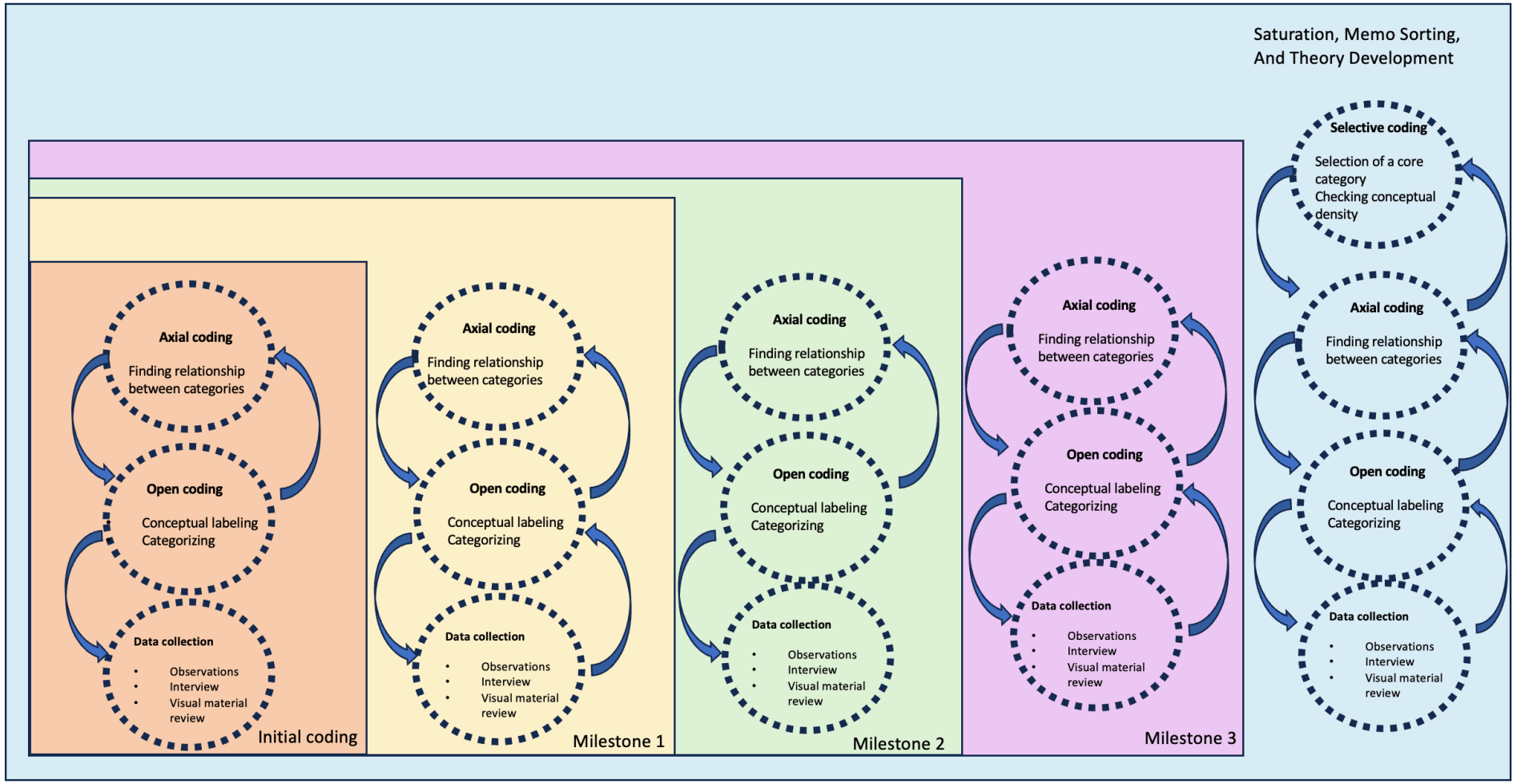

Figure 6-3: Research and analysis progression showing various milestones based on diagram by Cho et al.

Figure 6-3 is based on the diagram by Cho et al. (see 5.3.4, "Iterations") Here, it is shown progressing chronology from bottom to top with blue arrows representing the cycles and iterations, and shows the major research milestones using coloured squares (yellow, green, and violet) after initial coding (orange), all of which propelled the study towards saturation and theory development (blue) as described below.

6.3.5.1 Milestone 1

The first milestone was the researcher's consultation with a mentor in GT Dr. Helen Scott, during which the researcher discovered the need to make adjustments to the interview questions. Dr. Scott pointed out the tendency of novice GT researchers to *force* the data. The question, *"When pursuing your education in audio recording, have you faced any barriers to entry (i.e., microaggressions, discrimination, gatekeeping and / or access) that would prevent you from pursuing training, education, or career opportunities?"* was seen to be a "forcing" question. Instead, a GT question that does not force the data was agreed upon, and the first question became, *"How has it been finding your way through your audio journey?"* This allowed the interview subject to tell a more nuanced story that includes successes as well as challenges, the initial spark of interest, and other facts that a "forcing question" might not allow to emerge. Thus, it allowed the researcher to collect richer data.

Also, prior to the mentoring session, the second question was, "*What is your ideal learning environment? Describe the classroom or studio, the teacher, your classmates, and lab activities."* This was slightly better than a forcing question such as: "do you prefer online or in person classes?" or "what do you want from an immersive audio class?" as it allowed the interview subject to use their imagination or perhaps even compare experiences they have had in the past to a more ideal scenario. However, the question was ultimately dropped after Interview 10, since participants seemed to be giving the researcher "what she wanted to hear" and spoke about the positive experience they had in the workshop. Secondly, the design of the workshop's curriculum was no longer pertinent to the study (as discussed during the researcher's confirmation process and subsequent tutorials); rather, the concerns of participants and how they processed their concerns was brought to the forefront and established as RQ4. Therefore, although it was lovely to hear about participants' experiences during the workshops, the answers to the question about their ideal learning environment did not provide useful information about their concerns or how they processed those concerns. During a GT process, questions are refined and focused; thus the reframing of these questions is appropriate and conforms to the methodology.

After the consultation with Dr. Scott, the next round of coding and memoing was done following workshops with Audio Girl Africa. Another five interviews were conducted. After this round of transcription and coding, the number of codes increased to 54. Table 6-5 shows how the number of coded segments evolved. All the while, constant comparison was still taking place.

Interview	Codes	References
Participant 1	31	60
Participant 2	15	20
Participant 3	20	29
Participant 4	17	26
Participant 5	17	28
Participant 6	11	18
Participant 7	7	14
Participant 8	8	11
Participant 9	7	15
Participant 10	13	19

Table 6-5: Coding after Audio Girl Africa workshops

Only a few new codes were assigned at this stage, including "African access", "family", "affordability" and "musician". The process of constant comparison continued, and categories began to emerge such as "curiosity", "pathways in", and "disposition". The code "community" became a category, with subcodes such as "seeking women's affiliation", "mixed gender classroom", "isolation", and "gossip".

Notably, the number of references increased significantly for Participant 1. As the researcher came up with new codes, they were tried out in the first interview, but their relevance did not carry through to other participant statements. This is not unusual within the GT methodology, as it highlights the evolving and iterative nature of the analysis process, where constant clarification occurs based on emerging insights from the data.

6.3.5.2 Milestone 2

The second milestone was the researcher's visit to the Audio Engineering Society's Audio for Virtual and Augmented Reality (AES AVAR) conference in Seattle in August, 2022. During a casual conversation with a group of women in between lectures, one of them said to the researcher, "It's taken me 3-4 years to be taken seriously."

This resonated with the researcher, who then went back to the interviews for another iteration of coding and memoing. When looking for phrases that matched the theme of "being taken seriously", the researcher found examples of this precise wording and similar phrases. Thus, following the AES AVAR event, the researcher began asking *whether participants feel like they are taken seriously* in their careers. As the researcher incorporated this theme into her analysis she engaged in **theoretical sampling** (**5.3.6**), during which she sought additional data based on the emerging theory to explore and validate it further. This question is acceptable because it is elevating certain concepts and themes. It is iterative (5.3.4), emergent (5.1), and not forcing (5.4).

Thus, following the AES AVAR event, and to ensure minimal bias, the researcher incorporated the question, "do you feel as though you are taken seriously" in subsequent interviews. By deliberately seeking out perspectives related to the theme “being taken seriously,” the researcher added to her observations of how and why participants are concerned with their perceived credibility.

By the next round of workshops (Immersive Audio Intensive), the researcher reached a total of 120 codes, including “being taken seriously”, “role models”, “mentorship”, “isolation”, and “pandemic”.

Interview	Codes	References
Participant 1	45	78
Participant 2	20	26
Participant 3	20	29
Participant 4	17	26
Participant 5	23	36
Participant 6	15	22
Participant 7	11	19
Participant 8	21	30
Participant 9	21	33
Participant 10	21	29
Participant 11	30	52
Participant 12	24	34
Participant 13	18	19

Table 6-6: Coding after Immersive Audio Intensive Workshops

6.3.5.3 Milestone 3

The researcher consulted with her mentors through the fall of 2022, one of whom reviewed the data and suggested adding codes like “opportunity”, “intelligence”, “hands-on”, “secrecy”, “teaching”, “the only woman”, and “belonging”. Another mentor spoke of UGs and their “relentless creativity” to navigate BEDIs; thus the researcher added codes “innovation” and “dream”.

During this stage, the NVivo software exhibited data corruption wherein codes were attributed to full documents instead of phrases. Although unfortunate, this software bug proved to be serendipitous: as the researcher then switched to MaxQDA software for subsequent rounds of interview coding, she found she had developed a better grasp of the coding process, and was able to add some newly emerging codes while engaging in constant comparison.

The next round of coding came after the Pro Tools Dolby Atmos Operator Certification workshop. By Interview 23, the researcher had catalogued 236 codes.

Interview	Codes	References
Participant 1	70	105
Participant 2	57	70
Participant 3	59	90
Participant 4	57	73
Participant 5	40	47
Participant 6	29	35
Participant 7	41	57
Participant 8	29	31
Participant 9	36	48
Participant 10	41	52
Participant 11	41	56
Participant 12	38	48
Participant 13	32	40
Participant 14	34	45
Participant 15	21	26
Participant 16	41	58
Participant 17	41	60
Participant 18	51	69
Participant 19	61	75
Participant 20	49	72
Participant 21	48	64
Participant 22	28	33
Participant 23	50	69

Table 6-7: Coding after Pro Tools Dolby Atmos Operator Certification workshop

Table 6-8 shows the new memos and codes that were assigned to the same excerpt that was shown in Table 6-4. New memos and codes are in **bold**. This time, the theme of "being taken seriously" is shown, as well as some early speculation about "cracking a code" which appears in the memos.

Transcript	Memos	Codes
"I haven't faced anything that is very clearly, overt sexism (1,A); I have working theories for things but if you ask someone point blank they would say "no that's not it" (2). I have been lucky **(I)** to experience things that are subtle, grey area (3); So there is a studio I haven't worked at in a while. Run by a musician; he already had a crew of people around him at the studio and another engineer brought me in for a session **(II)** (B). The studio was his personal studio. I started working on his projects and kind of would get called in for other bands he knew… I know he had his "crew" he had been working with for a decade **(III)**. I know he enjoyed working with me. (4) I was in MN, it wasn't as easy for me to get there **(IV)** (to WI), So I'm not sure why I didn't get frequent gigs (5). And all the other engineers were white dudes **(V)** (6). So I could never prove it.(7,C) I interviewed for a job at [a large media company], one of 3 candidates and flattered and honored to get through to interview (C), they ended up hiring a white guy . I don't doubt he was qualified but I am also very qualified (D) (8) obviously something at [a large media company]they want to hire top notch, most qualified; but also you would hope they are looking at 3 candidates equally qualified or closely qualified maybe we can look at different factors **(19)** and maybe we cannot just keep hiring white men (9) (D). NOT THAT I WANT TO BE THE DIVERSITY HIRE (emphasis added) (E) (10) **(20).** The things I have experienced, they impact the work environment, but I am not being sexually harassed daily (11); but some people I work with will go in for a hug from me but not from other male producers, (G) (12) "I didn't know our relationship was on that level" this was a professional context. **(VI)** Like I said I am grateful and lucky to not have faced that (13). But I also have had the pleasure of post and recording studio where the people are primarily not men and those sessions absolutely feel different (14) (F). Especially when you are recording music where it's raw emotion (as opposed to a commercial), I sometimes wonder if I was a man (15) if people weren't recognizing different sex … I have heard men refer to women as "girls" (16), I can't stand that! I'm thinking of the early days of my internship where I was more susceptible because I'm trying to get my foot in the door … I don't know… It's hard to know when it's subtle." (17) (H)	**(18) As she recounts the story, she is trying to crack a code: Not sure why she didn't get the gigs – was it because the others were male? (19) She is also trying to crack the code of why she didn't get the [large media company] job? Later she says, "I wonder if I was a man".. does she think this be the key to cracking the code? (20) a code conundrum: how can I get the job but not be seen as a token hire?** *(1) Makes a distinction between "overt" and "covert"* *(2) sexism is hard for non-scholars to identify or define* *(3) considers the experience of "subtle" sexism to be "lucky" (vs. "covert" sexism)* *(4) seems to be justifying his behaviour, laying groundwork* *(5) seems to be questioning whether being passed over was discriminatory* *(6) establishes herself as minority* *(7) seems to be framing this as a possible complaint in a legal sense? Something she could have fought for?* *(8) confident in her abilities, does not seem to want preferential treatment* *(9) states that she wants status quo to change but* *(10) does not want to be a token hire; wants equality not special treatment* *(11) seems to consider "daily" harassment the "real problem" vs her own experience, setting up her justification for…* *(12) …hugs, which she doesn't consider to be sexual harassment but recognizes she is not being treated equally* *(13) again says she is "lucky" and that there are worse things* *(14) differentiates an all-female environment in terms of feeling / vibe* *(15) establishes different treatment and experiences of men, women* *(16) microaggression: "women /girls" are lesser beings"* *(17) reiterates subtlety of sexism, microaggressions*	**(I) Luck** **(II) male advocacy** **(III) Trust** **(IV) travel or relocate** **(V) the only woman** **(VI) Being taken seriously** *(A) sexism* *(B) work experience* *(C) validation* *(D) discrimination* *(E) tokenism* *(F) community* *(G) touching* *(H) overt / covert*

*Table 6-8: Subsequent memoing for an excerpt from an interview with Participant 2. New information shown in **bold**.*

6.3.6 Axial Coding

Now that the various milestones have been discussed, the narrative of analysis now returns to a bird's eye view of the progression leading to the emergence of the core category (6.3.7). This is represented by the blue square in Figure 6-3, which is the final iteration.

Throughout the axial coding process, the researcher continued arranging and rearranging codes and categories. After Milestone 3, the researcher continued to see connections between participants' actions, such as "seeking women's affiliation", "self teaching", "watch or watching", "innovating", "removing barriers", "pushing", "teaching", "going it on their own", "learning," and "seeking mentorship". These would ultimately form the basis of the core category (6.3.7) as the researcher found that a significant number of codes were assignable to one of these categories.

An illustration of this later stage of axial coding can be seen in Figure 6-4.

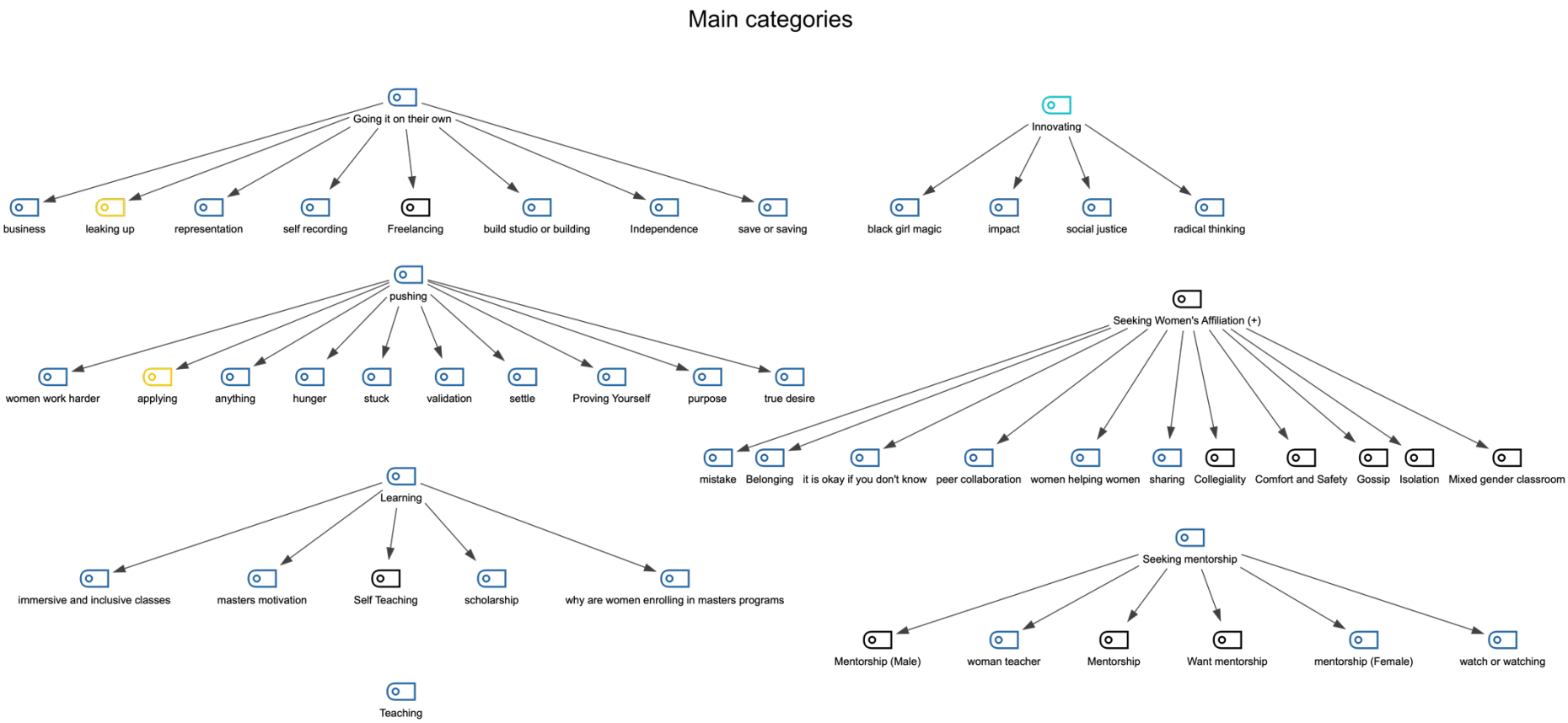

Figure 6-4: Axial coding showing main categories after Milestone 3

Figure 6-4 shows how codes such as "belonging", "comfort and safety", "woman teacher", and "purpose" became subcategories of larger themes such as "going it on their own", "seeking women's affiliation", "pushing" and so on as part of the axial coding process. Those themes in turn became subcategories of the **core category**.

6.3.7 Core Category ("Leaking Up, Not Out")

After Milestone 3, the core category began to emerge as the researcher saw that several codes could be categorized under the themes "Going it on their own," "Pushing," "Learning," "Seeking Mentorship," "Innovating," "Seeking Women's Affiliation," and "Teaching". The researcher was surprised at the ease with which she could categorize the related subcodes. To her, this was indicative that the process was yielding results. Perhaps most importantly, Glaser's criteria that "*it is relevant and works*" (5.3.3) was met by this phrase.

From these connections, the researcher coined the phrase **"leaking up, not leaking out"** to describe the common features between these categories and the phenomena being observed. This choice was inspired by the term "leaky pipeline" (3.3) which was encountered in the literature reviewed in Chapter 3. The phrase also captures the idea that participants are not leaving the audio profession ("leaking out"), but finding ways to persist and continue. It also brought to the researcher's mind that their paths are neither straight nor easy: a "drip" instead of a "flow".

Figure 6-5 shows each relevant theme with the percentage of interviews in which the theme occurs:

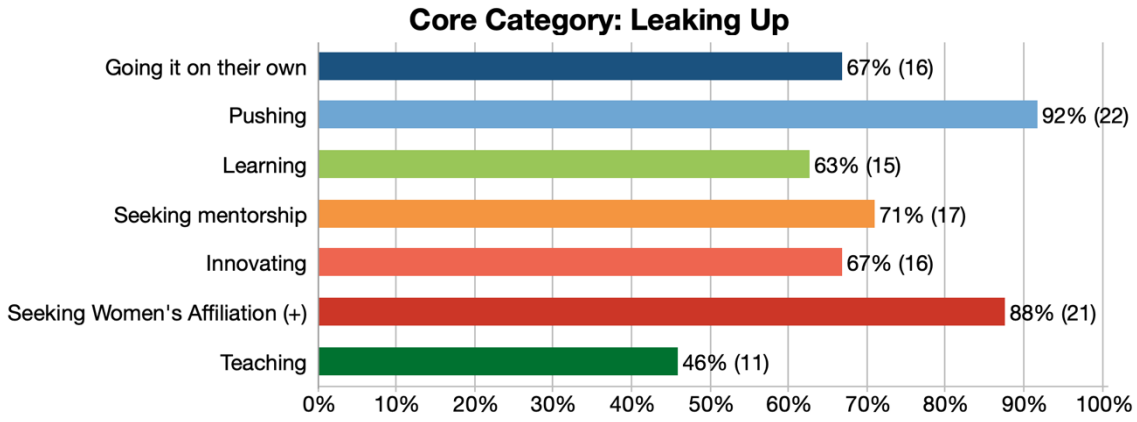

Figure 6-5: The occurrence of various themes related to the core category. Percentages reflect the number of interviews (out of 23) in which the themes occur.

A visual representation can be seen in Figure 6-6 of how this was diagrammed as part of the axial coding process.

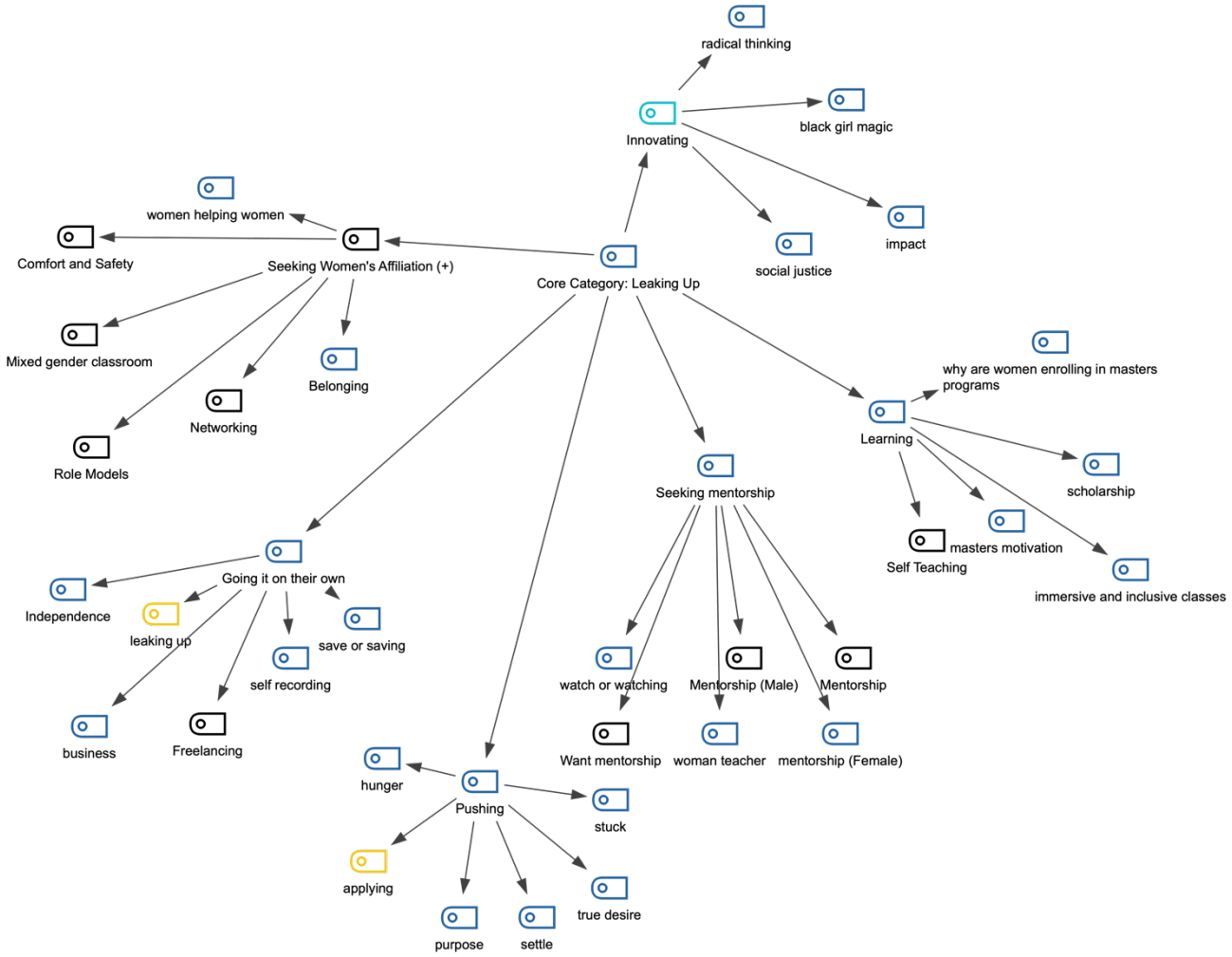

Figure 6-6: Axial coding around the core category, "Leaking up".

With this new epiphany, the researcher embarked on the last three interviews in what would become the last stage of theoretical sampling and selective coding, as described below.

6.3.8 Theoretical Sampling and Selective Coding

During the theoretical sampling process, a researcher seeks additional data based on the emerging theory to explore and validate it further. By deliberately seeking out perspectives related to the core category, "leaking up, not leaking out", the researcher added to her observations of how and why participants are concerned with their perceived credibility and what they do about it.

This "digging deeper" into the data is considered part of the **selective coding** process: the iterative nature of GT wherein questions become more focused after each round of coding. During subsequent interviews, the researcher continued to elicit open-ended responses about participants' careers and being taken seriously, focusing on specific core categories and themes that were most relevant to the research questions (RQ4a and RQ4b).

Table 6-9 shows an excerpt from Participant 3 in this selective coding phase. This time, a different question is shown with a different interview participant. It is interesting because it shows that the larger themes which emerged later in the iterative data analysis were relevant across all participants. It also shows that the themes are applicable to statements that were not necessarily prompted by the question, *"do you feel as though you are taken seriously?"*. The fact that major themes in the development of the theory reveal themselves here and many places elsewhere was seen by the researcher as indicative that the theory had relevance and significance.

Transcript	Memos	Codes
I'm 30 years old and I felt that I would have a really hard time (1)… it would take years to build the network where I can get an internship at a studio and I needed to accelerate that process (A, B). And this program (C) is accelerating the process of getting a placement somewhere (2, D) … otherwise I would have had to do that alone and it feels difficult to me to form relationships with studios .. I don't want to be "woe is me" negative – I know a lot of women who have done it – maybe I have always been a bit afraid (E) to try to. Based on other experiences I don't feel like having toxic relationships with predatory mean men (3, F). I dunno. It's interesting because there's .. it's always speculative and it's always like "I don't want to be in difficult situations by trying to apply to whatever studio", but in this context it feels more controlled; I can access a network and get referrals rather than 'please can I get you coffee' and be the coffee intern who can't touch the equipment (G). which felt like it would be harder to find the other type of opportunity (4). I am supposed to get an internship this summer, and they all feel like coffee internships. I have experience now (H). It's nice to be able to speak about this, it's always here in my brain and it feels like….! (I) And it's a huge financial investment to do this master's program (J). And just like walking into Guitar Center, I don't want to be assumed to be stupid (K) (L), so I feel like I have to work hard to know what I'm talking about so when I walk into an AES conference… and maybe that's what I like about WAM or a film festival, people don't have that same "read on you"(5, M) … or you're welcome to be there as whatever .. and it's okay if you don't know rather than you're a bitch who oversells herself or meek and don't know anything – the latter is personally how I have experienced (6). That could be intersectional with race and gender; people assume I'm meek and quiet and not knowledgeable. (N,M) (Transcription 003)	(1) she is concerned about her age (2) in a hurry, needs a solution that doesn't take years. (3) Basically he is saying she wants to GO AROUND the toxicity and predatory meanness. (4) She CAN'T BREAK THE CODE so she will go around. (5) SHE WILL USE ACCESS TO A DIFFERENT NETWORK (WAM) rather than be the coffee intern. And...! she is saying "I HAVE EXPERIENCE AND I KNOW IT." (6) the confidence conundrum	(A) Sexism (B) master's degree (C) Immersive and Inclusive (D) vocational training (E) afraid (F) toxic (G) lack of trust (H) Experience (I) comfort and safety (J) affordability (K) stupid (L) being taken seriously (M) comfort and safety (N) intersectionality (M) being taken seriously

Table 6-9: Subsequent memoing and selective coding for Participant 3

By exploring the themes of "leaking up, not out" and "being taken seriously", the researcher began to see patterns emerging throughout all the interviews. Furthermore, the researcher refined and deepened her understanding of what she would eventually designate as the participants' **main concern**: being seen as credible. This seemed to be the motivating factor that propelled women into their actions around the core category, "leaking up, not leaking out".

6.3.9 Saturation

The researcher became satisfied that the data had reached a point of saturation around Interview 20, at which point the core category and related themes had emerged. The criteria (5.3.7) for saturation were also met because:

- The researcher was able to use existing codes for the new interviews;
- The categories remained in place; and
- The theory was not changing based on new information.

To clarify how saturation was observed and determined, the researcher looked for consistency in the data and saw the prevalence of codes that belonged to the categories as shown in Figure 6-5.

There can be risks and limitations in making this determination too early; one of which is leaving some data unexplored and overlooking unique perspectives. In order to mitigate this risk, the researcher employed triangulation methods (6.3.10) to ensure the validity of the findings.

Altogether, 270 codes and 1,382 coded segments were generated. A full list of codes is given in Appendix B.

6.3.10 Fit and triangulation

As discussed in 5.3.9, the researcher in a GT study engages in constant comparison during the coding process to build an adequate explanation of the processes being described. The researcher refined the questions being asked by digging deeper into the data relevant to the emerging core category and related categories. Then, during the theoretical sampling process, the researcher also engaged in triangulation in the following ways:

- by working with her mentors, all of whom provided the researcher with possible codes and analytical insight (6.3.5.3);
- by going back to interview subjects ("member checking") to present a working draft of the theory. Their positive reactions and additional comments gave the researcher confidence in the "fit" of the results (6.3.10); and
- comparing these findings with the literature (7.2).

Going back to interview subjects ("member checking") is not part of the GT methodology described by Charmaz or Strauss, but it is a tool for qualitative research that the researcher chose to pursue as a way to further check the results and to see how they resonated with participants. When partnered with the processes of constant comparison, meeting with mentors, and checking with the literature, the process has value in a qualitative study. As Creswell writes, "in *member checking* the researcher solicits participants' views of the credibility of the findings and interpretations … I am interested in their views of these written analyses as well as what I was missing" [Creswell, 2013].

The researcher sent drafts of the theory to all participants, inviting them to comment. She met with seven interview subjects and received emails from another three. During the meeting with the seven interview subjects, the researcher asked them to respond how accurately the theory (up to that point) described the experiences of underrepresented groups in audio.

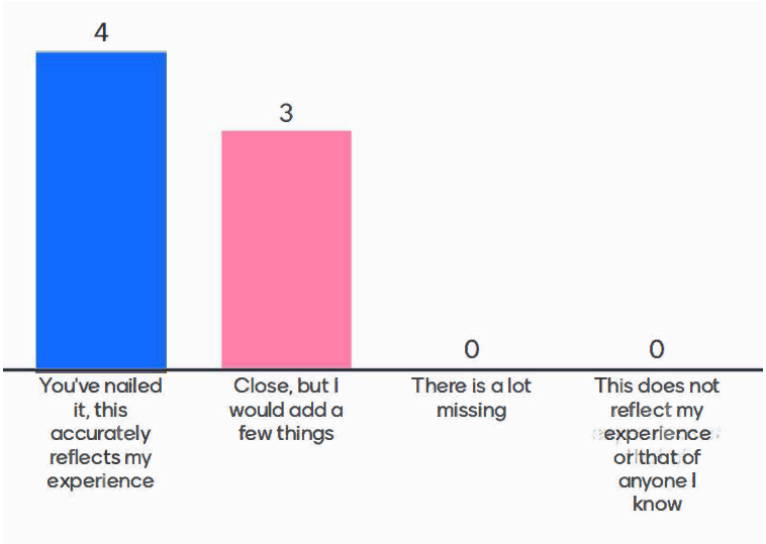

Figure 6-7: Participants' responses to how accurately a draft of the theory described the experiences of underrepresented groups in audio

Figure 7-2 shows that out of seven participants who came together for a review of the draft theory, four felt that the working theory was accurate, while three thought it was "close". None felt as though "a lot was missing", or that "it was not representative of their experience". During the ensuing conversation the researcher made notes and added these comments to her data set, incorporating ideas through the continued practice of constant comparison and memoing. In this way, she was sure that the emerging theory had good "fit".

It is important to note that the researcher is not striving to achieve 100% unanimous agreement among participants, since there are many people with many different experiences. Glaser reminds us, "the product will be transcending abstraction, NOT accurate description" [Glaser, 2007]. Rather, the researcher is striving for an understanding of the main concern of participants and how they process their concerns by using a theory grounded in data. In general, qualitative research aims to understand the diversity and complexity of participants' experiences, perspectives, and opinions. The fact that some participants offered additional insights or suggestions to enhance the theory is valuable and reinforces the researcher's goal of understanding and describing the phenomena under study. Thus, the comments from this session and the statements received from the other participants via email were fed back into the data pool with the goal of elevating the underlying concepts and themes.

6.3.11 Sorting, Memoing, and Theory Development:

At this last stage represented by the blue box in Figure 6-3, certain themes and connections in the codes and memos continued to be brought into focus and elevated to a theoretical level. It is not easy to do, and researchers undertaking GT sometimes struggle with staying open to the process. As Glaser explains, "Researchers seem to have the most trouble at this [theoretical coding, or "TC"] stage of generating GT – sorting memos and writing up the theory with emergent TCs." He continues,

> *"Substantive coding comes comparatively easily and is exciting, giving the exhilarating feeling of discovery. Theoretical coding does not come easily as an emergent and has a beguiling mystique. As one PhD student emailed me, 'theoretical codes and interchangeability of indicators were the two aspects of GT that I found the most difficult to comprehend"* [Glaser, 2005].

Theoretical codes (TCs) are different than those generated during the open coding process: they are "abstract models that emerge during the sorting and memoing stages of GT analysis", and challenge the researcher to stay "open to their emergence and earned relevance rather than their preconceived forcing on the theory under development" [Glaser, 2005]. In order to achieve success with coding for this study, it was essential for the researcher to undertake regular mentoring. The researcher had sessions with Dr. Helen Scott, who advised the researcher on appropriate practices and methodology.

Although both MaxQDA and NVivo feature the ability to work with codes, neither affords the researcher the ability to interact with the data in a more tactile, hands-on way. Specifically, it is not possible with either software to code *within memos.* Therefore, the researcher exported all of the memos from MaxQDA, printed them on paper, cut them up, spread them out on the floor, and began arranging them (see Figure 6-8). This approach was recommended personally to the researcher by Dr. Helen Scott and can also be found in Glaser's "The Grounded Theory Perspective III: Theoretical Coding" [2005]. It would be a desirable feature enhancement if either CAQDAS manufacturer could make this important GT tool available on their respective platforms.

The themes which were raised to a conceptual level included the code category, "leaking up, not leaking out" (see 6.3.4); the main concern, "being taken seriously" (6.4.1); and how the concern is processed, "codebreaking" (6.4.3). These can all be seen in the next section, "Emergent Themes".

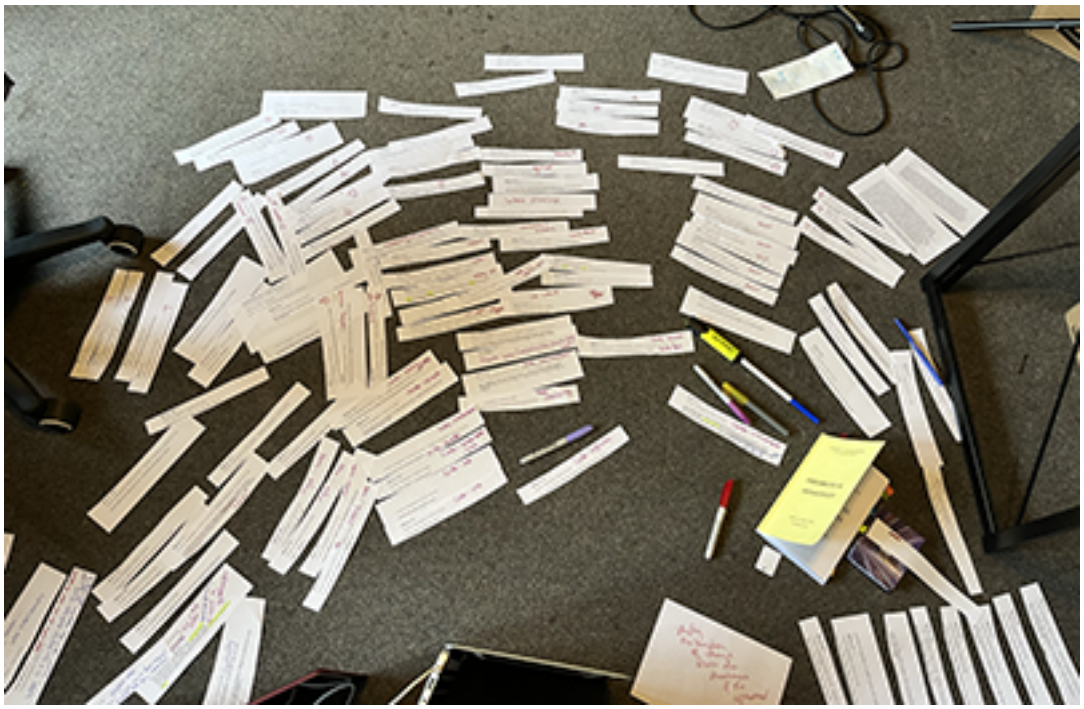

Figure 6-8: Hand-sorting of memos

6.4 Emergent Themes

By applying the methodology of coding, constant comparison, memoing, and theoretical sampling, the researcher the investigated the answer to question RQ4a, "what are the main concern of participants?", and question RQ4b, "how do they process those concerns?". In the following sections, the themes that have arisen from data addressing these questions are detailed.

6.4.1 Main Concern: Credibility (Being Taken Seriously)

During their journey, participants notice that they "aren't being taken seriously". For example, Participant 18 discusses working with clients:

> *"Sometimes clients felt safer with dudes because 'they knew what they were doing'. I am 36 I am going to be 37. When I was 27 I'm sure I looked 16 … We are not taken seriously in anything. We are seen as second rate lower unless we are a nurse or domestic. But in any technical field, [even] women firefighters, have to go through that and that's the state of the psychology of men in the world right now." P18*

P18 states that clients feel safer with a man because men "know what they are doing". This statement also suggests a lack of trust in her abilities. It appears that P18 believes the clients' perception of her competence may also be due to her youthful appearance. This may imply a perception that younger women are lacking in expertise and are therefore not to be "taken seriously". Further, she recognizes that many women are affected by this lack of trust and perceived credibility. In this statement she also points out that it is the "psychology of men" — not her own lack of skill.

P23 is a working professional, but receives reactions of surprise when she tells people how she began her career:

> *"When I say I produce or that I started out with engineering first that somehow causes a glitch in their matrix!" P23*

The phrase "a glitch in their matrix" refers to the movie *The Matrix,* which deals with notions of perceived reality. In this instance, the statement of P23 seems to imply that her stated profession challenges preconceived notions of who can be an audio engineer. It could also indicate she is not taken seriously because of the biases and assumptions of others.

Other participants mention similar concerns about how they are perceived when shopping for professional audio equipment, or when looking for mentorship — even by their employers:

> *"…because I was not a well-travelled person my boss did not trust me. He just wouldn't listen – not because the ideas are not great." P5*

> *"It took a lot of effort to keep proving myself; I am not here to joke, I am serious." P7*

> *"I discovered different aspects of sound, live sound, monitors. I got some encouragement. No one took my passion seriously". P9*

> *"Some people were saying 'why are you doing a man's job? Why are you here"? P10*

Interestingly, one respondent from the current study feels taken seriously now because she is not freelancing, and points to the issue of trust as a contributing factor:

> *"… I'm taken seriously because they trust me to be there and record what's needed, [whereas] I* ***didn't*** *feel that way in freelance world." P20*
> [emphasis added]

Another respondent also feels she was taken seriously:

> *"I must say, yes, 90% for me it was yes I was taken seriously and they didn't think about my gender for projects I worked on."*

However, her professor (with whom she had an otherwise great working relationship) let slip a microaggression:

"..he was in his 50s and he was working back in the day where there were only men. So he said something like 'even though she is a woman she is not afraid to touch the cables.' That was 10 years ago, so things changed. It's positive that happened because he learned from that comment." P21

Another participant is also expending energy to make sure she is taken seriously:

"I definitely [know some] people are not taking me seriously, and I am like, 'whatever' because I have an extremely good sense of hearing. I got my hearing tested because I was sensitive to sounds and they confirmed I am hearing a lot more than normal people. It's interesting with men and I provide feedback to them. Their first reaction is always defensive – as if I couldn't possibly sense something wrong with their mixes – but one person who reflected on their defensiveness and did diagnose a problem I had found … the first reaction is not to listen and not think my thoughts are valid – and then do what I say." P22

Overall, UGs at every stage in their career find it necessary but challenging to be seen as credible and gain the trust of clients, colleagues, and employers.

6.4.2 Impostor Syndrome

One contributing factor to the search for credibility is Impostor Syndrome, a kind of cognitive dissonance where an individual does not believe they possess the requisite skills and experience to succeed despite evidence to the contrary. [Hepworth-Sawyer et al., 2020] "Despite outstanding academic and professional accomplishments," write authors Pauline Clance and Suzanne Imes, "women who experience the Impostor Syndrome persist in believing that they are really not bright and have fooled anyone who thinks otherwise" [Clance et al., 1978].

In the previous section, Participant 23 mentioned that her clients felt safer with men, and ascribed this to the psychology of "men"; yet this same participant later discusses reluctance to follow a recommendation from colleagues to become a "social media influencer". The following statement may indicate feelings of "Impostor Syndrome" which could conceivably result from not being taken seriously:

"I didn't have the social media acumen to be an influencer … people always told me I have to establish myself as an expert [but I thought], 'what if I say something wrong? It'll be out there forever…!'" P18

Other examples include the following:

"And just, like, walking into Guitar Center (a pro audio shop in the US), I don't want to be assumed to be stupid, so I feel like I have to work hard to know what I'm talking about". P19

"I do not want to look like I don't know what I'm doing". P2

> *"With the benefit of ignorance, I did something amazing (laughs) and I have spent the rest of the time thinking, 'I don't know what I'm doing', 'I need to be super qualified', 'I have to get my technical knowledge up to my creative knowledge.'" P1*

> *"For half a year I had really bad impostor syndrome. I was the only one who didn't have a musical background. It took me a lot to overcome. For a very long time I forgot what I already knew and forgot my strengths and only saw my weaknesses. That combined with perfectionism is a rabbit hole." P16*

Very bright participants, aware that they are lacking in confidence, actively look for ways to improve. This comment comes from a participant who had top academic achievements:

> *"I guess the obstacles I put in my own way a lot. I don't actually think that they are anything to do with social norms or because I am a woman, they are things like perfectionism. I have to be twice as good. Maybe it is a social construct. I constantly want to improve what I'm doing. I want to be top game, but getting there is self-destructive." P16*

This quote seems to imply she is afraid of appearing to be incompetent, which is characteristic of Impostor Syndrome. Further, P16 refers to her "perfectionism", which can cause a person to obsess over their weakness. Of particular note is that P16 makes a point to say the obstacles "she puts in her own way" have nothing to do with being a woman. It is worth considering that in the process of codebreaking, women seek to eliminate the possibility that their gender could be holding them back.

> *"...and when you have mostly men and confident men working around you, you feel like Errrr! It messes with your brain!" P19*

Participant 19 highlights the influence that working with men has on her psyche, and illustrates how the presence of male colleagues may exacerbate the feelings of Impostor Syndrome.

6.4.3 Processing Concerns: Codebreaking

Next, the researcher considered how participants process their concerns (RQ4b). In order to be taken seriously (and as some grapple with Impostor Syndrome), participants work hard to "leak up, not out" of the field by engaging in **codebreaking** as they try to determine what is expected of them, how to succeed, and how to be seen as credible. They first do this by encountering "codes of credibility" (6.4.4) and attempting to understand them by "codebreaking". At an inflection point (7.1.1), if unsuccessful they begin doing things like "pushing" and "seeking mentorship" as described in 6.4.10, "code evading".

In this study, "codebreaking" refers to the process of attempting to decipher the unwritten rules and expectations of gatekeepers in the audio industry (see: 3.1.3, "Gatekeeping and Unconscious Bias"). The analogy seems fitting since codes can be used to open doors of opportunity. Codes can be used to keep secrets, and codes can change over time to keep systems "secure", "safe", or "inaccessible."

The Oxford Dictionary [2023] defines a “code” as:

“2. …any (unwritten) set of principles, conventions, or expectations governing a person's behaviour, etc., generally accepted by a society or group”.

3 c. A sequence of numbers, letters, or symbols used to open a combination lock, authorize use of electronic equipment, etc.; a passcode”.

6.4.4 Codes of Credibility

A *“code of credibility,”* as defined by the researcher, is any code that prevents a participant from demonstrating their skills and abilities and being taken seriously enough to access opportunity. These codes include hidden codes of sexism; secrecy; conundrums and codes of confidence; and codes of rank and rigour.

6.4.4.1 Hidden Codes of Sexism

The following quotes demonstrate how these systems operate for participants who are aware of roadblocks that hinder their progress and express the need to confront BEDIs. This awareness and participants’ subsequent actions reflect how they are trying to “crack the code” to understand why they are not getting anywhere.

For example, Participants 3 and 11 are aware of the challenges they face as women in the industry:

> *“There is working in the industry, and then there is social and emotional stuff to navigate; the gatekeepers don’t have to think about that because the structure fits them. And I don’t feel like I’m crazy or alone. And doing this [audio] work means confronting the big bubble of extra stuff you have to navigate.” P3*

> *“I called a post sound house to see if they had internships and they said ‘no’. But a male classmate of mine called and he got a placement! So going into this I knew I would have a few roadblocks in my way.” P11*

The "big bubble of extra stuff" referred to by Participant 3 might mean the challenge of “navigating” unspoken rules, something that looms large but is invisible and difficult to articulate. Similarly, the fact that Participant 11 knows about “roadblocks” (in other words, BEDIs) indicates awareness that she needs to be prepared for those obstacles. This process can be seen as codebreaking, which in this case may involve interpreting why her male classmate was accepted, but she was told *no internships were even available*. In this case, Participant 11 perceives that the gatekeepers at the post sound house had created unwritten rules that favoured men while creating barriers for women.

Similarly, in the quote that follows, Participant 1 observes the code in action when watching her female students obtain “coffee internships” while a male student went straight into a job.

> *"I have had 2-3 students offered jobs – women – in London, making tea. I had one guy go into a company, skipping out on making tea! That guy gets a job as an editor straight off … and he didn't do 200 level [Pro Tools]" P1*

Aside from ascribing success to the gender of her male student, P1 does not provide an explanation about the differences between the students, and similarly to P11, seems to imply there are unwritten rules that favour men. P1's observation of a male student skipping the traditional intern's role of making tea for clients and securing a job raises concerns about the existence of a code that unfairly advantages certain individuals: a gender bias wherein the male student bypasses a common step and benefits from an unexplained privilege.

Participant 14 wants to understand why women are not seen as appropriate choices for live sound work:

> *"…What makes it a man's job? It's not about carrying speaker. My boss has never carried a speaker. Why are we fixated on that? We have riggers. I have seen women lift weights. It is about where your passion is." P14*

Participant 14 has not received a reasonable explanation for why live sound is a "man's job" and rejects the unwritten code that "live sound is just for men," stating instead that "it is about where your passion is."

Similarly, Participant 18 has encountered at least one microaggression when someone remarked they didn't know "girls" could operate Pro Tools software:

> *"There was a point where someone said, 'Oh I didn't know girls could do that'. That's … WHAT?! There is no male anatomy required to open Pro Tools. You need an iLok. That's weird for you not to think a woman can use her brain and ears." P18*

Both participants reject the unwritten code that certain roles or tasks should be based on gender. Instead, they challenge those stereotypes and state that passion and skill should be the determining factors rather than gender-based assumptions.

Although these experiences seem to indicate gender-based discrimination, some women participants are unsure if they have experienced sexism. They are perplexed by the unwritten rule that gives men an advantage. In this case, Participant 2 attempts to decipher why she was passed over for jobs when she holds the same qualifications as the men who applied, and even states she was "lucky" not to have experienced overt sexism:

> *"I haven't faced anything that is very clearly, overt sexism; I have working theories for things but if you ask someone point blank they would say 'no that's not it'… I'm not sure why I didn't get frequent gigs. And all the other engineers were white dudes. So I could never prove it … I have been lucky to experience things that are subtle, grey area …I interviewed for a job at [a large media company], one of 3 candidates and flattered and honored to get through to interview, they ended up hiring a white guy. I don't doubt he was qualified but I am also very qualified … obviously something at [a large media company], they want to hire top notch, most qualified; but also you would hope they are looking at 3 candidates equally qualified or closely qualified maybe we can look at different factors and maybe we cannot just keep hiring white men? NOT THAT I WANT TO BE THE DIVERSITY HIRE." P2*

Not only does Participant 2 have difficulty describing sexism, she also pushes back against the notion that she *should* be hired just because she is a woman (or possibly woman of color). How, then, can she "crack the code" that allows her to be hired purely on merit? It seems she feels that being the "diversity hire" would be insulting and not allow her to be viewed as credible.

While it is important to acknowledge and address alternative explanations (such as the comparative skill levels of the men and women in each of these incidents and the employers' justifications for hiring the men), it is important to focus on the *perceptions of the UGs* who are trying to mentally process what is happening to them: to "decipher the code" of why specifically they were denied opportunities, and make decisions about their careers based on these interpretations.

6.4.4.2 Dealing with Secrecy

Codebreaking is also apparent as women express being mystified by the process of being promoted to a mixer or simply learning the art of mixing:

> *"Mixing is a dark art. It's difficult to learn. When I was looking for someone to mentor or help me – if I had wanted to find someone to edit, it would be a man that everyone* serves up to*, and then the prince walks in with his cape and people* serve stuff up to him*. Like – how do you become that safe pair of hands, unless you work your way up. But then I ask people to give me tips. 'Trust your ears'. Well, I can do* that*…" P1*

> *"I tried to sit in on mixes whenever I could but it wasn't tolerated because of the directors and personnel coming in." P19*

> *"Accessing the equipment and software ..I feel like there are hidden costs, access to speakers, access to demo things .. all of that feels like it contributes to the FORTRESS that feels a little impenetrable." P3*

> *"Some people block others from seeing what they are doing…" P2*

Participant 1 seems to imply that it is not the technology that is difficult to learn; what is difficult is the code or "dark art" of finding a mentor in an environment where there is such a strong hierarchy. The general sentiment expressed here is that the process of becoming a successful sound mixer is shrouded in mystery and exclusivity, with men in places of power and high esteem (a mixer in a "king" role and a "prince" in an assistant's role bringing things to him).

Participant 19 faced resistance when attempting to observe a session. Many times, non-disclosure and confidentiality agreements are in place and studios are protective of their content. So, although it is not possible to discern whether it was gender-based exclusion or simply "business as usual", it was nonetheless limiting of her chance to develop her skills. The metaphor of a "fortress" emphasizes the sense of exclusivity and difficulty in breaking into the industry, while being "blocked from seeing" suggests that certain individuals (likely men, given the context) may intentionally impede the opportunities of women to watch and learn, reinforcing hidden codes and BEDIs.

6.4.4.3 Conundrums

Participants seem eager to understand a "confidence code" and show that they are knowledgeable. But navigating the "confidence code" is tricky.

Some participants are *not* lacking in confidence:

> *"I am one of the most experienced UNKNOWN engineers, and I laugh when I see all these engineers, and I can tell you none of these people earned a tape recorder when they were 14 [as I did] and who also leased their own studio. It was 16 channels. I laugh all the time because I am an unknown." P12*

> *"I think that confidence is a very important part of the job and any career and profession … when you are stepping up you don't have experience. That experience gives you confidence. I am 26 now. It's important that people know you know what you are doing." P14*

The phrase, "It's important that people know you know what you are doing" relates to "being seen as credible". But women are aware of a subtlety in the code and a fine line they have to walk. For example:

> *"To be frank there's such a narrow road to navigate as a professional person, being assumed 'stupid and untechnical' or if I'm too confident, I'm overstating my qualifications or something … it's okay if you don't know; rather than you're a b---- who oversells herself or meek and don't know anything – the latter is personally how I have experienced." P3*

Staying humble could even have implications for personal safety:

> *"Sometimes – that might be a cultural thing – we might make ourselves small because we don't want to be targeted." P23*

Other conundrums include the requirement for experience, when experience itself is hard to obtain:

> *"…it's interesting that job postings that say 'you should have this experience', but you can't get in the studio to get the experience .. it's a chicken/egg catch-22." P3*

6.4.4.4 Codes of rigour and rank

The word "rank" implies a masculine, militaristic system. Participant 5 mentions that she had an unusual career path that prevented her from getting gigs:

> *"I had a good collection of work I could show, sound I had done …But when I went looking for job, I was told I was the wrong type of person; I hadn't **come through ranks**, and I was self-taught, but at that point of time I was willing to be poorly paid." P5*

Another statement discusses "rules and regulations" about producing content according to industry standards:

> *"The culture of immersive itself has rules, regulations, restrictions … Dolby is the big boss. Are there men in charge? Let's start there." P12*

> *"…he tried to help me as much as he could, but he was about the rules … for example with levels and Dolby 7 but if you mix that way for festivals everything gets sent back, and everything gets sent back because they are mixing at 4 ½ or 5 now. So if you have a mix that follows the rules at Dolby 7 then your mix is too soft. Then the [sound supervising editor] yells at you: 'Why is it too soft! It needs to be louder'! But he always mixed by ear. And not everyone applies the rules about using limiting, compression, eq, and on what kinds of stems. So that was something that made a mess within my mind because you get the impostor syndrome. 'Am I doing it right'? 'Do I know what I know?'" P19*

These quotes highlight established rules within the immersive audio industry. Dolby, as an industry manufacturer of content creation tools, sets many of those standards. Participant 12's mention of "men in charge" implies that certain gender-based power dynamics (perhaps within Dolby itself) might be a factor.

Also, the quote from P19 illustrates how following Dolby's specific guidelines for loudness is difficult to determine based on the destination venue, but failure to conform to this spec may result in negative consequences: from submissions that get rejected to criticism from sound supervisors. It shows the pressure to comply with the established codes of **rigor**; however, the code is difficult to follow because of differing industry practices within theatrical festivals, television, and other distribution outlets.

Further, P19 implies that the sound supervisor mixed by ear, whereas she is unsure whether she is qualified to do the same and is questioning herself.

Another participant wants to get better at "mixing by ear":

"So right now I added using a loudness meter that is always there. So I am using that – some people can mix by ear - but understanding the eq curve. That is one thing that … am I hearing this right or am I making stuff up? I try to do everything as minimally as possible." P5

One thing that could help participants is mentoring, which is discussed in 6.4.8.

6.4.5 Luck

When some participants are able to find work, they tend to ascribe their success to luck:

"It's been a dream come true. It's really, really fun, I don't know how I got this lucky that I landed this job but I've been lucky this is my 3rd contract and they're extending it to a 4th . If there are shows I'll be called for them but there have to be shows." P20

"My teacher at the music technology also gave me an internship, so I was one of the lucky ones who had two internships." P19

"The only reason I got the job is that the director's usual team was not available. So I came on as a sound designer." P11

"I got lucky and found a content production job at a radio place." P4

This could imply that they never really "cracked the code of credibility" and achieved success by "luck". Further, they seem to be unsure of what it was that got them through the door.

6.4.6 Male Endorsement

Some participants get around codebreaking with the help of men who vouch for them.

"[On] one session I was the head engineer, but I got kicked out … The studio owner always had to vouch for me. Always! 'No, you're good, she know what she doin', she got you' … Always needed that male approval for the guy clients." P18

"My teacher at the music technology also gave me an internship, so I was one of the lucky ones who had two internships. He's a great guy, he really nurtures the women from the sound design [degree] and gets them out there." P19

Even when possessing the skills and qualifications, women find themselves reliant on endorsement and help from men who serve as respected and trustworthy sources.

6.4.7 Pushing

One of the recurring themes from participants is the theme of "pushing". Participants find themselves at a certain point in their careers where they find they need to persevere as they encounter obstacles. At this point, perhaps unable to crack the code, they begin "pushing" with various degrees of success, facing regret, burnout, and self-doubt.

"I never found a way to do it. Maybe if I had gone to London, maybe if I had pushed harder…" P1

"Got offered a job at as a post house as an independent engineer. But I couldn't break through to the next step; I got stuck doing Foley or dialog, but could never break through to mixing … I wanted to mix but you get to a level where there are 3 or 4 men in their 50s who have the gear and reputation – that's fair, but the big jobs go to them all the time. I had good international projects but never progressing in my career. And as an independent contractor you just go from one project to the next and get burnt out." P4

"For years I applied to all the major studios; you start questioning yourself." P4

Participant 1 regrets *not* having pushed harder to fulfil her dream of working in post-production, whereas Participant 4 pushed and found herself coming up against an established cadre of men with "gear and reputation."

In the following examples, participants reveal some of their milestones that come from pushing:

"Against all odds I keep fighting and getting to meet someone like you." P7

"[I] applied to SAE Canada, Dubai, and I was pushing my audio engineering career. I was saving my money! …This beauty that 'I am not where I was last year.' I know I am going to pursue my audio engineering career and study." P7

"I am introverted, and I like to keep to myself. I didn't know what to ask…. I had a friend who told me to talk to the director of the program, I wasn't doing much, I didn't know what to do. I was looking on Google for a sound engineering school I could do 500,000 (Nigerian) Lyra (about £877 GBP) for a few months course. I didn't see one to help me, I was on my own. I kept pushing." P9

In these quotes, participants show their determination and commitment, often relying on their own resources to save money and find affordable training.

6.4.8 Seeking mentorship

Mentoring is seen as a very important tool for career survival, but is difficult to achieve. Sometimes there is a detectable hint of eagerness or desperation in the quest to find a mentor, especially one that will teach participants how to mix. Knowing that mentoring is the key to "unlocking doors" and thus "cracking the code of credibility", they work hard to secure opportunities: many of the participants in the study seek mentoring in one way or another, but struggle to find it.

"…And when I asked around and approached people, I was a strange proposition … I had a good collection of work I could show, sound I had done, but train me how you want…" P1

Participant 1 would have taken whatever mentoring or training she could get and seems to indicate frustration that no one would teach her, and that somehow people perceived her as "strange".

On the other hand, Participant 5 knows specifically what she wants to learn, and is looking for either workshop solutions that are affordable, or a "personal tutor":

> *"I think for the longest time I have been itching to fully understand mixing and balancing. Currently – I've been at this from quite a while – I've made a lot of progress but there's a long way to go. From just moving faders up and down … is there any plan to do a mixing and mastering course [at Immersive and Inclusive]? But the online courses are mostly from mixing and mastering music. They're not for radio drama and movies. So, I would like to join a workshop or tap someone to tutor me … I am looking to learn that and find something that's not so over the top in pricing." P5*

In the following excerpts, participants express a need for mentoring or internships, and discuss the challenges of working in a male-dominated industry and being self-taught. They discuss the lack of resources or "templates" they can use to learn.

> *"Finding mentorship is difficult when there is a strongly dominated male field." P3*

> *"Actually I had a friend, he was doing sound for my church … I follow him on Saturday as they prepare for Sunday service. But I want to learn more – I didn't know the career pathways. I didn't know what opportunities there were. I wish I could get a proper internship and from there find out. Right now I am not giving up yet." P9*

> *"Because one thing I find really hard in audio, especially because it is self-taught, I feel like there is no right or wrong way of doing things. But when you are actively looking for a system … let's say a dialog edit. How do we do this? There are four, five, six ways of doing it, so until we find confidence in our own way, how do we find methods, find people to show us? In uni of course I have been shown it, but I'm only finding a way of doing it. I wish it was more readily available: actively sending around templates. How can we adapt them for ourselves?" P16*

> *"We definitely didn't do any hip-hop, so I looked at going to [an audio trade school] for a certificate. I was looking at studios and didn't feel enough to offer them. That's when I needed a mentor to talk me through that. I didn't work in audio for a whole year. When I was looking for a job, I didn't know what I was doing. So I did video at [a sports league] for a year. [I thought to myself]: 'This is not my passion, I'm messing up…'" P18*

"But I did a lot of commercials, some recording of voice, reconforms … But I never really learned from someone else how to mix. That's something I still struggle with: I use my ears but I'm not sure if it's right – I don't get complaints but – it's a pain point for me. With levels for example I still get confused and my room is small, and the work I am getting means their budget won't allow us to get to a bigger stage to check the mix." P19

"At [my university] we didn't learn how to mix. But I really, really, really *want to learn." P20*

One respondent is aware of the perceived threat she poses to established professionals from whom she'd like to learn:

"I don't want to take anyone's work. I understand that people are afraid you'll take their work. But you have to learn somewhere. It used to be that you would have a boss and you could sit and watch someone mixing." P20

Other respondents directly appealed to the researcher - and perhaps God - for opportunities.

"…AND I PRAY that you [the researcher] can get a sponsorship to bring us abroad and we can use the most expensive gadgets! So seeing how all these things work in real life: the process of recording a movie from beginning to end. It means a lot to some of us and I pray that you will be able to bring us abroad and show it how it's done. The process of getting it from the beginning and how long it takes to finish it." P6

"Do you take internships?" P7

"Do you know of anyone who will let me sit in?" P20

"I saw people using EQ and going scene by scene to EQ and level stuff. I used to do EQ globally. Sometimes you are in a project and you don't hear it anymore. That intrigues me – I don't want to be only a re-recording mixer but (an internship) would help me learn more … I'm on the verge of emailing EVERYONE and saying, 'please take me in', 'please help me'" P16

These quotes reflect the participants' longing and need for affordable training in various aspects of audio engineering such as mixing, re-recording mixing for TV and film, hip-hop music production, dialogue editing, and even career pathways yet to be discovered. They want access to training and would love to study abroad. They need tools such as production templates that they can study to learn signal flow for production. They are seeking guidance on techniques and in to gain confidence in their skills. They are all demonstrating determination to continue pursuing their passion.

And finally, Participant 3 asks specifically if immersive is a "way in":

"Do you think that having immersive audio experience in skillset is necessary for someone trying to make it?" P3

The promise of immersive audio as a new career opportunity manifested in this participant's question, and may have been at the back of many participants' minds when they enrolled in the workshops.

6.4.9 Fear of Leaking Out

Participants in this study have managed **not** to "leak out" of the audio engineering career pipeline, but some do fear losing their way. Sometimes they find themselves "settling" for less:

> *"I ended up in film school because it was my second choice."*
>
> *"It's kind of just a job and not what I'm interested in."*
>
> *"I don't want to do production sound but I am going to, just for the cash."*
>
> *"What am I supposed to do when I ask my tutor to provide work – I'll do any paid work. Desperate because I know I'm leaking out."*

One participant seems to indicate that immersive audio is drawing her to looking for new avenues to pursue:

> *"When I was getting to listen to Atmos and technology it was like a no-brainer. This is the path because you don't have emerging technologies all together. And for me this intent of getting back into sound, sound editing and audio is because I want to get rid of the job I am doing right now to be honest."*

6.4.10 Code Evading

Code evading refers to a process in which UGs navigate gatekeeping by choosing to circumvent or "evade" codes and navigate gatekeeping to survive in their careers - and not "leak out". They do this despite a perceived lack of credibility or trust, and sometimes in the face of negative self-image (such as Impostor Syndrome). Participants find themselves wanting to circumvent "the codes of credibility" and find a more welcoming path by finding affinity groups, mentoring, or perhaps getting a graduate degree or certificate.

In this section, the reader should notice that these themes are subsections of the core category, "leaking up, not leaking out": the central concept that connects the themes of seeking affinity groups, etc.; whereas "code evading" represents a specific strategy or approach that participants employ within the context of leaking up. Together with finding "codes of credibility" and "codebreaking", "code evading" describes how participants process their concern by leaking up, not out of the audio career pipeline.

6.4.11 Seeking affinity groups

Women look for affinity groups to help them. An affinity group might be a feminist audio collective: a safe place where participants can evade the code of [men's] trust and confidence.

"I didn't see any other girls doing sound so I felt like I was the only I just needed a community of sound engineers. So I kept searching. I discovered Audio Girl Africa myself googling words like 'girl', 'audio', so I found that community so I was like okay, nice … now I have this community of audio girls and met ladies and now we are very established." P9

"I had wanted to start a post-production company … But my ambition was to work with women; maybe early career women, and we work in our studios and share workflow … There is something about being in a physical space that is good – you separate from your everyday life. Then maybe create something of a community. I did a class with theatre sound design – a class in [the UK] designed for women … there was 7 of us, and we still have that community. And we still refer each other for work. It built a community, a tiny but useful community … I would like something that would connect women …" P1

"…any time I am in that environment I can let out a deep long breath where I hadn't realized my shoulders were tensed (metaphorically) and you can relax … and maybe that's what I like about WAM (Women's Audio Mission) or a film festival, people don't have that same 'read on you.'" P3

"Most of the training stuff I have been doing is with WAM or SoundGirls; both of those organizations are about uplifting and empowering people who aren't men." P2

"We are starting a social media group where we share gigs. And people try to help each other out. And we try to set something up at schools visible for younger girls that this is something you can do; if you have an interest it is not impossible. And the more women see it the more easily it will be that it is normal that everyone can work in this field instead of 'wow! A woman!'" P19

"…my main professor is now the department chair and she is amazing and a huge champion of mine…" P22

Some participants do not seek out women to work with, but benefit by chance meetings with women in hiring positions:

"The boss is a woman … the husband is an engineer. They were creating an inclusive environment and she was hiring more women and I was lucky to get hired when I did." P8

"I found one at a post sound facility in [Canada] where I'm from. I started working with one of the only women in the field at the time – it was the early 1990s …I wanted to go in the mix sound of things – I got an internship as a sound editor with a female supervising sound editor. I worked in the industry for many years with her. Once I started working with her the work started rolling in. Paid work. Most of what I learned I learned from her. I learned in film school but not as much as when I was doing it (with her). There were a lot of opportunities, but … I was protected under her." P11

"Maybe 2 years ago I got invited to work with cutting room studios here. And that's because another woman (Black) engineer brought me …she just started another studio in New York City, she is young but blazing … When women work with me they are super excited. It's a party! 'Oh, [they say], you're not going to take advantage of me'. I was like, 'Oh that's happening out there'. The second they see me it's, 'YOU. You're doing this". P18

The role of affinity groups is similar for people who belong to certain ethnic groups: for example, an Historically Black College or University (HBCU), the National Society of Black Engineers (NSBE) in the US, or the Black Sound Society (UK). The following quotes highlight the importance of such groups:

"..coming from a HBCU I didn't feel comfortable going into a big studio. So I talked myself out of applying for those positions" P18

"I wouldn't say the degree put me at an advantage to anyone else .. you might be so-and-so's nephew or son who knows someone else. I did trainee job for 2- 3 years and then I got sound assistant job with [a member of a Black sound collective] obviously." P14

Participant 18, coming from a historically Black college or university (HBCU), recounts feeling uncomfortable in larger mainstream (presumably mostly white or mixed race) studios. On the other hand, the P14 emphasizes the advantage of belonging to a Black sound collective, recognizing that their degree alone did not guarantee opportunities; rather it was his connection to the affinity group and a recommendation from a colleague that opened doors for him. These quotes underscore the role of affinity groups in creating a sense of belonging which also lead to opportunities in the audio industry.

In summary, the participants above describe how working with mentors from affinity groups has helped them in their careers. They share examples of mentors and collectives who have championed them, provided opportunities, and protected them.

6.4.12 Innovating

When participants are able to experiment and explore, they do so in innovative ways. Participants are excited about immersive audio and sharing their knowledge with affinity groups.

"I have a documentary I am working on about regarding female taiko drummers. The director wants to do an immersive mix, could be surround sound." P2

"That's why I am always thinking about ways to expand the ways the audio-verse can sound like."P5

"So I reached out to SoundGirls and said I wanted to start something." P10

"That's sometimes I find interesting but I'm always thinking about organizing stuff. Maybe organizing a SoundGirls fly-on-the-wall idea about how people work. I talked to [a famous woman mixer] to see how others set up their session, and how you make it easy to work with." P19

"… my teacher at the time … had a speaker in his ceiling in 2004! And he was doing surround and a lot of the students at the time were like, "what?" And I thought, "oh he is on to something". So … I went out and put together my own Dynaudio system." P12

"Sound system culture in the UK is 60 years old but for it to last another 100 I felt it needed innovation. It wasn't enough to have the sound and tour it, but to encourage the next generation you need to appeal to a new audience. Being a woman especially." P13

"… that's why I founded my company because I think there is a gap between the offers and the actual skills that you get from a course, because it's not that all companies need sound design." P17

"… I'm also into podcasting and we have a … podcast we started doing." P19

"… marine science is my background, and where to start with the sounds of the ocean. And then how to host events and have immersive experiences and installations. Luckily I live in the [a large American city] and there are more opportunities there so we don't have to rent a bunch of equipment and put it in a bare building, so I can just focus on the logistics and creativity." P22

Part of this was made possible by the pandemic:

"…This freelance work is feast or famine. I am looking at models of working that would suit people better – I don't want to reduce this to gender – but anyone who has other commitments in life. A distributed way of working. And the pandemic showed us it was possible." P1

"So the pandemic opened up several ways in which things can be done. So if I can't get to campus I could have a virtual meeting with my tutor or teacher, someone to teach me about signal flow. So the pandemic showed me what was possible."

Altogether, these quotes show participants are innovative and creative: from exploring immersive audio to preserving urban culture. Many have founded companies, leveraged networks, even blending their non-audio related backgrounds with sound (for example, marine science). Also, the pandemic enabled alternative ways of working, and was a time when many people found creative solutions to remote working.

6.4.13 Social Justice

Participants are not only innovative, they are also giving back and lifting up their communities with sound technology.

Participant 13 refers to her sound system as a "she" or "her", and discusses the system's role in terms of building community:

> *"I say "she" ... as a sound system, I don't think I had referred to her as a "her" before. Interesting. Probably because I created it. [My sound system] is the "light and spiritual liberator" and it was about bringing people together due to how I struggled with identity. So it's about bringing people together and liberating people through music and spirituality." P13*

Participant 22 is working on an immersive installation in order to highlight injustices centering on gentrification:

> *"I am working with some artists in [my city] in an accelerator project that is looking at the erasure of Black sound in [my city] and the politics around sound, and how do we flip that and kind of like re-inject the sounds in [my city] on the practical level of just ...playing the sounds and get people back so the sounds come back and flourish." P22*

6.4.14 Upskilling: Immersive and Inclusive workshops

The participants in the workshops were all looking to upskill by obtaining new knowledge, skills, or certification. During the course of the interview, they expressed their feelings about why they chose to pursue the workshops.

> *"When I saw [the workshops] advertised, that's what I wanted to learn and it was difficult to find a way in. I bought the [Dolby Atmos] plug in for Pro Tools but I could never set up." P1*

> *"You are enabling people to get skills to do whatever they want with. And the type of people you're doing it for ... And I'm passionate about the class but even more so now because everyone is learning together. It's a great culture. Every week it get better. There's no one sat there passively ... The people are here doing it have skills that are gained through certain avenues and they don't have an influx of women or people of color. You're creating a route to gain these skills and go do it. And hopefully it will open." P14*

> *"...the Dolby certification was valuable to me because I didn't have the chance to study it, so finding the classes from you [the researcher], the light just went on and I thought 'oh!' this is an opportunity to learn about it in person and not just listen to [prerecorded] lectures ... I just wanted to say a big thank you because this is the first time that I saw that someone is creating a course that you can apply for a scholarship and pay less. ... We did a lot in one day but I felt I was somewhere I was safe and could talk about other things, not just Dolby Atmos but we could talk about other things besides the course materials. It was still hard and we did a lot in one day but I didn't feel .. I didn't feel like it was so rigid. I really liked the classes." P21*

Overall, the workshops had a positive impact and seemed to address many of the needs of participants seeking to gain the experience needed to "leak up, not out". Such experience included operating Dolby Atmos and earning the Pro Tools | Dolby Atmos Operator certificate in an affordable way.

6.4.15 Upskilling: Masters degrees

At least eight of the participants, mostly women in Europe, have or are pursuing master's degrees. Participants 3 and 19 attended universities in England with immersive sound studios. Participant 3 found it expensive, but felt like pursuing a masters would give her a "leg up" since at her age she did not want to "start over".

> *"I'm 30 years old and I felt that I would have a really hard time … it would take years to build the network where I can get an internship at a studio and I needed to accelerate that process … And it's a huge financial investment to do this master's program … even though it's expensive, because I needed to access this stuff somehow. So at [a university] there is a 5.1 class, and an ambisonics class, and then next quarter a film sound / surround class. There are opportunities and equipment here … otherwise I would have had to do that alone and it feels difficult to me to form relationships with studios." P3*

> *"…in 3 years I did my bachelor's and master's. At the time they weren't so strict and the only thing I had to do was my thesis, which was about surround sound: what works, doesn't work, and for whom."*

Participants 4 and 17 pursued a master's degree so that they could leave their respective home countries and find opportunities:

> *"My partner wouldn't get approved for tier 1, but I could apply for a master's." P4*

> *"I wanted to do a master's degree in something I really, really enjoy. And because I was in marketing I found a sound design [at a university in the UK]. I quit my job and got a scholarship … I did my dissertation in audio branding." P17*

Participant 23 pursued a master's in order to advance her career:

> *"So as an adult I was making records but wanted to work with producers who knew more than me and I wanted to take the next step. So for about 10 years there was a gap when I was relying on others. So then I went to [a university in the US] for grad school and did master's in audio technology." P23.*

Altogether, the participants saw postgraduate study as a way to find opportunities, advance their careers, and the experience of studying something they enjoyed.

6.4.16 Learning / Being Self-Taught

Many of the participants in the study rely on being self-taught, having to evade or circumvent the barriers posed by the "code of credibility." They have had to teach themselves and find alternative ways to gain knowledge and opportunities.

> *"I have always had that weird "I taught myself" scenario in my head. I had a minidisc recorder and DAT recorder and this became my material." P1*

> *"[I] did a lot of projects on my own in a DIY sense. WAM was really helpful in that journey to find conference opportunities and other events to keep that learning stimulated." P3*

> *"... a friend sent me a link to the podcast and I became obsessed with podcast. I started trying to make my own and encourage my friends to make their own podcasts that I would edit for them ... there was something for me in the podcasting space. And I knew that one day there would be lots of podcasts so I was training myself, watching YouTube videos, doing trial and error. And I am still learning on my own; You Tube, articles. There is no audio production school in Nigeria." P5*

> *"I learned about tech stuff, how to install, how to fix stuff. For example we got this system in 2019 but I am the only one who knows my system. ... I taught myself not to depend on presets. I like to know how it's done. That way I can do my work ... One thing that is a disadvantage (and an advantage) in this part of the world we don't have access to updated equipment. Say you want to buy a device or gadget: by the time you look at the exchange rate you are forced to keep using what you have. The good thing is that it forces me to learn how to manage things like this small mixer ... they don't invest in equipment but people just have to manage. But that forces you to learn more. But the downside is that certain things become alien to me when you see it (new technology) So to stay ahead I subscribe to YouTube channels, so even though I can't hold it in my hands I am familiar [with it]." P7*

> *"This is Nigeria, you have to be self-sufficient." P9*

> *"But you need to be a person who can be self-directed. Can I direct myself? Can I tell myself, 'Sit down and practice what I just learned'? If you're not, forget it! A class can only get you so far." P12*

> *"At the beginning it was very self-taught and then I had a couple of people trying to guide me, especially in the UK, but they weren't specialists in the field. For sound design I liked it but barely knew what it entailed." P16*

> *"But it's hard for me to sit still. I try to study, dive into new software or listen to podcasts. See how other people are doing stuff. Talk to people. I need that, otherwise I'd go mad." P19*

Working with personal projects, finding helpful videos on YouTube, and staying up to date on new technologies show that these participants are committed to their craft. In some cases, limited access to technology means that participants have to be creative and that they are developing troubleshooting skills, further underscoring their passion for audio.

6.4.17 Going it on their own

Although it is not easy to "go it alone," some participants find satisfaction when they circumvent the typical audio career path and act independently.

Participant 20 emphasizes the need to learn more than just audio skills, but to understand what it means to be a freelancer.

> *"A lot of what I found about audio that I don't like is that it is mostly freelance. I wasn't taught that in school. I didn't know what a 1099[12] is. I didn't know that I would have health care. It's scary and I wish there was a class that told or taught us more on how to navigate because it intimidates me a lot and after 5 years in the field, I'm still not sure that I'll be okay. It feels okay right now but what about after this contract? What if there's no new show?" P20*

Some find it rewarding to pursue their own interests; others simply recognize that independence is the only option available to them:

> *"...I feel pretty happy with my position now that my main paycheck is as an instructor and I do selected indie work on queer or feminist project that I choose myself. I'm picky about my projects. So, I decided I'm working on this big project which is an audio film – it is a film without images – which is how I got interested in your project." P11*

> *"After graduating I kind of had to find my own way. When we were on campus there was an internship class. We met as a class and recorded the ensembles around the campus as "the work for the internship". Then there was a more senior member who helped facilitate and helped you do the internship work but that was a class. All of the internships I did I found on my own." P20*

> *"When I realized I wasn't going to get that permanent job I was 25 and still living with my mom, so I wanted to be independent and get a proper job ... I learned a lot on those feature films but it wasn't steady income and I couldn't live just working on that. It would have to be more so I decided to transfer the PhD studies here [in the UK] so I had to start all over again." P21*

[12] A "1099" is a form used for American tax purposes to do with freelancing or self-employment.

> *"I have my own consulting company so there are areas where my journey is different. I am not relying on sound as my main company and I'm not hustling trying to get into live sound. The lack of diversity is one reason I am NOT looking to get in. I have experience as a tour manager of the scene being exclusive and exclusionary towards women and non-binary / gender expensive, even with the most progressive people. So that's kept me in the freelance world." P22*

Participant 11 finds it rewarding to work on independent projects on topics with which she identifies, and to work on something innovative and personal. Participant 20 has had to navigate her own path without support from her school. She was able to take an "internship class" but had to find the internship on her own; she is now a freelancer. Participant 21 felt the need to move away from her mother in order to become independent after being unsuccessful in finding the permanent job she desired; she then pivoted, saying she wanted a "proper job," and so sought a PhD.

The concept of "code evading" is particularly strong with Participant 22, who emphasizes that the lack of diversity is the reason she has her own consulting company and further laments that even very progressive people continue to maintain an exclusionary environment.

6.4.18 Teaching

A few women decided to learn Dolby Atmos material specifically so they could teach it:

> *"I wanted to be a part of this because I was feeling unenthused with where I was in my career. I wasn't excited so I took almost a year off and I had a conversation with someone who asked where I saw myself going. That's reminded me of Atmos that what's excited me, and (a woman from a feminist audio collective) asked me randomly if I wanted to learn about Dolby Atmos and teach it … I didn't know the setup. Sometimes I need that push, or pressure, and I'll do it and that'll let me know how to learn it to the point where I could teach it." P18*

She got involved with a mixed-gender group of audio professionals, but it was so she could attain the Atmos certification:

> *"…they reached out to me and the main reason I wanted to be with them wasn't because of bridging engineers with clients but they offer their version of Atmos cert so I could learn from them and advertise the service on the site." P18*

> *"So my interest in immersive audio started with [a famous producer]. He and [another famous producer won] a Grammy … He asked what I thought about immersive and would it catch on, but I didn't understand really what it was until I went to a listening event… And they had a 9.1.4 setup and I stood in a couple of sweet spots and during the same song I would change positions and have a completely different experience. So I saw the value for film and post so that was the spark so that I could learn this and be really good at it and then I could teach it as well." P23*

But people have other reasons for wanting to teach:

> *"By teaching I have been personal investment in my own education, and then looking at teaching to progress my own interests." P1*

> *"I was teaching post sound in [Canada] but I moved to Germany and started doing independent work in films here just on my own at home – not with a facility … So I feel pretty happy with my position now that my main paycheck is as an instructor and I do selected indie work on queer or feminist project that I choose myself." P11*

> *"I wonder about how to facilitate a space where those who are quieter can speak up. And this big question about how to get film students into sound. I remember I taught a sound class in the film class. The music students could also enrol. And they loved it! They dove right in. And felt good for me to have students who understand sound and wanted to learn about it from a film perspective. The school I'm teaching in now divides the students. The music students don't learn about film sound, and very few Film students are interested in film sound. So this is always been question." P11*

By finding their own way and actively seeking knowledge, these participants are escaping the existing "codes of credibility" to create their own opportunities for success in the audio industry. Their motivation to teach Dolby Atmos goes beyond mere career advancement or upskilling: for some, it is a chance to reignite their enthusiasm for their work. Others see teaching as a means of personal investment; a way to progress their own interests and deepen their understanding of immersive audio. Furthermore, P11 highlights the need to bridge the gap between music and film and create spaces where students can explore sound (perhaps including immersive audio) from various perspectives. By taking on the role of educators, these participants want to share their knowledge with minoritized groups.

6.4.19 Audio Identity and Purpose: Morphing through the process

Participants who are female want to be seen as "audio engineers", not "women audio engineers":

> *"I feel like for me it was 'I'm here to learn, I want this to be my career', and I didn't feel like it mattered what the guys thought because I was there to learn." P2*

> *"I never want people to judge me. In my year at [university] in 2022 I'm the only woman among 40 students." P4*

> *"I want to be good enough that people don't care about what I am. I don't want to be hired because I am a woman. I want to be the most qualified." P16*

Through this journey, some participants are finding renewed purpose:

> *"I made a lot of mistakes but that's how you learn. I have a one-track mind and was really focussed. It was a major pay cut but I felt better about life and purpose." P18*

"To move into something which … I saw it as something … it was my legacy. In my lifetime I can tour my sound system …" P13

"And that's what you are doing. You are giving me a place to be viable. Valid. To have a voice." P12

6.5 Chapter 6 Summary

Chapter 6 detailed the methodology used to discover the main concerns of participants in immersive audio workshops (RQ4a) and how they process those concerns (RQ4b). The researcher divulged her biases and point of view, presenting herself as an audio engineer who has embarked on research from a feminist point of view that also features characteristics of critical race theory (CRT).

A rigorous GT study has been described that allows the main concerns of participants to be elucidated during interviews held after workshops in immersive audio, along with an explanation of how the study adhered to a grounded method. Interview questions were refined so as not to "force" the data and were developed in an iterative way, reflecting the methodological processes of open coding, theoretical sampling, and selective coding. The questions can be summarized as follows (with the stage during which they were developed in parentheses):

- Have you faced any barriers to entry? (initial coding)
- How has it been finding your way through your audio journey? (Milestone 1 / second round of interviews and coding)
- What interests you about immersive audio? Have you listened to immersive audio before? (all stages of coding)
- Do you feel as though you are taken seriously in your career? (Milestone 3 / selective coding stage)
- Do you have any questions for me, or is there anything you wish I had asked? (all stages of coding)

Data collection and analysis was described, along with the population under study and five subgroups. The resulting code category is "leaking up, not leaking out" whereas the main concern of participants is "being taken seriously", findings which are grounded in the data. Thus, Research Question 4 ("what are the main concerns of participants in immersive audio workshops (RQ4a) and how do they process those concerns (RQ4b)?") have been addressed with several emergent themes. Chapter 7, "Theory" presents the connections between those themes that form the GT, along with their relationship to existing literature.

Chapter 7: Theory

This chapter presents the theory that was formulated based on the emergent themes resulting from the data analysis in Chapter 6, which used a rigorous GT methodology (Chapter 5) to discover answers to the research questions, "What are the main concerns of participants in immersive audio workshops (RQ4a) and how do they process those concerns (RQ4b)?" This chapter discusses how the themes are integrated to form the emergent theory, how they are connected to the existing literature, and the resulting theory itself.

The chapter is laid out as follows:

- Thematic integration (7.1);
- Connection to literature (7.2); and
- Theory (7.3).

7.1 Thematic Integration

The themes that have been established in Chapter 6 can be connected in a way that explains how participants process their main concern of being taken seriously. By exploring the relationships between the themes, this thematic integration shows the complex processes through which participants address their concerns. This in turn becomes the grounded theory.

The visual map in Figure 7-1 shows the themes in action.

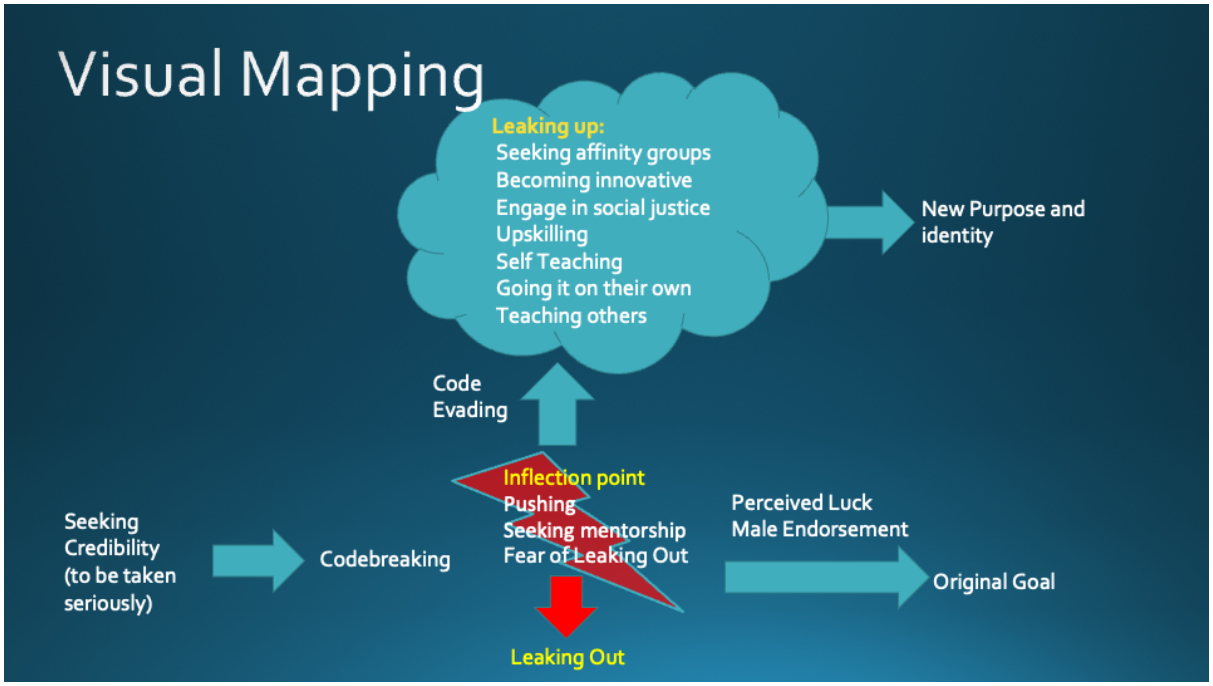

Figure 7-1: Visual map of theory

The diagram in Figure 7-1 visually represents the resulting theory of this research. It depicts a common career progression of the participants. The journey begins with a desire to be seen as credible, followed by an attempt to understand or crack the "code". At a certain inflection point (shown by a red lightning bolt) and if unsuccessful, participants are either faced with "leaking out" of the audio pipeline; or changing their circumstances by engaging in a combination of activities to improve their outcome. Those who make it through attribute their success to "luck", or to having someone, usually male, vouch for them. The following sections give a more detailed description of the dynamics at play.

7.1.1 Concerned with Credibility

Participants state often and clearly that they want to be taken seriously, as shown in the bottom left corner of Figure 7.1. Some participants also grapple with Impostor Syndrome. During this process, they navigate "codes of credibility" including sexism, secrecy, conundrums, and codes of rank and rigour (6.4.4) by "codebreaking". During this process they seem ask to themselves, "*why* am I not taken seriously?" and "*what do I need to do* to be taken seriously?"

7.1.2 Inflection Point

Having encountered "codes of credibility" and attempting to understand them by "codebreaking", an inflection point is reached, depicted by a red lightning bold in Figure 7-1. At this point, participants might perceive themselves "lucky" (6.4.5) to advance to a full-time job ("the original goal" on the far right side of the diagram), despite possessing all the requisite skills, passion, and drive necessary to succeed. Others perceive they have benefitted from male endorsement, perhaps to allay the distrust of a client. Alternatively, if they are unsuccessful in "cracking the code", participants begin doing things like "pushing" (6.4.7) and "seeking mentorship" (6.4.8) ; some are even expressly fearful of "leaking out" (6.4.9). This leads to a subsequent stage the researcher calls "leaking up", as shown in the blue cloud at the top of Figure 7-1.

7.1.3 Leaking up, not leaking out

Unable to "crack the code", some participants find ways to "evade the code" by seeking affinity groups (6.4.11); using their creativity and innovation by exploring new projects (6.4.12); engaging in social justice (6.4.13); upskilling (6.4.14, 6.4.15); teaching themselves (6.4.16); teaching others (6.4.18); or "going it on their own" (6.4.17) by freelancing or starting their own businesses. Along the way they find new purpose and identity (6.4.19). The term "leaking up" is meant to draw a parallel with the term "leaky pipeline", and to evoke imagery of "leaking" through a career pipeline rather than "flowing" through.

7.2 Connections to Literature

The thematic integration above addresses a gap in the data about participation by underrepresented groups (UG) in the audio field (Chapter 2), and goes beyond the numbers to show what participants are *thinking*, *feeling*, and *doing.* Similarly, the themes in this study are echoed in discussions of BEDIs (Chapter 3) and remedies to those BEDIs (Chapter 4).

In this section, a review of the literature connects the themes here to a larger context. In doing so, the theory is further strengthened.

7.2.1 Credibility and Recognition

The findings from the literature in Chapters 3 and 4 offer insights into the impacts of BEDIs in the audio field and their potential remedies. Workshops and educational initiatives provide practical knowledge and skills, but it is not clear whether they alter perceptions of credibility and related behaviour by gatekeepers. The literature in chapters 3 and 4 does not explicitly address the significance and impact of *recognition* and *credibility*; nonetheless, as the testimony from various professionals in the audio field indicates, there seems to be a deficit of credibility for women and other UGs, regardless of their accomplishments.

To address this gap in the literature, the theme of "being seen as credible" is connected to a "theory of recognition" and "social capital theory" as shown in the narrative below.

7.2.1.1 Credibility

Along with the testimonials from the participants in the study, "not being taken seriously" is a phenomenon not just confined to new career entrants. Emily Lazar, in the AES Panel "Equity Learning Series: Immersive and Inclusive - A Discussion of Representation in Immersive Audio", recounted an incident in which she was made to feel inferior:

> *"I have Grammy awards and Grammy nominations, and I've mastered the immersive at this point in time. I mastered the immersive 'Four' albums for the Beatles and the Rolling Stones and, you know, some other well-known bands pretty legit in this space. And I was included in a group that includes some of my very, very close engineering friends who are men. And I was only woman in there. And I think that I've already proven that everyone has to work hard. Don't get me wrong. I think I've already proven myself. I've been doing this for a while now, not my first rodeo, and I was completely disrespected in a text exchange in that group. And I left the group and I had a lot of terrible feelings about this, because as a younger person, I always fought to stay in the room" [Lazar et al., 2023].*

Lazar's story is indicative that women at all stages of their careers struggle to be taken seriously.

The literature review also yielded examples of the desire to be taken seriously: recall the testimonial from the University of Surrey students' report in 3.2.5.2, "Microaggressions in University Music Tech and Audio Programmes":

> *"If there's a man in the room, they are always approached before me for technical stuff, and no one assumes that I'm there to do the job I'm there to do" [Blakemore et al., 2021]*

Also recall the Women in the US MUSic IndUStry study in, 3.2.3, "Discrimination in the Music Industry":

> *"There's still a bias against female engineers, where I feel we need to prove ourselves more than our male counterparts."*
>
> *"I wanted to be taken seriously and recognized for my talent and hard work and not because I could look hot. Agents and musicians propositioned me relentlessly" [Prior et al., 2019].*

EveAnna Manley, owner of Manley Laboratories, remembers being ignored by men. In the article, *Female and non-binary music tech manufacturers on trade shows: 'People still don't think I'm the one doing the work',* Manley implies she "wasn't 'pretty enough' to be a 'booth babe.'" She goes on to say men were dismissive of her when they came to her booth at trade shows. Likewise, the same article reveals that Kris Kaiser (co-founder of Eurorack modular synthesizers) would often get passed over during trade shows – even when she was wearing the same company shirt as her colleagues [Kraftman, 2026].

Similarly, the researcher documented further examples of women at academic audio conferences who were passed over as interested attendees addressed their questions to the women's male colleagues [Gaston-Bird, 2023]. These are all examples of not being seen as credible. The testimonies of professionals in the audio field, as echoed by Lazar, Blakemore, and interview subjects, emphasize the ongoing challenge of UGs and women grappling with "credibility deficits" irrespective of their achievements.

7.2.1.2 Theory of Recognition

The term "justice of recognition" was mentioned during the researcher's chat with mentor Michelle Fine. Curious to learn more, the researcher discovered some interesting parallels with this study and the work of Alex Honneth's "theory of recognition", wherein human identity and self-worth are deeply connected to how others acknowledge and recognize each other. According to this theory, there are three tiers in the model of recognition: love, rights, and solidarity [Petherbridge, 2013].

The first tier is love, having to do with "familial relations of 'love' or affective recognition in which individuals are recognized as beings with concrete needs" [ibid.]. In this study, participants are looking for safe spaces where they work on building their credibility, and these safe spaces are akin to a family unit. Along with safe spaces, mentorship is also a place where UGs can get emotional support, guidance, and affirmation. "Emotional support and validation play a crucial role in empowering individuals and fostering their success in the field" [ibid.] [Mahayosnand et al., 2021] [Elliott et al., 2020].

The second tier is "legal relations in which individuals are recognized in abstract terms as beings with rights and responsibilities" [Petherbridge, 2013]. Chapter 3 talks about the barriers to entry and discouraging influences (BEDIs) faced by UGs in the audio industry. It could be that in order to create a sense of belonging, the audio industry must work towards equality and access – not just inclusion – for there to be "justice" to go with this recognition.

The third tier is "relations of solidarity within the [environment] within which individuals are recognized in their particularity as beings with specific traits and abilities" [ibid.]. One particular area where solidarity is important is within the trust and credibility issues faced by participants. Without trust, there cannot be solidarity. Affinity groups are where participants find love and solidarity among peers.

Therefore, Honneth's theory of recognition can be seen as part of the dynamic being observed in this study, about which one could say "participants want to be **recognized** for their skills and abilities, thus being seen as credible". Recognition is not just about a passing acknowledgment, but is also deeply tied to credibility and respect. In this study, the absence of recognition has been shown to affect participants' professional trajectories.

7.2.1.3 Social Capital Theory

Networking, role models, and mentoring are the ingredients to building social capital as discussed in 4.2. To review: social capital is "anything that facilitates individual or collective action, generated by networks of relationships, reciprocity, trust, and social norms" [Bourdieu, 1977], [Coleman, 1988]. Throughout this study, we see these themes emerge again and again as women "leak up" and try to build social capital. Liou and Chang, [Liou et al., 2008] add to the understanding about social capital by highlighting "relationships, community building, role models, networking, and empowerment". The additional nuance of community and empowerment is important when considering participants in the current study who are seeking affinity groups and interest in helping others and in social justice.

The literature examined in Chapters 3 and 4 *indirectly* discusses the nature of credibility and recognition, particularly in the context of how mentorship, role models, and networking serve important roles contribute to these concepts. The Mathematics Workshop (4.3.2.1), the Meyerhoff Program (4.3.2.2), and Computer Coding Boot Camps (4.3.2.3) feature common themes of mentorship, role models, and networking as ways to build social capital. Tsui [2007] also prescribed 10 "Major Intervention Strategies" which include mentoring, tutoring, counseling, and workshops. Researchers in those studies sought to elevate underrepresented groups and put them on equal footing with their white male peers by offering these tools in order to improve their social capital. This overlaps with the current study which finds that in the process of "leaking up, not out", participants are seeking these kinds of tools to succeed in their careers.

The literature also showed that unconscious bias can affect decisions about who is allowed to progress through "gates" in various STEM, medicine, and corporate disciplines, and unconscious bias impacts recognition and opportunities for advancement leading to a deficit in social capital. For example, the study "Do Female Executives Make a Difference?" [Flabbi et al., 2019] revealed that women are significantly underrepresented in top positions in firms, which highlights a lack of recognition of their leadership capabilities.

However, the literature does not tackle the search on the part of the participants for credibility. The theory emerging from the current study along with the concepts of "justice of recognition" and Honneth's "theory of recognition" *directly* confronts the issue of credibility and better aligns with the experiences of participants striving for acknowledgment in the audio field. Similarly, social capital theory, with the additional pillars of community and empowerment [Liou et al., 2008] add to the toolbox researchers and advocates can use to help UGs in their quest for credibility. These pillars are seen as participants seek women's affiliation, engage in self-teaching, develop innovative ideas and solutions, engage in social justice, and are empowered to go it on their own.

7.2.2 Impostor Syndrome

Overall, participants in this study are aware of the "impostor" phenomenon and discuss how it relates to being taken seriously. Some discuss that it pushes them to achieve higher credentials.

> *"My partner says I have impostor syndrome. … even though I'm doing my master's I think about how I can learn more.* ***I feel like I have to have a professorship before anyone takes me seriously****." P4*

> *"And I have been progressing that by becoming an Avid Certified Instructor, which has to do with my own impostor syndrome." P1*

These quotes reflect the belief that higher credentials are necessary to be taken seriously. Clance and Imes [1978] in their paper, "The imposter [sic] phenomenon in high achieving women: dynamics and therapeutic intervention" state that "the clinical symptoms most frequently reported are generalized anxiety, lack of self-confidence, depression, and frustration related to inability to meet self-imposed standards of achievement". They also describe the case of children that have an "all or nothing" approach to their self-image. "She is not a genius", they write of a typical subject, "therefore, she [feels she] must be an intellectual impostor" [ibid.].

While Impostor Syndrome is a contributing factor, it should be viewed within the larger context of being taken seriously. Some UGs may feel the need to continually prove themselves and achieve higher levels of achievement in order to alleviate their feelings of being "impostors", which in reality may never go away without counselling [ibid.].

7.2.3 Codes and Conundrums

Certain credibility codes and codes of confidence can be found in the literature. For example, Swim et al. [2005] state that "… it is not uncommon for women to encounter male peers who make remarks about women being accepted into STEM programs on the basis of their gender rather than their academic credentials... this type of double standard may contribute to the gender gap in STEM fields to the extent that it erodes girls' and women's sense of belongingness in their area of study". Similarly, Major et al. [1994] in their paper, "Attributional Ambiguity of Affirmative Action" write, "the more that observers perceive that an individual's positive outcomes were based on group membership [e.g. "women", "African Americans", etc.], the less likely they should be to infer that the person was highly competent or deserved the outcome". These factors make it difficult to establish credibility when others perceive the presence of UGs to be dictated by a diversity policy.

There is also the "confidence conundrum". In the book *Finding Your Career in the Modern Audio Industry*, re-recording mixer Sal Ojeda says, "you have to be confident in what you know and your talent. But at the same time, you have to humble yourself and remember that you're nobody" [Tucker, 2022]. Emily Lazar, in the panel "Equity Learning Series: Immersive and Inclusive - A Discussion of Representation in Immersive Audio", reinforces that this conundrum is still a problem in the music industry:

> *"The one piece of this conundrum that that is still hasn't really been fixed, yet is this access to the employment opportunity. And while getting an internship or an assistant level position is a really great thing, it actually doesn't garner you that credit on the album or necessarily guarantee that you're going to keep going past that internship level or that assistantship level"* [Lazar et al., 2023].

In other words, even though an internship or assistant position might get someone in the door, it doesn't offer an album credit that can be used for a resume.

Another conundrum is the mysterious, elusive ability to "mix by ear." At the Audio Engineering Society convention in Finland in 2023, industry veteran Richard King says the top of the "pyramid of competency" as a mixer is "knowing enough to break the rules" [Corbett et al., 2023], but in the case of P19, the question might be, "how do I know when I know enough"?

7.2.3.1 Mentorship and Endorsement

In her book, *Finding Your Career in the Modern Audio Industry* [Tucker, 2022] April Tucker writes, "..an emerging professional is someone who wants to have a career as a professional in the audio industry but who's income does not support it full-time yet. Anecdotally, this gap is usually between two and five years". Many of the participants in this study are aware that finding a mentor is hard, but seem unaware that they are going through a two- to five-year phase (according to Tucker) that could yield positive results.

Participants talked about men being allies and helping students who are women to find internships, and they also talked about men having to step in when trust is absent with clients. Roden et al. [2021] found that in a social media context, men have a "unique advantage in influencing other men with respect to gender equality." The value of male endorsement cannot be understated, especially when considering the influence it holds in shaping perceptions. Just as men can perpetuate negative stereotypes, they can also play a transformative role in debunking them. Roden et al. found that "higher estimates of male support lead men to express greater gender equality policy support" [ibid.].

The positive influence of women mentors can also be seen in STEM. Elliot et al. [2020] state that "The strong mentoring (and role modelling) of female professors, instructors, guest speakers, community entrepreneurs and peers was certainly key to developing a supportive environment in which the network of students could grow and strengthen".

7.3 Theory

The main concern of these participants is to be seen as credible ("to be taken seriously"). They are fighting for recognition as they yearn to be seen as competent within their respective audio fields of music, live sound, audio branding, podcasting, and post-production. Within an industry that has been shown to exhibit several barriers to entry and discouraging influences (BEDIs), participants are trying to "crack the codes and conundrums" of sexism, confidence, secrecy, rigour, and rank which are vague and sometimes completely hidden. In order to advance in their careers, some benefit from the endorsement of male colleagues, while others consider themselves "lucky" to find a way in. Others struggle not only to find respect for their talents and abilities but also to find very specific types of mentorship. In many cases this mentorship is desired because participants are having to sustain their careers with freelance work, and they are looking to solve specific problems – not just to find mentorship for the sake of it. During their journey, many abandon futile codebreaking efforts and instead look for welcoming spaces with affinity groups who help provide them with validation, role models, and mentorship. Through the process they find renewed purpose and identity, engaging in creative and innovative productions and conceiving of ways to share their knowledge and passion outside of the upper echelons of a male-dominated audio industry.

As Barney Glaser [1992] states, in GT, the "yield is just hypothesis …a theoretical formulation or integrated set of conceptual hypotheses about the substantive area under study". In this study, the theory integrates emergent themes based on interviews with underrepresented groups (UGs) who came to participate in workshops related to immersive audio. The theory is grounded in data during a rigorous process of coding, memoing, constant comparison, and saturation. It is further bolstered by mentoring, member checking, and comparisons with the literature and the "theories of recognition".

7.4 Chapter 7 Summary

This chapter presented the thematic integration leading to the emergent theory and accompanying visual map grounded in the data. The codes, categories, and themes were derived from semi-structured, open-ended interviews with 23 participants.

The resulting theory is that the main concern of UGs who participated in the study is "being viewed as credible" (also referred to as "being taken seriously"), and the way they process those concerns is by "leaking up, not out" of the audio career pipeline. They do this by codebreaking: either by seeking ways to establish their credibility ("breaking the credibility code") or by circumventing an industry with unnavigable pathways and finding their own way ("code evading").

Several examples from the literature were provided which bolster this theory, such as the experience of women at trade shows and academic conferences and a look at some perspectives from other industry professionals about internships and mentoring. Further, the theory of recognition has certain parallels to the current study, primarily that without recognition, underrepresented groups have to take action in order to "leak up" through the audio career pipeline. Altogether, these findings add support to the final theory.

Chapter 8: Conclusion

The overarching aim of this research has been to examine participation in the immersive audio industry; uncover barriers to entry and discouraging influences (BEDIs) and remedies for those BEDIs; and discover the main concerns of participants in immersive audio workshops. To do so, the following research questions were asked:

1) what is the current data regarding the participation of UGs (RQ1);

2) what are the BEDIs which exist in immersive audio (RQ2)

3) how might these BEDIs be removed (RQ3); and

4) what are the main concerns of participants in immersive audio workshops (RQ4a) and how do they process those concerns (RQ4b)?

For RQ1, a significant lack of representation of underrepresented groups in the immersive audio industry was demonstrated. Data from various sources, such as the Annenberg Inclusion Study, AES membership demographics, Motion Picture Editors Guild demographics, and a survey of employees in the game sound industry illustrate the extent of under-representation. Chapter 2 revealed that:

- fewer than 2% of producers for popular ("hit") songs were women between 2012-2019, and those numbers have gone down as of the 2021 report;
- fewer than 10% of presentations on immersive audio at AES conferences were done by women;
- there are very few women (fewer than 2%) and minorities (fewer than 1%) who belong to the Atmos Facebook group;
- there are few women (fewer than 10%) and minorities (fewer than 1%) who belong to the Spatial Audio in VR/AR/MR Facebook group, and the number has decreased;
- fewer than 10% of people working in sound design for video games in the US are women (around 16% in the UK). The number has gone up in the US but down in the UK slightly;
- fewer than 9% of post sound producers in Hollywood's Motion Picture Editors Group are women, while in the UK only 4 to 5 out of 60 audio post-production roles were held by women (around 8.3%), and only 1 of those roles was held by a mixed race woman; and

- very few, if any, leaders or directors in sound at leading ("AAA") game audio companies are Black or female and less than 2% of game sound engineers identify as Black or African American.

For RQ2, factors such as gender-, age-, and race-based discrimination, microaggressions, gatekeeping, and economic factors such as limited access to technology and educational programmes were identified as significant BEDIs. The experiences reported in various surveys, academic studies, and discussions related to inclusion and access provide insights into the challenges faced by underrepresented individuals in pursuing careers in the audio industry. Chapter 3 showed that audio and STEM fields have similar barriers to entry and discouraging influences (BEDIs), including:

- gender- and race-based discrimination;
- microaggressions;
- gatekeeping; and
- economic factors including access to technology via educational programmes.

In terms of removing or mitigating these barriers (RQ3), Chapter 4 shows that efforts in STEM, medicine, and audio industries demonstrated successful strategies for removing barriers and promoting inclusivity. The following strategies have proven effective in improving diversity and supporting the career development of UGs:

- mentoring programmes;
- networking opportunities;
- educational initiatives; and
- workshops.

For RQ4, a methodology for undertaking a GT study was described in Chapter 5 which involved coding, memoing, and theoretical sampling. The chapter began by recalling that BEDIs can be reduced through the implementation of strategies such as role models, mentoring, training, and workshops. These measures aim to address factors of discrimination, microaggressions, limited access, and gatekeeping, with the ultimate goal of creating a more inclusive environment within the immersive audio industry. As such, workshops were designed and offered to interested participants, who were then invited to an interview with the researcher. A GT framework was described as the qualitative research design employed for the study. Additionally, the chapter introduced a checklist designed by Charmaz and Thornberg, which served as a tool for assessing the quality of the study and the emergent theory.

Chapter 6 detailed the open coding, constant comparison, axial coding, theoretical coding and selective coding process as undertaken for 23 interviews of underrepresented groups (UGs) who completed workshops in immersive audio. The interviews were transcribed in real-time, then coded. As articulated by Barney Glaser, a co-founder of GT, the core category plays a crucial role in generating theory by accounting for patterns of behaviour. A process of constant comparison and memoing enabled the researcher to raise certain themes to the forefront: in particular, the core category identified was "leaking up, not out" of the audio pipeline. The main concern is "being viewed as credible" (also referred to as "being taken seriously"). Other themes include: Impostor Syndrome, luck, male endorsement, pushing, seeking mentorship, fear of leaking out, codes of credibility, code evading, seeking affinity groups, innovating, social justice, upskilling, learning, going it on their own, and teaching.

In Chapter 7 the emergent theory was given which was formed by integrating the themes revealed in Chapter 6. The theory states that the main concern of UGs who participated in the study is "being viewed as credible", and the way they process those concerns is by "leaking up, not out" of the audio career pipeline: either by seeking ways to establish their credibility ("breaking the credibility code") or by circumventing an industry with unnavigable pathways ("code evading") by seeking affinity groups, innovating, upskilling, teaching themselves and others, and freelancing; activities which help them discover their audio identity and purpose. It seems that without a way to navigate "codes of credibility" participants are sometimes deflected away from their goals. Those that achieve their goals attribute their success to "luck".

This conclusions chapter looks at the study's limitations (8.1), novelty and impact (8.2), original contributions to knowledge (8.3), and recommendations and future work (8.4).

8.1 Limitations

Identifying and discussing the limitations of the study provides an understanding of its scope and potential areas for improvement.

Eighty-one participants who saw the workshops promoted in various social media networks found their way to the workshops, and 23 agreed to be interviewed. A larger pool might give further insight, although the researcher did consider a point of saturation to have been reached in the data. The study was time-limited in nature, whereas a longer study might enable more follow-up interviews, more data, and the ability to track the careers of participants in the study.

Other limitations include:

8.1.1 Sample Bias

The study included members of SoundGirls, Audio Girl Africa, and Black Sound Society. This may be biased towards audio engineers who also belong to these groups and are more active on social media. Therefore, it is possible individuals who are not as engaged might a) be more successful and too busy to spend time on social media, b) be struggling to find networks such as the ones mentioned here, or c) be subject to other factors yet to be considered.

Secondly, the participants were all interested in the workshops being offered, and thus training was a priority for them. This could imply a bias towards people who are interested in upskilling. However, within this population was a wide range of interests in post-production, live sound, podcasts, and music mixing, among other subdisciplines of audio. Participants came from different socioeconomic backgrounds and were all different ages and at different stages in their careers. Further, the semi-structured, open-ended interview format allowed participants to share their career journeys. Nonetheless, an opportunity to extend the study and examine "credibilitizing" (8.4.1) with a larger group is an interesting possibility.

Ultimately, it is not possible to say whether upskilling was the only factor bringing people to participate; other factors such as networking and curiosity may have also motivated people to attend.

8.1.2 Researcher Bias

The researcher presented her biases in 6.1, "Researcher Reflexivity and Bias", and as such there was likely an influence on how the data was interpreted. Efforts were made to minimize this by using a rigorous data analysis process along with triangulation: the researcher consulted with mentors and checked with a group of participants (member checking) to present the emerging theory.

8.1.3 Grounded Theory as a Tool

GT requires a lot of time and effort, as mentioned in Chapter 5. Such a huge amount of data is generated, and the process must be limited in some way. Therese Uri [2015], in her study "The Strengths and Limitations of Using Situational Analysis Grounded Theory as Research Methodology" mentions "analysis paralysis" and "value paralysis" as consequences if researchers do not constrain their data. These phrases encapsulate the need to embed limits and restrictions into the design process itself, and for researchers to restrain themselves from trying to satisfy "as many needs, wants, and desires as possible" [ibid.]. In other words, by acknowledging the limitations and scope of her study, the researcher can effectively handle the amount of data without falling prey to "analysis paralysis" or feeling responsible for addressing every single aspect related to underrepresented groups in immersive audio.

8.1.4 Visual mapping

Similarly, Uri points to the complexity of mapping. Creating the visual map for Figure 7-1 was a challenge, especially as the theory continued to emerge, because of the number of concepts to distil into an easy-to-read diagram. She laments the availability of guidance on visual map-making, drawing comparisons with geographical maps: "Cartography is an exciting research venture; yet postmodern multidimensional mapmakers need tips and examples on how to chart information so it truly conveys the rich complexity of multidimensionality" [Uri, 2015]. Thus, the limitation in this study is that the visual map does not necessarily reflect all of the complexity contained in the hundreds of codes and statements meant to capture the lived experiences of the participants.

8.2 Novelty and Impact

This study is the first to look at representation in immersive audio and to interview UGs seeking to upskill by participating in workshops related to immersive audio. It takes a qualitative, GT approach in order to investigate the *experiences* of UGs, going beyond the numbers to find what UGs are *thinking, feeling*, and *doing* as they navigate their careers.

The participants were invited to participate in safe, affordable workshops about immersive audio and to speak to the researcher about their experiences. The impact of the workshops was articulated by many participants, including one woman who also happens to be studying inclusion in the industry. Along with her insights, she offered the following accolades to the researcher:

> *"You are doing the Lord's work. You really are. It's amazing. I know you have folks working with you, but you have a vision. You are one person with a vision using it to educating the masses. There is a saying, 'you educate a Black woman, you educate 10,000 people'. And I am fascinated because the music industry is not doing this work. It's not defeating the army of erasure. It's not winning this battle of inequity. But you are David … and you are literally killing a giant with a stone. Literally." P23*

Other statements include:

> *"…you [the researcher] are enabling people to get skills to do whatever they want with. And the type of people you're doing it for. And I'm passionate about the class but even more so now because everyone is learning together. It's a great culture. Every week it gets better. There's no one sat there passively … There a lot of people who can decide who can come into the 'club' … for them it's like … well, they don't feel as passionately about it as you or I do. That's what it takes so that you CAN unlock the code. That's at the fundamental level about what we are doing. … You're creating a route to gain these skills and go do it. And hopefully it will open." P14*

> *"I just wanted to say a big thank you because this is the first time that I saw that someone is creating a course that you can apply for a scholarship and pay less – all those things are so expensive, especially if you want to get a setup at home – even just two speakers at home is expensive … but what you are doing is amazing because all of a sudden you can learn something, afford the class, and learn more about it. I felt I was somewhere I was safe and could talk about other things, not just Dolby Atmos but we could talk about other things besides the course materials. It was still hard and we did a lot in one day but I didn't feel .. I didn't feel like it was so rigid. I really liked the classes." P21*

Statements like these from participants provide evidence of the study's impact. The comment from P14 includes language about "unlocking the code", indicating that students are engaged and that the program is creating a route to gain the skills necessary to advance in one's career. Participant 21 talks about the affordability of the experience and the safe environment of the class.

In the interest of "full disclosure", there was a participant who taught a class in Dolby Atmos as part of a feminist audio collective, but that course did not offer certification and was not part of an accompanying research project. Therefore, this study and its impact are still novel and of significance in informing industry practice. If anything, the fact that there is another woman teaching Dolby Atmos in a safe space should be an encouraging sign of progress.

During the four immersive and inclusive workshops conducted in this study, 36 students earned certificates as Pro Tools Operators and Dolby Atmos Operators. Supposing any of these students were to continue into paid positions in the music industry, it could have an even bigger impact. As mastering engineer Emily Lazar stated, "there's really just a handful of the same people: the same white men making the records. That's a really interesting thing to think about; that interjecting even five women into a group of ten people changes that number very, very quickly. And obviously, as we grow these communities larger and larger, adding more and more is the goal" [Lazar et al., 2023].

8.2.1 Personal impact

One of the sentiments the researcher gleaned from the many participants can be summarized with the following statement: *"I have accepted that there is discrimination out there, but I don't need to crack the code if you'd just let me see what you are doing. I can create my own path."* It seems that many BEDIs are so ingrained in the industry that UGs have accepted them and are resolved to deal with them, but they are determined to pursue their passions.

Another quote that resonated with the researcher was, *"I feel like I have to have a professorship before anyone takes me seriously." (P4)* That struck a chord in the researcher, who might even be on this PhD journey because she seeks to be seen as credible as well.

Other impactful moments for the researcher included statements made by educators and industry professionals which seem to fit the concepts of gatekeeping and unconscious bias. For example, the researcher was excited to receive a sponsorship to provide training using Avid products, including their integration of the Dolby Atmos Production Suite, as part of this Immersive and Inclusive project. However, even though she explicitly stated one of her long-term goals is to provide Dolby Atmos certification, there was hesitation when she asked to confirm whether the sponsorship would include this. The course was "meant for a specialized group of practitioners", she was told. This uncovered a significant barrier to entry; a type of "glass ceiling" (or "gate") which - despite her pitch deck explicitly stating providing training in Dolby Atmos was her raison d'être - might have prevented her from delivering this curriculum. However, this was an opportunity for her to underscore the mission of the "immersive and inclusive" training program, and after some persuading, she was able to take the course. In this example, there is a gate between the DEI mission and "specialized" practitioners.

In 2023 the researcher approached the AES about holding a special event called "Immersive and Inclusive," to be supported by funding from the University of Surrey. The resulting event was called "Equity Learning Series: Immersive and Inclusive - A Discussion of Representation in Immersive Audio." The researcher hopes that the AES will invite these same panelists to participate during their "regular" Immersive Audio series so that diversity is *incorporated* into AES' public events, not done as a separate, "special" event.

Perhaps the biggest impact was felt by the researcher at an event in June 2023. At a photo shoot featuring influential women in the industry, one woman disclosed her personal career trajectory as part of a casual conversation. She stated simply, "when I was starting out I wanted to go into music technology but I ended up studying music instead. I didn't really have anyone to help me. I basically taught myself everything and it took me years to be taken seriously". In less than 30 seconds, her statement seemed to succinctly sum up the theory, and the woman who said it knew nothing of the researcher's work. A very good sign of the study's relevance, indeed.

8.3 Original Contributions to Knowledge

The study offers the following original contributions to knowledge in the following ways:

- by providing statistics from various audio fields to show participation in a number of subdisciplines: audio for games, cinema, and music, all of which are places where immersive audio is found, and all of which show very low participation by UGs. However, at least one scholar in the "feminist audio collective" space reminds us emphatically that these rates of participation are for Hollywood movies, top charting songs, and blockbuster game titles. As stated in 2.1.1, Barra's quote lamenting the misuse of data highlighted the need for proper contextualisation so that we can have a true picture of how many women are working in the field and at what level (i.e. "hit makers" versus "non hit makers"). Thus, the researcher sought to go beyond the data to find how UGs are processing their concerns regardless of whether they were employed by "major industry players".

- by looking at data from social media groups on Facebook in order to augment the understanding of participation rates by in mixed gender and affinity groups having to do with immersive audio.

- by examining certain BEDIs in STEM and audio and incorporated written accounts from young women in audio engineering and recording arts programmes. The research took a comprehensive look at studies of women in the music industry, microaggressions in the recording studio, and sound for film and television. In this way, the study is one of few that attempts to document BEDIs for more than one subdiscipline of audio. Altogether, these discouraging factors highlight the need for safe spaces where UGs can study and pursue their interests. Many such spaces exist as documented by Dobson's cataloguing of over 70 "feminist audio collectives".

- by elevating the concern of being taken seriously. Previous research has not explicitly addressed this, but the sentiment has been there, seemingly waited to be noticed: it has been articulated in studies (see 3.2.3, “Discrimination in the Music Industry”) including the current one, at conferences, and in casual conversations with the researcher. This longing to be seen as credible should be addressed by industry scholars and professionals, perhaps reflecting on the question, “what does it take for someone to be taken seriously”? Perhaps more importantly, “how can someone from an underrepresented background know they are being judged on their skills, not their race, age, or gender?” In pursuit of this answer, it is imperative that work on unconscious bias remains part of the conversation.

- by using GT to investigate this topic, the conversation has moved beyond generalizations (e.g. “how many?”, “how few?”) and instead provides an in-depth look at the experiences and behaviour of UGs in immersive audio.

This research is the only GT study in the field of audio that attempts to discover the main concerns of UGs who participated in workshops on immersive audio and how they process their concerns. The concept of "leaking up, not out" lends a new perspective on how UGs are managing to survive in their careers. Instead of solely looking at data and more traditional thinking about overcoming BEDIs, the study shows the strategies that UGs have found which the industry should consider. UGs are creative problem-solvers and innovators who are finding a way to pursue their passions. If the audio industry can meet this creativity with bespoke mentorship, jobs, and other opportunities, there is tremendous potential to make sustainable changes in terms of diversity, equity, and inclusion.

8.4 Recommendations and Future Work

This section lays the foundation for further study and practice by looking at the need for stronger participation data, more perspectives from gatekeepers who can modify their recruiting and hiring practices and examine issues of trust and credibility, and how to create better mentoring opportunities.

8.4.1 "Credibilitizing"

The next stage of this GT study would be to expand upon the results of this study and explore the structural conditions of underrepresented groups in audio. For example, looking at safe spaces, where UGs can work on **credibilitizing,** a gerund that comes from the process of "seeking and gaining credibility, the desire to be taken seriously". Gerunds are part of the coding process (e.g. "seeking", "exploring", "gatekeeping", "helping"), but they are also used at a higher level to explain Basic Social Processes (BSPs). These BSPs refer to patterns of social behaviour and interaction between individuals; thus, the next phase of the work would be to expand the study to include BSPs and independent variables, such as the study of safe spaces [Glaser, 1978]. The presence or absence of a safe space is a variable that might influence how UGs behave and interact. A future study might investigate what happens when that space is not available and how behaviours and interactions changes as a result, which would in turn explain the phenomenon of "credibilitizing" (a term coined by the researcher with guidance from her GT mentor[13]).

8.4.2 Participation

A re-examination of participation by UGs in terms of "hit makers" and "non-hit makers" would be useful, as Barra (2.1.1.) reminds us that most data gathering efforts so far have looked at major studios in cinema, music, and games [Barra, 2021]. A look at leadership roles could be beneficial, too; Roget et al. stated in 2020 that there are no people of color in senior audio positions. Future studies could investigate whether that has since changed.

8.4.3 The right kind of mentorship

It isn't just that mentoring will fix things; it needs to be the right kind of mentoring. In this study, participants mention very specific things they need to learn, such as: dialogue editing, workflow, templates, and "mixing by ear," to name a few. Mentors should be prepared to meet mentees where they are and provide the appropriate level of instruction. A study on the efficacy of these programmes in audio and immersive audio would be helpful in the future. Further, mentorship programs and DEI (Diversity, Equity and Inclusion) initiatives can incorporate these concepts into their design, examining the inflection points where UGs are at risk of "leaking out" and building strategies to help UGs "flow" more easily through the pipeline.

[13] This is a new coinage; the words "credibilize" and "credibilized" appear in Google search results quite infrequently, sometimes as a Portuguese word. "Credibilize" means "To make credible or more credible, increase the credibility of", whereas "credibilitize" in this new context means "to seek and gain credibility".

Also, when taking the “theory of recognition” into account, the nature of mentoring provided must be carefully considered, ensuring it is emotionally supportive. [Mahayosnand et al., 2021] [Elliott et al., 2020]. Roslind Chow [2021] suggests “Whereas mentorship focuses on help that a mentor can provide directly, such as guidance, advice, feedback on skills, and coaching, sponsorship entails externally facing support, such as advocacy, visibility, promotion, and connections”. This would certainly be helpful in order to help career aspirants find their way into jobs more in line with their original goals and desires.

Similarly, the issues of trust and respect should be explored. Pamela Laird (author of *Pull*) suggests: “…mentoring is an investment. Not just in time, but also in a mentor’s reputation. That’s why the issue of trust is so important. And it’s often hard for people to trust someone who doesn't look like them or who doesn't know their code. It’s also impossible to trust someone with your reputation if you don't respect them. So respect is a hard target for outsiders trying to get through the gates” [Laird, 2023]. These issues of trust and respect should be examined and discussed within the context of mentorship, the efforts to overcome BEDIs, and promoting diversity.

8.5 Main Conclusions

The main conclusions of this study are that there is a lack of representation in immersive audio which mirrors that of the industry at large, and that UGs who participated in workshops related to immersive audio are seeking ways to be seen as credible, often by using innovation and relentless creativity to evade “codes of credibility” in order to survive in their careers. To do this, they are persistent, often seeking affinity groups with whom to network and feel safe. They also “pull up” other UGs by teaching.

The study is the first to examine representation in immersive audio and interview individuals seeking to upskill through workshops. It takes a GT approach to understand the experiences of participants beyond statistical data. Statements from participants highlight the impact of the workshops and the positive environment created by the researcher. Mentorship should be designed to meet UGs where they are; often participants desire targeted solutions such as explanations of workflow and Pro Tools session templates, among other tools. Mentoring programs should also be reviewed and evaluated for their effectiveness, and gatekeepers’ attitudes and perspectives should be examined in contrast to the needs, expectations, and desires of hopeful mentees.

By exploring the concept of "leaking up, not out," the study challenges traditional thinking about BEDIs and goes beyond the data, demonstrating that UGs are looking for opportunities and specific types of support from the audio industry. In addition, the study demonstrates the need for a shift in industry attitudes and gatekeeping behaviours to ensure that UGs are not impeded by “hidden codes” of sexism, secrecy, confidence conundrums, rank and rigour. By addressing these issues and proposing effective mentoring strategies, this research offers insights and strategies that have the potential to reshape diversity, equity, and inclusion in immersive audio.

In summary, considering the heartfelt and earnest testimonials from the hard-working and determined participants in this study, people interested in creating change in the industry can use this study to continue to advocate effectively for diversity, equity, and inclusion, and to create mentorship opportunities and jobs for individuals from underrepresented backgrounds. In these ways, this study is powerful in helping to foster an immersive and *inclusive* audio industry.

Appendix A: Publications and Activities

The following publications have arisen either directly from or from work related to this thesis.

Peer Reviewed Journal Articles

Gaston-Bird, L. (2023). "It's Immersive, but is it Inclusive?". *Representology*, Birmingham City University. Manuscript submitted for publication.

Conference Papers

Gaston-Bird, L., Mason, R. & Sena, E. D. (2021). Inclusivity in Immersive Audio: Current Participation and Barriers to Entry. AES Education Conference. Nashville, TN.

Invited Lectures

The following lectures have arisen either directly from or indirectly from work related to this thesis.

"Immersive and Inclusive: Immersive and Inclusive: Cracking the Credibility Code" (2023). Keynote at the AES 2023 International Conference on Audio Education. Hasselt, Belgium, 8 September.

"Immersive Audio and Education", (2021). AES New York with Miles Fulwider, Paul Geluso.

"Immersive Audio", (2021). Media Sound Hamburg, Germany, 11-12 August.

"Women in Entertainment: A discussion of diversity in music and film production." (2021). Rowan University, 7 April.

Guest Lecture for Douglas McKinnie at SUNY Potsdam, (2021). 16 March.

"AAA (Audio Arts and Acoustics) Presents Leslie Gaston-Bird: Inclusivity in Immersive Audio", (2021). Columbia College, 1 March.

Leading Women in Audio Conference, (2021). Elon University, 27 February.

Diversity and Inclusion Roundtable, (2020). AES 149th Convention: 27 October.

"Hidden Figures" conference (2020). Royal Holloway University of London, 23 June.

Patriots Virtual Summer Camp, (2020). National Society of Black Engineers, 9 July.

Certifications

Avid Certified Instructor: Pro Tools 101, 110, 201, 210P, 205, 210D.

Avid Certified Dolby Atmos Professional

Appendix B: Codebook

Core Category: Leaking Up 0

Core Category: Leaking Up > Going it on their own 0

Core Category: Leaking Up > Going it on their own > business 11

Core Category: Leaking Up > Going it on their own > leaking up 9

Core Category: Leaking Up > Going it on their own > representation 2

Core Category: Leaking Up > Going it on their own > self recording 5

Core Category: Leaking Up > Going it on their own > Freelancing 8

Core Category: Leaking Up > Going it on their own > build studio or building 4

Core Category: Leaking Up > Going it on their own > Independence 12

Core Category: Leaking Up > Going it on their own > save or saving 5

Core Category: Leaking Up > Pushing 20

Core Category: Leaking Up > Pushing > women work harder 1

Core Category: Leaking Up > Pushing > applying 10

Core Category: Leaking Up > Pushing > anything 1

Core Category: Leaking Up > Pushing > hunger 2

Core Category: Leaking Up > Pushing > stuck 2

Core Category: Leaking Up > Pushing > validation 2

Core Category: Leaking Up > Pushing > settle 9

Core Category: Leaking Up > Pushing > Proving Yourself 0

Core Category: Leaking Up > Pushing > purpose 6

Core Category: Leaking Up > Pushing > true desire 3

Core Category: Leaking Up > Learning 0

Core Category: Leaking Up > Learning > immersive and inclusive classes 10

Core Category: Leaking Up > Learning > masters motivation 3

Core Category: Leaking Up > Learning > Self Teaching 16

Core Category: Leaking Up > Learning > scholarship 1

Core Category: Leaking Up > Learning > why are women enrolling in masters programs 1

Core Category: Leaking Up > Seeking mentorship 0

Core Category: Leaking Up > Seeking mentorship > Encouragement 2

Core Category: Leaking Up > Seeking mentorship > woman teacher 3

Core Category: Leaking Up > Seeking mentorship > Mentorship (Male) 8

Core Category: Leaking Up > Seeking mentorship > Mentorship 3

Core Category: Leaking Up > Seeking mentorship > Want mentorship 13

Core Category: Leaking Up > Seeking mentorship > mentorship (Female) 3

Core Category: Leaking Up > Seeking mentorship > watch or watching 15

Core Category: Leaking Up > Innovating 13

Core Category: Leaking Up > Innovating > black girl magic 4

Core Category: Leaking Up > Innovating > impact 2

Core Category: Leaking Up > Innovating > social justice 8

Core Category: Leaking Up > Innovating > radical thinking 2

Core Category: Leaking Up > Seeking Women's Affiliation (+) 17

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Networking 10

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Role Models 12

Core Category: Leaking Up > Seeking Women's Affiliation (+) > mistake 4

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Belonging 5

Core Category: Leaking Up > Seeking Women's Affiliation (+) > it is okay if you don't know 0

Core Category: Leaking Up > Seeking Women's Affiliation (+) > peer collaboration 0

Core Category: Leaking Up > Seeking Women's Affiliation (+) > women helping women 13

Core Category: Leaking Up > Seeking Women's Affiliation (+) > sharing 4

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Collegiality 0

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Comfort and Safety 11

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Gossip 1

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Isolation 0

Core Category: Leaking Up > Seeking Women's Affiliation (+) > Mixed gender classroom 6

Core Category: Leaking Up > Teaching 25

Main Concern: being taken seriously 21

Main Concern: being taken seriously > Failure to break the code 9

Main Concern: being taken seriously > Failure to break the code > lack of trust 10

Main Concern: being taken seriously > Failure to break the code > Imposter Syndrome 7

Main Concern: being taken seriously > Failure to break the code > value 1

Main Concern: being taken seriously > Failure to break the code > observing or noticing 1

Main Concern: being taken seriously > Failure to break the code > YELLOW 1

Main Concern: being taken seriously > Failure to break the code > ..the only woman 23

Main Concern: being taken seriously > Failure to break the code > alone 4

Main Concern: being taken seriously > Failure to break the code > advancement or promotion or ladder 1

Main Concern: being taken seriously > Failure to break the code > code break the code 10

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Low Pay 15

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > leaving 6

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > travel or relocate 16

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Leaky Pipeline or Leaking Out 20

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving 20

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > part-time 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > laid off or fired 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > What is Available 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > awareness 16

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > cutting edge 6

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > re-enter 5

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Bias mitigation 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > burnout 3

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Competition within high unemployment 5

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Employment 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Entrepreneurship as divestiture 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Industry Changes 3

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Tokenism Diversity Hire 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Careers and Survival or surviving > Tokenism Diversity Hire > Diversity Hire Stigma 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > we just want the best person for the job 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > UK immigrant 4

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > escaping 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry 9

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Lack of Resources 6

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > qualified 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > long hours 4

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > objectification 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > prejudice 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Sexual Favors 3

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > stereotyping 8

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Access 3

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Access > Consumer access 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Access > Access to training 10

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Access > Access to technology 12

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Access > African Access 5

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > overt vs covert 5

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > affordability 12

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Unwanted touching 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > closed 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination 7

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination > Age Based 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination > Gender Based 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination > Nationalism 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination > Pull Discrimination 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination > Salary gap 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Discrimination > Sexism 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > toxic 2

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > excluded or lack of belonging 9

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Glass Ceiling 1

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Microaggressions 16

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Perceived difficulty 5

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Perceived threat 3

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Priveledged Intern 3

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Gatekeeping 7

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > turned away 8

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > harassment 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Lack of Social Capital 0

Main Concern: being taken seriously > Failure to break the code > Leaking Out or Leak Points > Barriers to Entry > Pigeon holing 0

Activities Subdisciplines 1

Activities Subdisciplines > Live Sound 4

Activities Subdisciplines > producer 3

Activities Subdisciplines > video 1

Activities Subdisciplines > mixing 13

Activities Subdisciplines > radio 4

Activities Subdisciplines > television 2

Activities Subdisciplines > janitor 1

Activities Subdisciplines > documentary 4

Activities Subdisciplines > sound design 0

Activities Subdisciplines > Post Production 3

Activities Subdisciplines > podcast 3

Activities Subdisciplines > computer science 3

Activities Subdisciplines > gaming 1

Activities Subdisciplines > Sound Art 4

Activities Subdisciplines > acoustics 0

Activities Subdisciplines > ambisonic 6

Activities Subdisciplines > binaural 5

Pipeline: The Way in 0

Pipeline: The Way in > aspiration or aspiring or dreaming 22

Pipeline: The Way in > volunteering 1

Pipeline: The Way in > student projects 1

Pipeline: The Way in > Inspiration 3

Pipeline: The Way in > Pathways and ways in 23

Pipeline: The Way in > Pathways and ways in > Feminist audio collective 7

Pipeline: The Way in > Pathways and ways in > cinema 4

Pipeline: The Way in > Pathways and ways in > back door 0

Pipeline: The Way in > Pathways and ways in > church 6

Pipeline: The Way in > Pathways and ways in > Friend or colleague 11

Pipeline: The Way in > Pathways and ways in > Immersive Pathways 23

Pipeline: The Way in > Pathways and ways in > Internships 11

Pipeline: The Way in > Pathways and ways in > Internships > coffee intern 2

Pipeline: The Way in > Pathways and ways in > Opportunity KB 14

Pipeline: The Way in > exploring 3

Pipeline: The Way in > Family 2

Pipeline: The Way in > Family > Motherhood, Parenting, and Caretaking 12

Pipeline: The Way in > Family > Parental Support Approval 14

Pipeline: The Way in > Family > Parental Support Approval > parents withhold support 3

Pipeline: The Way in > Family > Parental Support Approval > parents offer support 5

Pipeline: The Way in > Curiosity 1

Pipeline: The Way in > Curiosity > Immersive Curiosity 4

Pipeline: The Way in > Education 0

Pipeline: The Way in > Education > teaching style (+) 11

Pipeline: The Way in > Education > Class size 1

Pipeline: The Way in > Education > vocational training 4

Pipeline: The Way in > Education > Hands-On 14

Pipeline: The Way in > Education > Desired Class Features 1

Pipeline: The Way in > Education > certification 0

Pipeline: The Way in > Education > grades 8

Pipeline: The Way in > Education > learning style 2

Pipeline: The Way in > Education > masters degree 19

Pipeline: The Way in > Education > University major 22

Pipeline: The Way in > Education > University major > Engineering Major 0

Pipeline: The Way in > childhood 11

The Code Defined 3

The Code Defined > Luck 15

The Code Defined > Change the code 0

The Code Defined > Change the code > Change 9

The Code Defined > Aware of a code 6

The Code Defined > Aware of a code > rules rigidity militaristic 1

The Code Defined > Aware of a code > Secrecy 4

The Code Defined > Circumventing the code 3

The Code Defined > Using the code 2

The Code Defined > Using the code > male advocacy 7

The Code Defined > Using the code > nepotism 4

The Code Defined > Understanding the code 1

The Code Defined > Understanding the code > experience 14

The Code Defined > Understanding the code > male dominated 10

The Code Defined > Understanding the code > Perception of Needed Qualification 11

Age 10

Age > Age based awakening 2

Age > age confident 1

Personalities Dispositions Skills 0

Personalities Dispositions Skills > audio identity 14

Personalities Dispositions Skills > gratitude 8

Personalities Dispositions Skills > problem solving 3

Personalities Dispositions Skills > LGBTQIA 1

Personalities Dispositions Skills > math 4

Personalities Dispositions Skills > Disposition 3

Personalities Dispositions Skills > Disposition > relationships 1

Personalities Dispositions Skills > Disposition > intimidation or intimidating 7

Personalities Dispositions Skills > Disposition > perfectionism 1

Personalities Dispositions Skills > Disposition > surprise 4

Personalities Dispositions Skills > Disposition > Imagination 3

Personalities Dispositions Skills > Disposition > Confidence low 5

Personalities Dispositions Skills > Disposition > stupid 3

Personalities Dispositions Skills > Disposition > confidence 7

Personalities Dispositions Skills > Disposition > crying 1

Personalities Dispositions Skills > Disposition > enjoy or happy (+) 20

Personalities Dispositions Skills > Disposition > afraid 11

Personalities Dispositions Skills > Disposition > determination 3

Personalities Dispositions Skills > Disposition > Passion 7

Personalities Dispositions Skills > Disposition > Self Doubt 1

Personalities Dispositions Skills > Disposition > Self questioning and denial 2

Personalities Dispositions Skills > gender advantage 5

Personalities Dispositions Skills > personality 1

Personalities Dispositions Skills > Musical Ability 13

Personalities Dispositions Skills > Musical Ability > Musician Confident 8

Personalities Dispositions Skills > Musical Ability > goal 5

Personalities Dispositions Skills > Intelligence 2

Personalities Dispositions Skills > not a musician 7

Personalities Dispositions Skills > patient 4

Environment and Context 0

Environment and Context > Removing Barriers 6

Environment and Context > Removing Barriers > support 6

Environment and Context > Removing Barriers > corporate partnership sponsorship 9

Environment and Context > psychology 1

Environment and Context > Pro Tools and DAWs 12

Environment and Context > Pandemic 7

Environment and Context > immersive industry 4

Environment and Context > geography 15

Environment and Context > Erasure 4

Environment and Context > diversity 3

Environment and Context > being exploited 2

women identified 20

race 4

UNUSED 0

UNUSED > Blessing Rewarding Fun 0

UNUSED > proud or pride 0

UNUSED > frustration 0

UNUSED > coping 0

UNUSED > Self Validation 0

UNUSED > wealth or well-to-do 1

UNUSED > quality 7

UNUSED > Immersion 0

UNUSED > discovery 0

UNUSED > uncertainty of resources 0

UNUSED > Participation Rate Observations 0

UNUSED > Blind 2

UNUSED > yelling 1

UNUSED > role models (male) 1

UNUSED > Discerning Choices 0

UNUSED > multidiscipline 1

UNUSED > authority or power dynamic 1

UNUSED > challenge 0

UNUSED > Facilitation 0

UNUSED > home studio 0

UNUSED > immersive music0

UNUSED > legacy 0

UNUSED > Prestige 0

UNUSED > privilege 0

References

Adu, P. (2018). Using Grounded Theory Approach: From Start to Finish Interview by Methodology Related Presentations - TCSPP. https://www.youtube.com/watch?v=7awjNYdoS6w.

AES AVAR Committee (2018). *AVAR 2018 opened ….* [Twitter]. Aug 23, 2018. Available from: https://bit.ly/3GNr4ej (Accessed 14/2/2022).

Aldiabat, K. & Navenec, C.-L. (2011). 'Philosophical Roots of Classical Grounded Theory: Its Foundations in Symbolic Interactionism', *The Qualitative Report. ,* 16, 1063–80. .

Aldiabat, K. M. & Le Navenec, C.-L. (2018). 'Data saturation: The mysterious step in grounded theory methodology', *The qualitative report,* 23, 1, 245-261.

Allan, G. (2003). 'A Critique of Using Grounded Theory as a Research Method', *Electronic Journal of Business Research Methods,,* 2, 1, 1-10.

Allen, B. J. (2011). *Difference matters: communicating social identity,* Long Grove, Ill, Waveland Press.

Allen-Ramdial, S. A. & Campbell, A. G. (2014). 'Reimagining the Pipeline: Advancing STEM Diversity, Persistence, and Success', *BioScience,* 64, 7, 612-618.

American Association of University Women (2022). 'The Perfect Storm'. Washington, D.C.: AAUW. Available at: https://www.aauw.org/app/uploads/2022/08/PerfectStorm_NYC-Student-Debt-Survey-Report_Aug-2022.pdf (Accessed 5/13/2023).

American College of Physicians (2004). 'Racial and Ethnic Disparities in Health Care', *Annals of Internal Medicine,* 141, 3, 226-232.

Annenberg Inclusion Initiative (2022). *Annenberg Inclusion Initiative*. Available at: https://annenberg.usc.edu/research/aii (Accessed 28/2/2022).

Armstrong, V. (2011). *Technology and the Gendering of Music Education,* London, Routledge.

Ash, D. P. (2023). 'The Behavioural Motivations of Police Officers Engaged in Domestic Abuse Incident Work', *The Grounded Theory Review: An International Journal,* 21, 2, 104-122.

Association of Motion Picture Sound (2020). 'Black Lives Matter'. https://www.amps.net/news/blacklivesmatter. (Accessed 1/29/21).

Aswad, J. (2020). 'Recording Academy Joins Forces With Racial-Justice Organization Color of Change'. https://variety.com/2020/music/news/recording-academy-color-of-change-1234699456/. (Accessed 1/24/2021).

Audio Engineering Society (2019). 'Diversity and Inclusion Data'. New York: Audio Engineering Society.

Audio Engineering Society (2020). 'A Statement from the AES'. https://www.aes.org/blog/2020/6/community. (Accessed 1/23/2020).

Avid (2020). *Dolby Atmos® Mastering Suite vs. Production Suite*. Available at: https://cdn-www.avid.com/-/media/avid/files/immersive-audio/dolby-atmos-dams-vs-daps.pdf (Accessed 11/4/2021).

Barra, E. (2021). *Pedantic.* [Instagram]. 21/11/2021. Available from: https://www.instagram.com/p/CWXG_25lJ4s/ (Accessed 14/2/2022).

Bayton, M. & Whiteley, S. (2004). 'Women and the Electric Guitar'. *In:* Frith, S. (ed.) *Popular Music: Critical Concepts in Media and Cultural Studies.* London: Routledge. 275.

Beasley, M. A. & Fischer, M. J. (2012). 'Why they leave: the impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors', *Social Psychology of Education,* 15, 4, 427-448.

BECTU (2021). *Survey confirms exclusion of parents and carers in UK screen sector*. Available at: https://www.screen.scot/news/2021/10/survey-confirms-exclusion-of-parents-and-carers-in-uk-screen-sector (Accessed 5/25/2023).

Berklee College of Music (2021). *Tuition and Related Costs: 2020–2021*. Available at: https://www.berklee.edu/student-accounts/tuition-and-related-costs-previous-year#BCM-undergrad (Accessed 6/17/2021).

Biederman, R. & Pattison, P. (2013). *Basic Live Sound Reinforcement: A Practical Guide for Starting Live Audio,* New York, Routledge.

Blakemore, N., et al. (2021). 'Tonmeister EDI report', *Report based on Equality Diversity and Inclusion Survey for the Tonmeister Course, 8/11/2021*, Department of Music and Media, University of Surrey.

Born, G. & Devine, K. (2015). 'Music Technology, Gender, and Class: Digitization, Educational and Social Change in Britain', *Twentieth-Century Music,* 12, 2, 135-172.

Bourdieu, P. (1977). *Outline of a Theory of Practice*, Cambridge University Press.

Boychuk Duchscher, J. E. & Morgan, D. (2004). 'Grounded theory: reflections on the emergence vs. forcing debate', *Journal of advanced nursing,* 48, 6, 605-612.

Brooks, G., et al. (2021). 'Do We Really Want to Keep the Gate Threshold That High?', *J. Audio Eng. Soc,* 69, 4, 238-260.

Brtish Broadcasting Corporation (2022). *Work Experience at the BBC*. Available at: https://www.bbc.co.uk/careers/trainee-schemes-and-apprenticeships/work-experience (Accessed 28/2/2022).

Buckingham, S. A. M. & Ronan, M. 2019. Factors Contributing to Gender Imbalance in the Audio Industry. 146th Audio Engineering Society Convention, 2019 Dublin, Ireland. Audio Engineering Society. http://www.aes.org/e-lib/browse.cfm?elib=20292 (Accessed 28/2/2022).

Bui, Q. & Miller, C. C. (2016). 'Why Tech Degrees Are Not Putting More Blacks and Hispanics Into Tech Jobs'. *The New York Times* [Online]. Available at: https://www-nytimes-com.aurarialibrary.idm.oclc.org/2016/02/26/upshot/dont-blame-recruiting-pipeline-for-lack-of-diversity-in-tech.html?smid=url-share (Accessed 2/8/2022).

Butt, E. (2020). 'Diversity in Post-Production Sound Roles in UK Television Production', *The Journal of Media and Diversity Issue 01 Winter 2020,* 1, np.

Byars-Winston, A. (2014). 'Toward a Framework for Multicultural STEM-Focused Career Interventions', *The Career Development Quarterly,* 62, 4, 340-357.

Casado Pérez, J. F. (2019). 'Everyday resistance strategies by minoritized faculty', *Journal of Diversity in Higher Education,* 12, 2, 170-179.

Castillo-Page, L., et al. (2005). 'Minorities in medical education: Facts & figures 2005'. Washington, DC: Association of American Medical Colleges. Available at: https://www.yumpu.com/en/document/view/36652270/minorities-in-medical-education-facts-figures-2005-aamcs- (Accessed 14/2/2022).

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.,* London, Sage.

Charmaz, K. & Thornberg, R. (2021). 'The pursuit of quality in grounded theory', *Qualitative Research in Psychology,* 18, 3, 305-327.

Cho, J. Y. & Lee, E.-H. (2014). 'Reducing Confusion about Grounded Theory and Qualitative Content Analysis: Similarities and Differences', *The Qualitative Report,* 19, 1-20.

Chow, R. (2021). 'Don't Just Mentor Women and People of Color. Sponsor Them.'. *Harvard Business Review* [Online]. Available at: https://hbr.org/2021/06/dont-just-mentor-women-and-people-of-color-sponsor-them (Accessed 5/24/2023).

Clance, P. R. & Imes, S. A. (1978). 'The imposter phenomenon in high achieving women: Dynamics and therapeutic intervention', *Psychotherapy: Theory, Research & Practice,* 15, 3, 241-247.

Clark Blickenstaff, J. (2005). 'Women and science careers: leaky pipeline or gender filter?', *Gender and education,* 17, 4, 369-386.

Coleman, J. S. (1988). 'Social Capital in the Creation of Human Capital', *American Journal of Sociology,* 94, S95-S120.

Corbett, I., et al. 'What I Wish I Knew (When Starting My Career)'. Presentatiion at the 154th Audio Engineering Society Convention, Helskinki, Finalnd, 5/14/2023.

Corbin, J. & Strauss, A. (2008). *Basics of Qualitative Research (3rd ed.),* Thousand Oaks, CA, Sage.

Cornish, A., et al. (2021). *George Floyd's Impact On The Fight For Racial Justice*. Washington, D.C.: National Public Radio. Available at: https://www.npr.org/2021/05/25/1000273932/george-floyds-impact-on-the-fight-for-racial-justice (Accessed 6/23/2023).

Credence Research (2018). '3D Audio Market By Product Type (Speakers, Headphones, Microphones), By End-Use (Personal, Commercial), By Sales Channel (Offline, Online) - Growth, Share, Opportunities & Competitive Analysis, 2018 – 2026'. Normans Media Ltd. Available at: https://www.credenceresearch.com/report/3d-audio-market (Accessed 14/2/2022).

Creswell, J. W. (2013). *Qualitative inquiry & research design : choosing among five approaches,* Los Angeles, CA, SAGE.

Cummins, R. E. (1979). 'The Tyranny of Technique', *Journal of Thought,* 14, 1, 4-7.

Daley, S., et al. (2006). 'Improving the retention of underrepresented minority faculty in academic medicine', *Journal of the National Medical Association,* 98, 9, 1435-1440.

Delve (n.d.). *How To Do Axial Coding with Examples*. New York, NY: Delve. Available at: https://delvetool.com/blog/axialcoding (Accessed 7/18/2023).

Denker, K. J. (2022). Critical Feminist Theory. *In:* Braithwaite, D. O. & Schrodt, P. (eds.) *Engaging theories in interpersonal communication: multiple perspectives.* 3rd ed. New York, NY: Routledge.

Diversity Best Practices (2016). 'Barriers Underrepresented Groups Face Impact: Advancement & Retention'. Seramount. Available at: https://www.diversitybestpractices.com/sites/diversitybestpractices.com/files/attachm

ents/2020/09/final_2020_barriers_barriers_under-represented_groups_face_in_advancement_2020.pdf (Accessed 9/12/2021).

Dobson, E. (2018a). Digital Audio Eco Feminism (DA'EF): The Glocal Impact of All-Female Communities on Learning and Sound Creativities. *In:* de Bruin, L., Burnard, P. & Davis, S. (eds.) *Creativities in Arts Education, Research and Practice.* Leiden, The Netherlands: Brill, Leiden. 201-222.

Dobson, E. (2018b). *70+ (and growing) All-women and feminist sound/music tech collectives, co-ops, non-profits*. Available at: https://drlizdobson.co.uk/2018/02/18/feministsoundcollectives/ (Accessed 7/11/2022).

Duke, A. M. & Fripp, J. A. (2022). 'Examining youth participatory action research as a context to disrupt implicit bias in African American adolescent girls', *Educational Action Research,* 30, 1, 92-106.

Elliott, C., et al. (2020). 'An entrepreneurship education and peer mentoring program for women in STEM: mentors' experiences and perceptions of entrepreneurial self-efficacy and intent', *International Entrepreneurship and Management Journal,* 16, 1, 43-67.

Ellul, J. (1964). *The Technological Society,* New York, NY Vintage Books.

Encyclopedia Brittanica (n.d.). Encyclopedia Brittanica. https://www.britannica.com/search?query=sexism (Accessed 5/24/2023).

Engward, H. (2013). 'Understanding Grounded Theory', *Nursing Standard* Vol. 28, 7, 37.

Epstein, D. (2006). 'So That's Why They're Leaving'. *Inside Higher Ed,* [Online]. Available at: https://www.insidehighered.com/news/2006/07/26/so-thats-why-theyre-leaving (Accessed 14/2/2022).

Equity Challenge Unit (2013). 'Unconscious Bias and Higher Education'. London. Available at: http://www.ecu.ac.uk/wp-content/uploads/2014/07/unconscious-bias-and-higher-education.pdf (Accessed 28/2/2022).

Evans, P. & Green, J. (2017). 'Eyes Half Shut Report'. London, UK: Broadcasting Entertainment Communications and Theatre Union. Available at: https://members.bectu.org.uk/advice-resources/library/2363 (Accessed 5/25/2023).

Fairclough, A. (1990). 'Historians and the Civil Rights Movement', *Journal of American studies,* 24, 3, 387-398.

Fang, D., et al. (2000). 'Racial and Ethnic Disparities in Faculty Promotion in Academic Medicine', *JAMA : The Journal of the American Medical Association,* 284, 9, 1085-1092.

Flabbi, L., et al. (2019). 'Do Female Executives Make a Difference? The Impact of Female Leadership on Gender Gaps and Firm Performance', *The Economic Journal,* 129, 622, 2390-2423.

Frenette, A. (2015). 'The Internship Divide: The Promise and Challenges of Internships in the Arts. Special Report'. Available at: https://eric.ed.gov/?id=ED574458 (Accessed 14/2/2022).

Future Market Insights (2022). '3D Audio Market Snapshot (2022 to 2032)'. Insights, F. M. Available at: https://www.futuremarketinsights.com/reports/global-3d-audio-market (Accessed 5/10/2023).

Gasiewski, J. A., et al. (2011). 'From Gatekeeping to Engagement: A Multicontextual, Mixed Method Study of Student Academic Engagement in Introductory STEM Courses', *Research in Higher Education,* 53, 2, 229-261.

Gaston-Bird, L. (2019). *Women in Audio,* New York, Routlege.

Gaston-Bird, L. (2023). 'It's Immersive, but is it Inclusive? A look at diversity in the field of immersive audio for popular music, film & television, and games', *Representology,* Publication Pending.

Gaston-Bird, L., et al. 2021. Inclusivity in Immersive Audio: Current Participation and Barriers to Entry. Audio Engineering Society Education Conference, 2021 Nashville, TN. http://www.aes.org/e-lib/browse.cfm?elib=21217 (Accessed 14/2/2022).

GGM Staff (2021). *Beats By Girlz presents BBG.wav Louder than Ever!* : Guitar Girl Magazine. Available at: https://guitargirlmag.com/news/friday-december-3rd-beats-by-girlz-presents-bbg-wav-louder-than-ever-a-virtual-celebration-and-fundraising-party-loaded-with-music-from-around-the-world/ (Accessed 2/8/2022).

Girls Who Code (2020). 'Girls Who Code Annual Report 2020: Bravery in a Crisis'. New York, NY: Girls Who Code. Available at: https://girlswhocode.com/2020report/ (Accessed 14/2/2022).

Girls Who Code (USA) (2022). *Girls Who Code*. New York, NY. Available at: https://girlswhocode.com/ (Accessed 14/2/2022).

Glaser, B. (2005). 'Staying Open: The use of theoretical codes in grounded theory', *Grounded Theory Review,* 5, 1, n.p.

Glaser, B. (2007). 'All is Data', *Grounded Theory Review,* 6, 2, n.p.

Glaser, B. & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research,* Chicago, Aldine.

Glaser, B. & Strauss, A. (2014). 'Applying grounded theory', *The Grounded Theory Review,* 13, 1, 46-50.

Glaser, B. G. (1978). *Theoretical sensitivity*, University of California.

Glaser, B. G. (1992). *Basics of grounded theory analysis : emergence vs forcing,* Mill Valley, ca, Sociology Press.

Glaser, B. G. (2002). *Theoretical sensitivity : advances in the methodology of grounded theory,* Mill Valley, Calif, Sociology Press.

Glaser, B. G. (2005). *The Grounded Theory Perspective III: Theoretical Coding*, Sociology Press.

Glaser, B. G. (2007). 'Constructivist Grounded Theory?', *Historical Social Research / Historische Sozialforschung. Supplement*, 19, 93-105.

GOV.UK (2012). *Discrimination: your rights*. GOV.UK. Available at: https://www.gov.uk/discrimination-your-rights/how-you-can-be-discriminated-against (Accessed 9/10/2021).

Government Equalities Office (2020). *Gender pay gap reporting: guidance for employers*. London: GOV.UK. Available at: https://www.gov.uk/government/collections/gender-pay-gap-reporting (Accessed 14/2/2022).

Greenfieldboyce, N. (2022). 'Who gets to use NASA's James Webb Space Telescope? Astronomers work to fight bias'. *Morning Edition* [Online]. Available at: https://www.npr.org/2022/01/11/1071752559/who-gets-to-use-nasas-james-webb-space-telescope-astronomers-work-to-fight-bias?sc=18&f=1001&t=1643878057195 (Accessed 2/3/2022).

Greenwood, B. N., et al. (2020). 'Physician–patient racial concordance and disparities in birthing mortality for newborns', *Proceedings of the National Academy of Sciences,* 117, 35, 21194-21200.

Guest, G., et al. (2006). 'How Many Interviews Are Enough?:An Experiment with Data Saturation and Variability', *Field Methods,* 18, 1, 59-82.

Harley, A. E., et al. (2009). 'Developing long-term physical activity participation: A grounded theory study with African American women', *Health Education & Behavior,* 36, 1, 97-112.

Henn, S. (2014). *When Women Stopped Coding*. Washington, D.C.: National Public Radio. Available at: https://www.npr.org/sections/money/2014/10/21/357629765/when-women-stopped-coding (Accessed 14/2/2022).

Hennink, M. M., et al. (2017). 'Code saturation versus meaning saturation: how many interviews are enough?', *Qualitative health research,* 27, 4, 591-608.

Hepworth-Sawyer, R., et al. (2020). *Gender in Music Production,* New York, NY, Routledge.

Hernandez, K., et al. (2022). 'Inclusion in the Recording Studio? Gender and Race/Ethnicity of Artists, Songwriters & Producers across 600 Popular Songs from 2012-2021'. Los Angeles, CA. Available at: https://assets.uscannenberg.org/docs/aii-inclusion-recording-studio-20220331.pdf (Accessed 8/4/2023).

Hoff, M. L., et al. (2021). 'An Initiative to Increase Residency Program Diversity', *Pediatrics,* 149, 1, 1-9.

Holton, J. A. (2010). ' The Coding Process and Its Challenges', *The Grounded Theory Review: An International Journal,* 9, 1, 31.

House of Lords Library (2021). *Mandatory ethnicity pay gap reporting*. UK Parliament,. Available at: https://lordslibrary.parliament.uk/mandatory-ethnicity-pay-gap-reporting/ (Accessed 14/2/2022).

Huang, J., et al. (2019). 'Women in the Workplace'. October, 2019: McKinsey & Company. Available at: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Gender%20Equality/Women%20in%20the%20Workplace%202019/Women-in-the-workplace-2019.ashx (Accessed 14/2/2022).

Iddris Sandu, A. G., Ari Melenciano (2020). Critical Discourse in Design. Interview by Alli-Balogun, A. ArtCenter Professional Education. https://www.youtube.com/watch?v=WpAbeXHRJi0&t=3644s (Accessed October 30th, 2020).

International Game Developers Association (IGDA) (2020). *Being Black in Game Audio*. International Game Developers Association (IGDA),. Available at: https://igda.org/event/being-black-in-game-audio/2020-06-23/ (Accessed 18/2/2022).

Janssen, J., et al. (2022). 'Guidance or Gatekeeping: An Audit Examination of Racial Discrimination in Leading STEM High Schools', *Journal of Research on Adolescence,* 32, 2, 625-635.

Johnson, S. & Kirk, J. (2020). 'Dual-anonymization Yields Promising Results for Reducing Gender Bias: A Naturalistic Field Experiment of Applications for Hubble Space Telescope Time', *Publications of the Astronomical Society of the Pacific,* 132, 1-6.

Kapadia, D., et al. (2022). 'Ethnic Inequalities in Healthcare: A Rapid Evidence Review'. London: NHS Race and Health Observatory. Available at:

https://www.nhsrho.org/wp-content/uploads/2022/02/RHO-Rapid-Review-Final-Report_v.7.pdf (Accessed 21/2/2022).

Kerr, S. (2023). Why You Should Pay Your Interns. Interview by Stewart, J. The Problem With Jon Stewart Podcast. The Problem With Jon Stewart. https://www.youtube.com/watch?v=us4_3kFqSbg (Accessed 5/5/2023).

Kirkman, M. S. & Oswald, D. L. (2020). 'Is it just me, or was that sexist? The role of sexism type and perpetrator race in identifying sexism', *The Journal of Social Psychology,* 160, 2, 236-247.

Kraftman, T. (2026). *How women- and non-binary-led music tech manufacturers are navigating a male-dominated industry*. MusicTech. Available at: https://musictech.com/news/industry/female-non-binary-manufacturers-trade-shows/?fbclid=IwAR3tx8LXat_8qc5GOp0OlMSMdpov7uKqbvevQj3vkVwtoAQfL224AkyBbU8 (Accessed 07/25/2023).

Kvale, S. & Brinkmann, S. (2009). *Interviews : learning the craft of qualitative research interviewing,* London, SAGE.

Laird, P. (2006). *Pull: Networking and Success since Benjamin Franklin*, Harvard Studies in Business History.

Laird, P. (2017). Capital gains: business and politics in twentieth-century America. *In:* John, R. R. & Phillips-Fein, K. (eds.) *Capital gains: business and politics in twentieth-century America.* Philadelphia: University of Pennsylvania Press.

Laird, P. 3/11/2023 (2023). *RE: Re: Thanks for joining today!* Type to Gaston-Bird, L.

Landers, R. (2020). 'Unconscious Bias: The Gatekeeper of Racism and Discrimination'. Available at: https://medium.com/illumination/unconscious-bias-the-gatekeeper-of-racism-and-discrimination-300e2c213944 (Accessed 11/1/2021).

Lanzendorfer, J. (2017). 'Why Aren't There More Women Working in Audio?'. *The Atlantic* [Online]. Available at: https://www.theatlantic.com/entertainment/archive/2017/08/why-arent-there-more-women-working-in-audio/537663/ (Accessed 15/2/2022).

Lazar, E., et al. (2023). Equity Learning Series: Immersive and Inclusive - A Discussion of Representation in Immersive Audio. Interview by Gaston-Bird, L. Audio Engineering Society, Inc. https://youtu.be/zSY_2f-R5sY (Accessed 5/22/2023).

Lewin, K. (1947). 'Frontiers in Group Dynamics: II. Channels of Group Life; Social Planning and Action Research', *Human Relations,* 1, 2, 143-153.

Liou, T.-Y. & Chang, N.-Y. (2008). 'The applications of social capital theory in education', *Hsiuping journal of humanities and social sciences,* 11, 99-122.

Lyon, L. A. & Green, E. (2020). 'Women in coding boot camps: an alternative pathway to computing jobs', *Computer Science Education,* 30, 1, 102-123.

Mahayosnand, P. P., et al. (2021). 'E-Mentoring Female Underrepresented Public Health Student Researchers: Supporting a More Diverse Postpandemic Workforce', *Health Security,* 19, S1, S-72-S-77.

Major, B., et al. (1994). 'Attributional Ambiguity of Affirmative Action', *Basic and applied social psychology,* 15, 1, 113-141.

MAMA Youth Project (2022a). *MAMA Youth Project*. Available at: https://www.mamayouth.org.uk/ (Accessed 2/8/2022).

MAMA Youth Project (2022b). *Education, Engagement and Energy as MAMA Youth Tips the Scales for Training and Outreach*. London. Available at: https://www.mamayouth.org.uk/whats-new/news/education-engagement-and-energy-as-mama-youth-tips-the-scales-for-training-and-outreach (Accessed 7/1/2023).

MAMA Youth Project (n.d.). *Training*. London. Available at: https://www.mamayouth.org.uk/training (Accessed 7/1/2023).

Margolis, J. & Fisher, A. (2002). *Unlocking the clubhouse: women in computing,* Cambridge, Mass, MIT Press.

Massy, S. (2018). *A beautiful 'relic'....* [Facebook]. 9/21/2018. Available from: https://www.facebook.com/sylvia.massy/posts/10160832772985024 (Accessed 14/2/2022).

Master, A., et al. (2021). 'Gender stereotypes about interests start early and cause gender disparities in computer science and engineering', *Proceedings of the National Academy of Sciences - PNAS,* 118, 48, 1.

Maton, K. I. & Hrabowski III, F. A. (1995). 'Enhancing the Success of African American Students in the Sciences: Freshman Year Outcomes', *Innovating and Evaluating Science Education: NSF Evaluation Forums, 1992-94*, 19-27.

Mauk, M., et al. (2020). 'The can-do girl goes to coding camp: a discourse analysis of news reports on coding initiatives designed for girls', *Learning, Media and Technology,* 45, 4, 395-408.

May, G. S. & Chubin, D. E. (2003). 'A retrospective on undergraduate engineering success for underrepresented minority students', *Journal of Engineering Education,* 92, 1, 27-39.

McDowell, M. (2021). *'Pro Tools proficiency' may be keeping us from diversifying audio*. New York, NY: Vox Media. Available at: https://www.theverge.com/2021/1/22/22242606/pro-tools-proficiency-podcasting-diversity-gatekeeping (Accessed 14/2/2022).

McKinsey & Company (2020). 'Diversity wins: How Inclusion Matters'. May, 2020. Available at: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Diversity%20and%20Inclusion/Diversity%20wins%20How%20inclusion%20matters/Diversity-wins-How-inclusion-matters-vF.pdf.

Meeks, L. M. & Jain, N. (2018). 'Accessibility, inclusion, and action in medical education: lived experiences of learners and physicians with disabilities'. Washington, D.C.: American Association of Medical Colleges. Available at: https://store.aamc.org/downloadable/download/sample/sample_id/249/ (Accessed 14/2/2022).

Meyerhoff Scholars Program (2022). *Results: Meyerhoff by the Numbers*. Baltimore, MD: University of Maryland, Baltimore County. Available at: https://meyerhoff.umbc.edu/about/results/ (Accessed 21/02/2022).

Minniear, M. & Cardwell, M. E. (2022). Critical Race Theory. *In:* Braithwaite, D. O. & Schrodt, P. (eds.) *Engaging theories in interpersonal communication: multiple perspectives.* 3rd ed. New York, NY: Routledge.

Mohler, W. (2018). *The Fine People at Tree Audio….* [Facebook]. 9/22/2018. Available from: https://www.facebook.com/billy.mohler.3/posts/2503196536364750 (Accessed.

NEA Center for Social Justice (2021). *Implicit Bias, Microaggressions, and Stereotypes Resources*. Washington, D.C.: National Education Association. Available at: https://www.nea.org/resource-library/implicit-bias-microaggressions-and-stereotypes-resources (Accessed 11/17/2021).

Obasi, A. I., et al. (2022). 'Racism in two UK global health institutions', *The Lancet,* 399, 10332, 1287-1288.

Owen, L. J. (2007). *Pull: Networking and Success since Benjamin Franklin (book review)*. EH.net. Available at: https://eh.net/book_reviews/pull-networking-and-success-since-benjamin-franklin/ (Accessed 14/2/2022).

Oxford Dictionary (2023). Oxford University Press. https://www.oxforddictionaries.com/ (Accessed 5/18/2023).

Peek, M. E., et al. (2013). '"URM candidates are encouraged to apply": a national study to identify effective strategies to enhance racial and ethnic faculty diversity in academic departments of medicine', *Academic medicine,* 88, 3, 405-412.

Pekar, N. (2022). Keeping the STEM Pipeline Filled: Time for You to Help. *Fuentek's Tech Transfer Blog* [Online]. Available from: https://www.fuentek.com/blog-post/keeping-the-stem-pipeline-filled/.

Perry, E. & Francis, B. (2010). 'The social class gap for educational achievement: A review of the literature', *RSA Projects*, 1-21.

Petherbridge, D. (2013). *The Critical Theory of Axel Honneth,* Blue Ridge Summit, UNITED STATES, Lexington Books/Fortress Academic.

Prasad, P. (1997). *Managing the organizational melting pot: dilemmas of workplace diversity,* Thousand Oaks, Calif, Sage Publications.

Prior, B., et al. (2019). 'Women in the US MUSic IndUStry: Obstacles and Opportunities'. Boston, MA: Berklee Institute for Creative Entrepreneurship. Available at: https://college.berklee.edu/sites/default/files/d7/bcm/Women%20in%20the%20U.S.%20Music%20Industry%20Report.pdf (Accessed 14/2/2022).

Prospects (2022). *Sound Technician, Broadcasting / Film / Video*. Available at: https://www.prospects.ac.uk/job-profiles/sound-technician-broadcasting-film-video (Accessed 28/2/2022).

Quaintance, Z. (2018). 'The Quest for Digital Equity'. *Government Technology* [Online]. Available at: https://www.govtech.com/civic/the-quest-for-digital-equity.html (Accessed 1/29/21).

Raine, S. & Strong, C. (2019). *Towards Gender Equality in the Music Industry: Education, Practice and Strategies for Change,* New York, NY, Bloomsbury Academic.

Reid, I. N. (2014). 'Gender-Correlated Systematics in HST Proposal Selection', *Publications of the Astronomical Society of the Pacific,* 126, 944, 923-934.

Research and Markets (2020). 'Global 3D Audio Industry (2020 to 2027) - Market Trajectory & Analytics'. Dublin, Ireland: Cision PR Newswire. Available at: https://www.prnewswire.com/news-releases/global-3d-audio-industry-2020-to-2027---market-trajectory--analytics-301167176.html (Accessed 10/5/2021).

Roden, J., et al. (2021). 'Who else likes it? Perceived gender of social endorsers predicts gender equality support', *Computers in Human Behavior,* 118, 106696.

Rodrigo, T. (2021). 'MPEG Survey Offers Inside Look at Industry Discrimination, Diversity, Pay and More'. *CineMontage Magazine* [Online]. Available at: https://cinemontage.org/mpeg-diversity/ (Accessed 4/2/21).

Roget II, W., et al. (2020). Being Black in Game Audio. Interview by Xiao'an, L. The IGDA. https://youtu.be/echs_BcmPOo (Accessed Jun 25, 2020).

Roginska, A. & Geluso, P. (2017). *Immersive sound: The art and science of binaural and multi-channel audio*, Taylor & Francis.

Rotenstein, L. S., et al. (2021). 'Addressing Workforce Diversity — A Quality-Improvement Framework', *New England Journal of Medicine,* 384, 12, 1083-1086.

Russell, A. (2011). 'A Grounded Theory of Liberated Identity: Lesbians transcending oppression', *The grounded theory review,* 10, 1.

Saffron (2022). *Saffron*. Available at: https://saffronmusic.co.uk/ (Accessed 2/8/2022).

Schmidt, B. (2019). *GameSoundCon Game Audio Industry Survey 2019*. www.gamesoundcon.com. Available at: https://www.gamesoundcon.com/post/2019/09/10/game-audio-industry-survey-2019 (Accessed 1/19/2021).

Schmidt, B. (2020). 'Game Audio Job Skills - How to Get Hired as a Game Sound Designer'. 7/29/2020. Available at: https://www.gamesoundcon.com/post/game-audio-job-skills-how-to-get-hired-as-a-game-sound-designer.

Schmidt, B. (2021). *GameSoundCon Game Audio Industry Survey 2021*. www.gamesoundcon.com. Available at: https://www.gamesoundcon.com/post/game-audio-industry-survey-2021 (Accessed 4/8/2023).

Scott, C. & Medaugh, M. (2017). Axial Coding.

Scott, H. M. (2007). *The temporal integration of connected study into a structured life: A grounded theory.* University of Portsmouth UK.

Sebastian, K. (2019). 'Distinguishing between the strains grounded theory: Classical, interpretive and constructivist', *Journal for Social Thought,* 3, 1.

She Shreds Staff (2020). 'A Compilation of Anti-Racism Resources For White & Non Black Musicians'. https://sheshreds.com/a-compilation-of-anti-racism-resources/. (Accessed 2/1/2021).

Shoemaker, P. J., et al. (2001). 'Individual and Routine Forces in Gatekeeping', *Journalism & Mass Communication Quarterly,* 78, 2, 233-246.

Simon, P. (2005). 'The measurement of racial discrimination: the policy use of statistics', *International Social Science Journal,* 57, 183, 9-25.

Simpson, R., et al. (2020). 'Towards a performative understanding of deservingness: Merit, gender and the BBC pay dispute', *Gender, Work & Organization,* 27, 2, 181-197.

Smith, S. L., et al. (2018). ''Inclusion in the Recording Studio? Gender and Race/Ethnicity of Artists, Songwriters & Producers across 600 Popular Songs from 2012-2017''. Los Angeles, CA: Annenberg Inclusion Initiative. Available at: https://assets.uscannenberg.org/docs/inclusion-in-the-recording-studio.pdf (Accessed 14/2/2022).

Sony Music (2020). *Sony Music Group Announces $100 Million Global Social Justice Fund*. Available at: https://www.sonymusic.com/sonymusic/sony-music-group-announces-100-million-global-social-justice-fund/ (Accessed 1/29/21).

SoundGirls.org (2020). *Anti-Racist Resources*. SoundGirls.org. Available at: https://soundgirls.org/anti-racist-resources/ (Accessed 14/2/2022).

Stewart, M. (1998). 'Gender issues in physics education', *Educational Research,* 40, 3, 283-293.

Stirling, L. (2019). *I've committed to making the music industry more inclusive….* [Facebook]. Available from: https://m.facebook.com/lindseystirlingmusic/photos/a.658370784195112/2263542900344551 (Accessed 14/2/2022).

Sue, D. W. (2010). *Microaggressions in Everyday Life : Race, Gender, and Sexual Orientation,* Hoboken, NJ, Wiley.

Sue, D. W., et al. (2007). 'Racial Microaggressions in Everyday Life: Implications for Clinical Practice', *The American psychologist,* 62, 4, 271-286.

Swim, J. K., et al. (2005). 'Judgments of sexism: A comparison of the subtlety of sexism measures and sources of variability in judgments of sexism', *Psychology of Women Quarterly,* 29, 4, 406-411.

Takala, T. (2018). *An Exploration of Women's Experiences of Sexism in the UK.* University of East London.

The Grainger College of Engineering (2021). *A guide to responding to microaggressions*. University of Illinois at Urbana-Champaign. Available at: https://wie.engineering.illinois.edu/a-guide-to-responding-to-microaggressions/ (Accessed 11/16/2021).

Theberge, P. (1999). *Any Sound You Can Imagine: Making Music/Consuming Technology,* Thousand Oaks, CA, Sage Publications.

Thomas, S. (2016). 'Future Ready Learning: Reimagining the Role of Technology in Education. 2016 National Education Technology Plan'. Washington, D.C. Available at: https://tech.ed.gov/files/2015/12/NETP16.pdf (Accessed 14/2/2022).

Thompson, P., et al. (2016). 'Interrogating Creative Theory and Creative Work: Inside the Games Studio', *Sociology,* 50, 2, 316-332.

Todd, C. (2015). 'Commentary: GamerGate and resistance to the diversification of gaming culture', *Women's Studies Journal,* 29, 1, 64-67.

Treisman, P. U. (1983). 'Improving the Performance of Minority Students in College-Level Mathematics', *Innovation Abstracts,* 5, 17, 3-4.

Treisman, U. (1992). 'Studying students studying calculus: A look at the lives of minority mathematics students in college', *The College Mathematics Journal,* 23, 5, 362-372.

Tschmuck, P. (2006). *Creativity and Innovation in the Music Industry,* Netherlands, Springer.

Tsui, L. (2007). 'Effective Strategies to Increase Diversity in STEM Fields: A Review of the Research Literature', *The Journal of Negro education,* 76, 4, 555-581.

Tucker, A. 6/12/2021 (2021). *RE: Women in Audio: Historical records access.* Type to Gaston-Bird, L.

Tucker, A. (2022). *Business Essentials for the Emerging Audio Professional,* London, Routledge (In Press).

Tucker, A. (2022). *Finding Your Career in the Modern Audio Industry*, CRC Press.

U.S. Equal Employment Opportunity Commission (2020). *What is Employment Discrimination?* : United States Government. Available at: https://www.eeoc.gov/youth/what-employment-discrimination (Accessed 6/17/2021).

U.S. Equal Employment Opportunity Commission (2022). *Small Business Requirements*. Washington, D.C.: EEOC Headquarters. Available at: https://www.eeoc.gov/employers/small-business/small-business-requirements (Accessed 14/2/2022).

United States Congress Senate Committee on Small Business Entrepreneurship (2020). *Barriers to entry in the tech industry for diverse entrepreneurs: field hearing before the Committee on Small Business and Entrepreneurship, United States Senate, One Hundred Sixteenth Congress, first session, October 3, 2019,* Washington, D.C., U.S. Government Publishing Office.

Uri, T. (2015). 'The Strengths and Limitations of Using Situational Analysis Grounded Theory as Research Methodology', *Journal of Ethnographic & Qualitative Research,* 10, 2.

Vollstedt, M. & Rezat, S. (2019). An Introduction to Grounded Theory with a Special Focus on Axial Coding and the Coding Paradigm. *In:* Kaiser, G. & Presmeg, N. (eds.) *Compendium for Early Career Researchers in Mathematics Education.* Cham: Springer International Publishing. 81-100.

Winston, T., et al. 2021. Women in Audio: Today's Leaders. AES Show Spring European Convention, 2021 Online. Audio Engineering Society. *Live (unpublished) Panel Discussion*.

Women's Audio Mission (2017). *Programs | Women's Audio Mission*. Available at: https://womensaudiomission.org/training/ (Accessed 10/28/2021).

Women's Audio Mission (2021). *WAM Internship Program*. Available at: https://womensaudiomission.org/wam-internship-program/ (Accessed 9/12/2021).

Women's Audio Mission (2022). *About*. Available at: https://womensaudiomission.org/about (Accessed 10/28/2021).

Young, K., et al. (2018). 'The Impact of Gender on Conference Authorship in Audio Engineering: Analysis Using a New Data Collection Method', *IEEE Transactions on Education,* 61, 4, 328-335.

Young, K., et al. (2019). *The Impact of Gender on Conference Authorship in Audio Engineering (interactive data)*. Available at: https://tibbakoi.github.io/aesgender/#composition-across-topics (Accessed 1/29/21).