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## 'I'm just not sure.' The persistence of uncertainty in the information seeking of undergraduate students with dyslexia

[Lynne Beveridge](#), [Stephann Makri](#) and [Andrew MacFarlane](#)

**Introduction.** As information seeking progresses, it is expected feelings of uncertainty surrounding, for example, the information need, what information will be useful to satisfy the need and how well the need has been satisfied will shift towards confidence and clarity. The six corollaries offered by Kuhlthau outline and explain areas where this shift can happen. However, does it happen for all groups of information-seekers? Undergraduate students with dyslexia often have lower information seeking-related self-efficacy than their peers and this can result in uncertainty persisting throughout information seeking.

**Method.** Retrospective naturalistic think aloud observations were held with 20 undergraduate students with dyslexia. After looking for information for one of their (self-chosen) assignments, participants were invited to explore their thoughts, feelings and actions with the researcher while watching a screen recording of their information seeking session.

**Analysis.** First, an inductive reflexive Thematic Analysis was conducted which revealed self-efficacy to be a key influence in the information seeking behaviour of undergraduate students with dyslexia. To investigate this further, a dedicated deductive analysis was conducted leveraging Kuhlthau's six corollaries.

**Results.** The expected shift away from uncertainty towards clarity and confidence was found to be either delayed, disrupted or prevented by participants' low self-efficacy surrounding selecting and spelling keywords and reading, interpreting and evaluating information online. Uncertainty persisted throughout information seeking and was rarely reduced or resolved.

**Conclusions.** Key areas for additional support during information seeking for this user group are identified, including keyword selection and spelling, accurate reading and interpretation and confident evaluation of online information.

## Introduction

Kuhlthau's (1993) seminal work on information search explains that, as people looking for information progress in their information seeking, their affective state should generally shift from feelings of uncertainty towards confidence. Uncertainty is defined as, '*a cognitive state which commonly causes affective symptoms of anxiety and lack of confidence*' (Kuhlthau, 1993, p.347). While Kuhlthau's research initially involved school-aged children, this shift away from uncertainty has since been found to be the case for those seeking information in different contexts, such as undergraduates preparing their theses (Wu, et al, 2016). Furthermore, when Kuhlthau, Heinström and Todd (2008) revisited Kuhlthau's findings in light of technological advancements in the information seeking landscape, they found the framework and principle of uncertainty still offered valid explanation of the information behaviour of school aged children.

The six associated corollaries formed by Kuhlthau (1993, p.347) to support the assertion that people seeking information should move towards feelings of confidence (process corollary, formulation corollary, redundancy corollary, mood corollary, prediction corollary and interest corollary) elucidate different factors that can influence this shift in affective state. The corollaries outlined by Kuhlthau (1993) can also serve as a theoretical framework for considering how the affective states of specific user groups change during information seeking.

Dyslexia is a specific learning difficulty (SpLD), defined by Reid (2008) as '*a processing difference...usually [causing] some discrepancies in educational performances*'. Dyslexia affects around 10% of the general population in the UK (UK Government, 2017), with some universities reporting a similar proportion of people with dyslexia in their undergraduate population (Newman University, 2020). It is often the case that undergraduate students with dyslexia have lower self-efficacy in comparison to their peers in relation to their academic abilities (Stagg, Eaton, and Sjoblom, 2018), where self-efficacy is understood to be, '*the conviction that one can successfully execute the behavior required to produce a specific outcome*' (Bandura, 1977). If undergraduate students with dyslexia have low self-efficacy in educational tasks, this could reasonably be argued to translate to low self-efficacy in information seeking tasks within the context of education and possibly beyond. Understanding how this low self-efficacy manifests in their information seeking can help us understand how best to support it (e.g., through information literacy and systems design).

Linking self-efficacy and information seeking, Wilson, et al. (2002) noted that '*self-efficacy theory may explain whether or not a person engages in information seeking*' (p.706) as '*unless people believe that they can produce desired effects by their actions, they have little incentive to act*' (Bandura, et al, 1996). However, links between self-efficacy and information seeking have not been fully investigated, particularly regarding whether self-efficacy impacts uncertainty reduction during information seeking for students with dyslexia. Specifically, we are unaware of any prior research in this area. This research investigates this issue. It is an important focus, as information seeking is an essential university skill for assignment preparation and for academic achievement overall. Therefore, understanding and addressing any impacts on information seeking can support academic achievement which, in turn, may provide access to enriching career options.

## Literature

### Dyslexia

There is no common set of difficulties associated with dyslexia. Dyslexia can present itself in multiple ways and each person's profile of symptoms is unique. However, there are some common cognitive differences described in the literature. Recall and spelling of vocabulary are frequently reported as being affected (Reid, 2016). Some people with dyslexia have challenges in fluent and accurate reading that can persist into adulthood (Snowling, 2000). Furthermore, working memory capacity may be reduced, as compared with

peers (Snowling, 2000). While people with dyslexia can have strong creative skills (BDA, 2021), low self-esteem and low self-efficacy may be reported in educational settings (Stagg, Eaton, and Sjoblom, 2018). We now discuss self-efficacy further.

## Self-efficacy

Research investigating self-efficacy in educational contexts has shown learners with dyslexia have low self-efficacy in relation to their peers. This low self-efficacy impacts upon their achievement and success (Bandura, 1993; Pavey, Meehan and Waugh, 2010). In the context of university study, undergraduate students with dyslexia have persistent difficulties with academic skills and low self-efficacy in relation to these skills (Stag, Eaton and Sjoblom, 2018). Difficulties faced by undergraduate students with dyslexia caused by low self-efficacy can be mapped to the experience of information seeking for educational purposes – as many essential academic skills (e.g., accurate reading and interpretation) are also required during information seeking. Self-efficacy is important for persisting with information seeking in the face of setbacks (Wilson, 1981) and it is possible low self-efficacy impacts information seeking in other ways. This study focuses on understanding this impact.

## Corollaries

In his problem-solving model, Wilson (2002) acknowledged that uncertainty can temporarily increase as information-seekers interact with new information but that, ultimately, this uncertainty should reduce. Hyldegård's (2009) work investigating graduate students' collaborative information seeking behaviour noted some differences from Kuhlthau's findings in the reported uncertainty levels when information seeking was carried out in small groups, but Wilson's (2002) model echoes Kuhlthau's (1993) research with school children, which notes uncertainty reduction during individual information seeking. Kuhlthau's (1993) six corollaries provide a theoretical framework for considering how low self-efficacy (in this case in undergraduate students with dyslexia) can affect uncertainty reduction during information seeking. We now discuss each corollary.

### Prediction Corollary

Kuhlthau (2018) highlights that, *'people make predictions derived from constructs built on past experience about what sources, information and strategies will be relevant and effective.'* Kuhlthau further noted that these *'predictions are based on expectations derived from constructs built on past experience'* (Kuhlthau, 1993, p.351). If a student with dyslexia has previous negative experiences of information seeking for an assignment or their predictions are overly impacted by low self-efficacy, this might impede the move from uncertainty towards confidence.

### Process Corollary

Kuhlthau (2018) describes how the acquisition of new knowledge during information seeking should aid the shift of feelings from *'vague and anxious to clear and confident'*. However, low self-efficacy surrounding the behaviour required to support the process of information seeking, such as accurate and fluent reading, could impact this acquisition of new knowledge, and therefore the shift towards confidence.

### Formulation Corollary

This corollary involves the actions of *'thinking, developing an understanding, extending and defining a topic from the information encountered in a search'* (Kuhlthau, 1993, p.348) and is underpinned by similar behaviour as the process corollary. Kuhlthau (1993, p.349) stated, *'the problem is not solved or the topic*

*understood until the information has been interpreted'* and dyslexia may impact peoples' ability to accurately read and interpret information and their efficacy surrounding their abilities to do so. If this is the case, then the 'problem' may not be solved and the information-seeker may be left with lingering feelings of uncertainty.

## Redundancy Corollary

Kuhlthau (2018) describes redundant information as *'information [that] fits into what we already know and is promptly recognized as being relevant or not relevant'*. Whereas *'unique information does not match our constructs and requires reconstruction to be recognised as useful'* (Kuhlthau, 1993, p.349). If too much redundant information is encountered, according to Kuhlthau, lack of interest may be experienced; *'too much redundant information leads to boredom, whereas too much unique information causes anxiety'* (Kuhlthau, 2018). Here, the concept of 'unique' information is understood to be novel information. Kuhlthau (2018) asserted that the Redundancy Corollary may be the cause of much of the anxiety felt at the onset of information seeking as, if the topic is relatively unknown to the information-seeker, then much of the information found will be new and will require a decision to be made as to whether it is useful or redundant for addressing the seeker's information needs. The process of decision-making may involve competencies that undergraduate students with dyslexia have low self-efficacy toward, such as reading and interpreting information, therefore affecting a shift away from uncertainty.

## Interest Corollary

Kuhlthau (2018) explains that as information seeking progresses, seekers' interest, motivation and intellectual engagement increases. It would be expected this would ignite an interest in the topic information is sought on. Zimmerman stated, *'in educational settings, self-efficacy is a highly effective predictor of students' motivation'* (2000 cited in Stagg, Eaton and Sjoblom, 2018, p.27). Therefore, low self-efficacy might impact on motivation and hence interest which, in turn, could impede a shift from uncertain to confident as information seeking progresses.

## Mood Corollary

Mood is defined as *'a stance or attitude that the user assumes'* (Kuhlthau, 1993, p.350) and can be either indicative or invitational (Kuhlthau, 1993). Different types of mood can result in differing actions during information seeking and can potentially reflect uncertainty. For example, if an information-seeker has low self-efficacy, they might be more likely to feel confused and demonstrate actions that indicate their confusion (e.g., repeated reformulation of search queries). These actions will not necessarily address their confusion, allowing uncertainty to persist.

## Research Question

To summarise the literature, in the context of assignment preparation it would be expected that there would be a shift away from uncertainty and towards confidence as information seeking progressed and the assignment was prepared. However, because of low self-efficacy towards much of the behaviour required during information seeking (Cole, MacFarlane and Buchanan, 2016), it may be that this shift is delayed, disrupted or not achieved for undergraduate students with dyslexia. Therefore, the research question we sought to answer was: *RQ1: Does low self-efficacy in undergraduate students with dyslexia impact the shift from uncertainty to confidence when seeking information for assignments?*

## Method

We recruited 20 UK undergraduate students with dyslexia by advertising on social media and posting a call on the website [Callforparticipants.com](http://Callforparticipants.com). We also recruited through the universities we were affiliated with, but did not contact students we knew (e.g., had previously taught), for ethical reasons. We made it clear that their participation would not influence the assignment mark they received and that we were not involved in marking it. Participants were invited to participate if they had received a formal, post-16 diagnosis of dyslexia. As it was participant's experiences of how their dyslexia presented during information seeking that was sought, no Educational Psychologist's report was requested and no formal diagnostic measurements were taken.

Participants were all female, aged 18-26. While an all-female participant group is unusual, gender has not been found to impact on self-efficacy levels in undergraduate students (Reilly, et al, [2021](#)) and we do not think this influenced the results. Participants took part in retrospective think-aloud (RTA) observations, comprising a naturalistic information seeking session. Participants used the researcher's laptop to seek information for no longer than twenty minutes on a topic of their choice that would help them prepare for any upcoming assignment that had been set as part of their degree. Topics included Periodization in Sports Coaching for preparation of an essay (P15), Children's Physical Development for preparation of a presentation (P20) and Irrational Numbers for preparation of a report (P14).

Screen recording software Electa (Electa Communications Ltd, [2012](#)) was used and the information seeking session recording was played back to participants. Participants were prompted to comment on their thoughts, feelings and actions as they watched the recordings of their information seeking session. The researcher guided participants through the use of questions, such as 'what were you thinking while you were scrolling through this source?', 'how did it make you feel when your search returned these results?' and 'why did you chose reformulate your query here?', to help elicit details about the actions performed and the rationale behind them through the exploration of the cognitive, affective and behavioural aspects of their information seeking.

## Data Analysis

The transcripts and associated screen recordings were analysed together using a reflexive Thematic Analysis approach (Braun and Clarke, [2021](#)). First an inductive analysis was conducted which, through coding, revealed self-efficacy to be a key component in the information seeking behaviour of undergraduate students with dyslexia (we had not set out to examine self-efficacy).

Although levels of self-efficacy had not been measured, per se, during data collection, the language used by participants when discussing their information seeking behaviour and the rationale behind it conveyed their perceived low self-efficacy. The repetition of phrases such as '*I can't*' for example inferred low self-efficacy. We make no attempt to differentiate the level of self-efficacy across participants in this study and note that, for some participants self-efficacy was lower than others. While factors other than a diagnosis of dyslexia might have contributed to low perceived self-efficacy (some people without dyslexia, for example, may have low self-efficacy during information seeking), we noted a robust pattern of perceived low self-efficacy across our participants.

A second, deductive component of the analysis involved us turning to the literature on uncertainty reduction in information seeking, particularly Kuhlthau's six corollaries. We deemed these corollaries to be potentially useful theoretical lenses to help explain the low self-efficacy data further, so applied them (deductively) to frame our analysis. Rather than 'look for each corollary' in our data (which would be difficult or not impossible when analysing such granular data), we looked for *evidence related* to each corollary to support us in framing our findings in terms of each corollary.

We identified two broader areas of information seeking impacted by low self-efficacy (when expressing

information needs on online systems and when evaluating online information). Within each of these areas, we also identified distinct information seeking behaviour participants demonstrated low self-efficacy towards (keyword selection and spelling, accurate reading and interpretation and confident evaluation of online information). Each of these actions (Table 1) was analysed leveraging each of Kuhlthau's corollaries to align these with the information seeking behaviour that participants had been identified as displaying low self-efficacy towards.

## Results

Participants reported experiencing high uncertainty levels that persisted throughout information seeking (i.e., did not reduce or resolve as information seeking progressed). Participants did not believe that they could communicate effectively with online information platforms or evaluate information for relevance and hence usefulness to their assignment. This made them constantly unsure if they were finding and using relevant information or not. Participants were at varying stages of preparing for their assignments. While some were at an early stage of information seeking where feelings of uncertainty might be expected, uncertainty was rife across participants and their chosen information seeking tasks. All participants demonstrated low self-efficacy as a cause of their uncertainty, specifically regarding keyword selection and spelling, reading, interpretation and evaluation. These modes of behaviour are presented in Table 1, alongside the corollaries impacted by them. We now present the results, corollary by corollary.

Table 1. Information behaviour that participants had low self-efficacy for and the associated corollaries

	<b>Prediction Corollary</b>	<b>Process Corollary</b>	<b>Formulation Corollary</b>	<b>Redundancy Corollary</b>	<b>Interest Corollary</b>	<b>Mood Corollary</b>
Selecting Keywords	x		x			
Spelling Keywords	x		x			
Reading Information	x	x		x	x	x
Interpreting Information	x	x		x	x	x
Evaluating Information	x			x	x	x

### Prediction Corollary

Negative past experiences related to seeking online information for university assignments led some participants to believe they could not select appropriate information seeking strategies or relevant information.

P27 voiced concern about her ability to express her information need on her university's library catalogue, noting, *'you have to be really specific with it'* (P27). This would suggest P27 had previously found it challenging to communicate effectively with the platform. P27 continued by stating, *'I think that's why I struggle... 'cause I've got to narrow it down what I want, and I always wonder how it works, like what keyword do they want kind of thing'*. P27 was unsure of what strategy would be effective when selecting keywords and rather than help reduce her uncertainty, her previous experiences with the system made her continue to *'wonder how it works.'* P27 also asserted *'I can't spell'* (P27). P27 did not believe she was able to accurately spell keywords she wished to use for her search queries and felt this would have a negative impact

on her information seeking. She noted that the library catalogue did not offer spelling corrections in the way Google does and that this would have helped her be more confident in her information seeking. Low efficacy towards selection and spelling of keywords prevented the shift from uncertainty towards confidence during information seeking for P27.

Participants also demonstrated low self-efficacy when evaluating the relevance and usefulness of information found. The process of evaluation is understood here to involve first the reading, then the interpretation of information, so that confident evaluation can take place. Low self-efficacy was noted for reading, interpreting and evaluating for P10, who reported negative previous experiences regarding all of this behaviour. P10 said she worried that she was missing relevant information, stating she felt she could not '*read [information] properly*' (P10). P10 was left with feelings of uncertainty as movement towards confidence and clarity was not achieved.

P10 used three strategies to mitigate for uncertainty by reducing the amount of reading and interpreting she had to do during information seeking: 1) she avoided reading documents that she felt she could not read, 2) she scan-read and 3) a family member extracted sections of potentially useful text from information sources for her to read. Here are examples of each strategy:

1) She abandoned an online source quickly after selecting it, later stating in her RTA session that she had done this as '*I was like, I can't read this*'. This left her feeling uncertain as to what impact the decision to abandon was having on her information seeking, noting '*I don't know if that's why I miss out, maybe I should read it*' (P10).

2) P10 stated her scan-reading strategy aimed at avoiding large amounts of text left her feeling uncertain as to whether she had evaluated and selected relevant and useful information. She asked herself rhetorically, '*when I'm scanning other articles do I miss things because I'm not reading it?*' (P10).

3) While P10 thought a family member highlighting sections of text for her to read they felt were relevant to her assignment '*helped... a lot*', this in the end added to her uncertainty as she was concerned that her family member might lack the necessary subject knowledge to make appropriate relevance decisions: '*his knowledge wasn't as good as mine because he hadn't sat in the lectures, so he doesn't necessarily then know what he's then looking for*' (P10).

These strategies did not reduce levels of uncertainty for P10 and, ultimately, she did not believe she could evaluate and select relevant information for use in her assignment. She based this assertion on previous experiences during previous years of her degree. Her strategies also point to the risk of low self-efficacy limiting the development of information seeking expertise by reducing exposure to difficult aspects of information seeking, such as interpreting large amounts of text or making relevance decisions.

## Process Corollary

Accurately reading and successfully interpreting information can support development of new knowledge, which might lead to feelings of clarity and confidence during information seeking. However, participants voiced low self-efficacy regarding reading and interpretation and they did not voice confidence even when they felt they had nearly completed their information seeking.

Several participants considered themselves to be a '*slow reader*' (P15, P17, P18) and stated this contributed to their low self-efficacy in reading during information seeking, with this activity requiring considerable cognitive effort and time. Extra time spent reading meant it took more time overall to interpret and select information for an assignment. P27 said the extended reading needed to develop new knowledge took '*a long time*' and meant she did not '*get a lot done*' during information seeking. P27 experienced a delay in interpreting information during information seeking due to perceived slow reading which, in turn, disrupted

the development of new knowledge and a shift away from uncertainty and towards confidence. Persistent uncertainty in the ability to read and interpret information was also demonstrated by participants losing their place within lines of text in online sources (P10, P12, P15, P19, P21, P22, P23). P23 stated *'reading, understanding it and actually where I have to follow the lines'* was something she found difficult. Participants did not believe that they could accurately follow along lines of text to read passages of information accessed during information seeking and hence, development of new knowledge was affected. Participants had to reread information several times, often with the aid of the cursor or their finger, to keep place as they read: movement away from uncertainty was delayed or disrupted in these instances.

Participants' low self-efficacy towards reading and interpreting information during information seeking meant reading was avoided by some participants (P10, P13, P20, P27). P20 noted, *'I'm one of those people that won't read things because they know they can't do things'*, while P27 stated, *'if I don't understand the first few sentences, I just don't carry on...I just feel like I can't. 'Cause I know it's me that can't understand it, so I just get like ah I can't do it'*. This avoidance of reading has the potential to disrupt new knowledge development, allowing uncertainty to persist. Even when participants persevered with reading, uncertainty was still present as they were unsure they had interpreted information accurately; for example, P9 thought she had *'only processed 20% of what's going on'* when reading and interpreting information for her assignment.

## Redundancy Corollary

Rather than report that too much redundant information resulted in their interest in that information decreasing, as might be expected according to the redundancy corollary, participants reported that finding information already known gave them reassurance, confidence and a feeling of certainty. Familiarity with new information found provided reassurance they were accessing relevant and useful information for their assignments. However, this can be regarded as *false reassurance*, as if only previously known information is judged to be relevant, potentially useful new information is likely being missed.

Several participants reported seeking information that confirmed knowledge they already held (rather than information on areas entirely new to them) and that using novel information was the cause of anxiety and uncertainty, and something that they would actively avoid if possible (P11, P12, P18, P20, P22, P23, P24). On this point, P12 reflected *'it's interesting, you're not reading for knowledge, you're reading to have it backed up, to have your points [backed up]'*. P22 described how she would dismiss novel information during information seeking, stating *'if I've got a thought in my head...it's not like matching up to that I'm like oh well that's not what I want to search even though it potentially could be.'* Similarly, P25 stated that she was unsure if she was missing important information when seeking information for assignments, as if the first sentence she read did not exactly match with her conception of the information she needed, she dismissed the entire information source.

Novel information could be the source of confusion for participants and P11 stated that she would dismiss information as redundant if she did not *'really understand what it's saying'*. Other participants were reluctant to dismiss information they had read as redundant, because of the time they had invested in reading and interpreting the information. When questioned about evaluating information for relevance and usefulness, P23 commented *'I'm not particularly confident, I think. A lot of the time where it takes me such a long time to read stuff, I'm sort of quite anxious to just sort of to pick a point and go with it'*. It takes time and cognitive effort to read, interpret, then evaluate information for relevance and usefulness, to the extent it was not in P23's interest to dismiss information as redundant, potentially disrupting a move from uncertainty to confidence – as she could not be sure information was selected for its usefulness to the assignment, rather than because significant time had been invested in reading and understanding it.

## Formulation Corollary

Kuhlthau (1993) found information-seekers would narrow their focus as information seeking progressed, as explained in the formulation corollary. Although we observed incidences when a more focused perspective was formulated during information seeking, it did not result in reduced uncertainty for participants because they had low self-efficacy in their ability to express their information needs through the selection and spelling of keywords. Participants claimed they felt more comfortable and confident finding information that was broader and more general in scope, as this did not require the recall or spelling of more specific vocabulary.

P13 was completing an assignment on children's physical development and commented, *'I just find it really hard to find sources in general, for this topic, for this essay'*. The reason P13 gave was that she felt the topic was very *'specific'*, as she was required to include information in her assignment that discussed the narrower topics of outdoor play and risk assessments. P13 commented, *'I put too many words in. So I do find it quite hard to limit down the words'*. P13 became frustrated and noted, *'then loads of irrelevant stuff came up, which really annoyed me'*. P26 also described her low self-efficacy related to finding narrowly focused information, commenting *'usually, especially when things are more niche, I just can't find anything'*.

The spelling of search terms disrupted P20's information seeking; she wanted to find information about *'two new people that I hadn't heard of before, which I then later went back to research to try and find research on them.'* P20 noted, *'that was a bit more difficult to try and find the specific research'*, as she could not spell *'Helen Moylett and Nancy Stewart'* to conduct further searches. P20 was reluctant to continue with her information seeking, stating, *'I knew if it wasn't spelt right, then it probably wouldn't come up with anything that I needed'*. P20 could not perform new, more focussed searches, to progress her information seeking, as she did not persevere due to low self-efficacy related to spelling keywords.

Rather than develop a specific focus, low self-efficacy towards selecting and spelling keywords meant uncertainty prevailed across this corollary too.

## Interest Corollary

Participants reported that low self-efficacy in relation to reading and interpreting online information affected their feelings of interest and motivation during information seeking.

P15 reported a lack of interest in and a continued avoidance of reading throughout the information seeking she performed when preparing for an assignment. She stated *'I just lose interest if I try and read...I'm not very good with reading and I get really confused'* (P15). In an attempt to minimise the amount of reading she engaged in during information seeking, P15 used the CTRL+F browser function frequently. She would type words into the browser search box, then only read the sentence with the highlighted word, and no other parts of the information source. P15 was observed to use CTRL+F frequently during her session and, as a result, did not spend much time reading the information sources she accessed beyond those sentences that contained a keyword match. When questioned about her use of CTRL+F and its benefits, P15 stated *'I'm a slow reader so it means I don't have to do so long, take so long to do research'*. P15's low self-efficacy with regards to reading meant she had little interest in reading substantial chunks of text and remained uncertain about whether she had found useful information for her assignment.

P21 was looking for ways to support *'fine motor skills and gross motor skills'* for an essay on children's physical development. She reported low self-efficacy related to evaluating information because of her working memory. P21 brought a post-it-note with her as a reminder of her information need, to help her evaluate information found against it. The post-it had assessment criteria from her assessment written on it and P21 referred to it several times during information seeking. When questioned about its purpose, she explained, *'I can be like reading something or trying to find something... then I can look up for a minute or whatever and then I've just forgotten what I'm actually looking for'*. For P21, the prospect of forgetting what she was looking for allowed uncertainty to persist throughout information seeking.

## Mood Corollary

Kuhlthau (1993) theorised on the benefits of moving from an indicative to invitational mood as information seeking progresses. An *invitational mood* reflects openness to new information and willingness to adjust information seeking approach in response to information found. An indicative mood reflects a reliance on existing understanding and a lack of acceptance of new information (Kuhlthau, 1993). While this study examined information behaviour and the rationale behind it, it did not explicitly probe into participants' mood. However, the actions described across the other corollaries (e.g., avoiding reading long chunks of text, using familiar information) indicate participants avoided activities that could be classed as more invitational and this could be attributed to their increased uncertainty due to low self-efficacy.

Participants were observed to avoid more invitational actions during information seeking, such as extensive reading. For example, for most participants reading involved focused cognitive effort on small sections of text. P23 described taking time to accurately read information she had selected, to facilitate interpretation (and use within her assignment). P23 stated, '*hopefully the stuff I am reading, I'm really understanding and I can use that properly*'. Similarly, once P24 made the commitment to read a piece of information found online, she would read it in its entirety if possible. P24 noted '*I feel like if I miss something out it might have been an important bit*'. The considerable time invested by participants to read, interpret and then evaluate information did not allow them to invest more time in invitational behaviour, such as wide reading or engaging with unfamiliar information.

## Discussion

The research that underpins Kuhlthau's (1993) corollaries has previously been found to be robust across educational settings (Mohammad, et al, 2018; Beheshti, et al, 2015). However, here it has been found that, for some user groups at least, such as undergraduate students with dyslexia, low self-efficacy can delay, disrupt or prevent reduction of uncertainty as information seeking progresses. We found that, in this particular group of information-seekers, the expected shift away from uncertainty and towards clarity and confidence did not manifest.

Participants demonstrated and reported low self-efficacy relating to a range of information seeking behaviour essential for completing university assignments, such as selecting and spelling keywords and reading and interpreting information. Their low self-efficacy meant that, even as they were approaching the end of their information seeking and finalising their assignments, they still felt uncertain about their information seeking process (i.e., the adequacy of their approach towards finding information) and the suitability of the information they found. Even after completing their assignments, participants were often left feeling uncertain they had found useful and relevant information for it.

Low self-efficacy towards selection and spelling of keywords was found to influence the Prediction and Formulation corollaries; participants did not believe they could effectively communicate with online systems to obtain relevant and useful information for their assignments and were left unsure as to whether the information they found was suitable (or as suitable as it could be) for their assignment. Participants also reported low self-efficacy in reading, interpreting and evaluating information. Related to the Process corollary, new knowledge development was impeded by low self-efficacy in reading and interpreting information. Related to the Redundancy corollary, participants avoided novel information and instead *preferred* familiar and therefore potentially redundant (i.e., duplicated) information. This was so they could prevent additional uncertainty but can potentially have a negative impact, as it is the opposite of broadening one's horizons through new knowledge development. While this behaviour might protect people from difficulties associated with engaging with overly-complex content, it may simultaneously restrict their learning and development – a learning-related 'backfire effect.'

Rather than interest and motivation increasing as information seeking progressed, as might be expected in the Interest corollary, the substantial time and effort required to read, interpret and evaluate information resulted in some participants lacking interest or motivation as information seeking progressed. Also, rather than move from an indicative to invitational mood - as might be predicted by the Mood corollary - participants remained indicative by over-relying on their existing understanding gained through familiar information and avoiding novel information.

## Conclusion

While Kuhlthau's research emphasised uncertainty reduction during information seeking as a key aspect of the affective process, this study found that among a certain group of people (undergraduate students with dyslexia), low self-efficacy can delay, disrupt or prevent reduction of uncertainty as information seeking progresses. This highlights that the principle of uncertainty reduction may hold stronger with some user groups than others and that Kuhlthau's corollaries may be reflected differently in the information seeking of particular user groups; information seeking is not experienced the same universally - different individuals and user groups will experience it differently and we should cater for these potentially diverse experiences through information literacy and design efforts that take this diversity into account.

Implications of these findings highlight the importance of supporting the development of self-efficacy for undergraduate students with dyslexia. This research has identified key information seeking activities where this group of information-seekers has demonstrated or voiced low self-efficacy (e.g., when selecting or spelling keywords, reading and interpreting information and when evaluating the relevance and usefulness of that information), spanning across Kuhlthau's (1993) corollaries; Prediction, Process, Formulation, Redundancy, Interest and Mood. This can provide an indication of where to focus information literacy and systems design efforts aimed at better supporting self-efficacy.

Self-efficacy and ability are likely to go hand-in-hand. Therefore, supporting this group of information-seekers to have greater belief in their information seeking abilities could become self-fulfilling. Likewise, providing dedicated support for key activities that this group finds difficult, might result in greater perceived success and therefore increase self-efficacy. It is important not to assume that everybody experiences information seeking the same. Understanding the complex informational needs and behaviour of diverse groups of information-seekers is essential for supporting these groups through information literacy and systems design efforts. Future research might examine how existing information systems facilitate and inhibit uncertainty resolution for this cohort and others. It is also possible that better supporting specialised groups (such as people with dyslexia) might lead to design and literacy interventions that might benefit a far broader range of people. Future research might examine how best to achieve this.

## About the authors

**Lynne Beveridge** is a PhD candidate in Information Science at City, University of London. She has previously worked with undergraduate students in both information professional and student support roles.

[lynne.beveridge@city.ac.uk](mailto:lynne.beveridge@city.ac.uk)

**Stephann Makri** is a Senior Lecturer in the Centre for Human-Computer Interaction Design at City, University of London. His research in Human-Information Interaction involves understanding how people find and engage with information and using this understanding to inform the design of digital information environments to create experiences that are engaging, enriching, exciting and fulfilling. [stephann@city.ac.uk](mailto:stephann@city.ac.uk)

**Andrew MacFarlane** is a Reader in Information Retrieval in the Centre for Human-Computer Interaction Design at City, University of London. His research focuses on user aspects of search in specific areas such as systematic reviews for healthcare and journalism, and he has a particular interest in user groups with impairments such as users with dyslexia or aphasia. [a.macfarlane-1@city.ac.uk](mailto:a.macfarlane-1@city.ac.uk)

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