

Advancing Inclusive E-learning

Relationship between Motivational Factors and Dyslexic Characteristics

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Abstract. Ensuring e-learning is inclusive for all is a global endeavor to ensure educational quality and equity. Little research has explored the relationship between learners' dyslexic characteristics and motivational factors that affect continued intention to interact with an e-learning system. Identifying the motivational factors that are mostly related to dyslexia can inspire future research and practice for implementing motivational strategies and assistive services targeting these specific needs in e-learning environments. The present study investigated the relationship between severity of dyslexic characteristics and levels of motivational factors for engaging with e-learning. Preliminary results indicated significant relationships between severity of dyslexia and seven motivational factors, including a moderate, significant, negative correlation with Perceived Ease of Use, Confirmed Fit, Utilization, and Perceived Control, and a small, but significant, negative correlation with Feedback, Learning Experience, and Reading Experience. Discussions highlighted a personalized solution to dyslexia-related motivational needs in e-learning, considering the possibility of real-time data collection and computing enabled by e-learning environments. To advance e-learning for those with dyslexic traits, the seven dyslexia-related motivational factors found in this study can be prioritized to be monitored to detect dyslexic learners' motivational needs and deliver personalized design, assistance, or strategies.

Keywords: E-learning, Dyslexia, Motivational Factors.

1 Introduction

1.1 Dyslexia and E-learning: a Motivational Perspective

Dyslexia is a common type of specific learning difficulties, impacting one in ten people in the UK [1], involving specific difficulties in literacy skills about reading and language comprehension resulting from poor spelling, decoding and memory deficits [2]. The heterogeneity of symptoms in dyslexia can affect individuals' learning and perception of stimuli [3]. Furthermore, dyslexia can impact motivation in learning [4], which is significantly underexplored despite its importance to learning performance [5, 6, 7].

Ensuring learning and teaching environments are inclusive for all is a global endeavor for educational quality and equity. With the increased pervasiveness of mobile and web-based e-learning systems such as Brightspace and LinkedIn Learning, growing attention has been focused on their effectiveness for end users' learning and the possibility for real-time monitoring of learners' states to offer personalized support [8]. On the other hand, while e-learning systems have offered a flexible, self-paced virtual learning environment, compared to traditional classroom learning, online, distance learning is less monitored and more self-regulated [9]. Therefore, it is essential that factors influencing sustained motivation to engage with e-learning are considered when it comes to evaluating the usability of e-learning systems and whether they can offer an inclusive environment for all including those with specific learning difficulties. This is a more acute issue for learners with dyslexic characteristics given their literacy difficulties and lower academic self-worth compared with those without dyslexia [10].

1.2 The Current Study

Despite the urgency and importance, the area of assistive e-learning for dyslexic learners based on motivational factors has obtained little attention. Research investigating factors influencing dyslexic learners' motivation to engage with e-learning systems is scarce. Recently a motivation model was developed integrating multidisciplinary perspectives together including motivation theories, technology acceptance and dyslexic characteristics for monitoring and analyzing dyslexic learners' motivational needs in the e-learning context [8]. Empirical studies found the twelve motivational factors in the motivation model were significantly crucial to dyslexic learners' sustained motivation to engage with e-learning, consisting of intrinsic factors (Feedback, Perceived Privacy, Self-efficacy, Attitudes Toward School), extrinsic factors (Perceived Ease of Use, Perceived Control, Perceived Usefulness, Visual Attractiveness) and mediators (Learning Experience, Utilization, Confirmed Fit, Reading Experience), which function together on continued intention to use an e-learning system [7, 8, 11].

With the ultimate goal in mind to advance inclusive e-learning for dyslexic learners from a motivational perspective and given a notable lack of related research, the current study aims to investigate: 1) the relationships between severity of dyslexic characteristics and levels of motivational factors in e-learning environments, and 2) dyslexic end users' experiences with a specific e-learning system, i.e., Brightspace. This paper will focus on the first part regarding the quantitative relationships.

2 Method

An online survey was adopted consisting of general background questions and two questionnaires (see details in Materials) to measure levels of motivational factors to engage with e-learning and severity of dyslexic characteristics.

2.1 Materials

The survey began with general background information including age, gender, e-learning platforms that respondents had used, followed by two quantitative questionnaires. The Motivation Questionnaire (MQ) was used to measure levels of the motivational factors in e-learning, consisting of multiple items for each factor in the motivation model, based on a 5-point-likert scale for each item, with high internal consistency [8]. The Dyslexic Adult Checklist (DAC), was used to assess the severity of dyslexic characteristics, targeting literacy, language, and organization [12]. Despite not being a formal diagnostic tool, DAC offered high accuracy of correlation between the self-reporting and formal measures of word recognition and learning difficulties [12]. Finally, open-ended questions explored users' experiences with Brightspace, involving motivation and challenges faced by dyslexic learners based on research [13, 8, 14].

2.2 Participants

With ethics approval obtained from Bournemouth University, fifty-four participants (18 males, 36 females) aged 18-56 ($M = 23.63$; $SD = 7.81$) completed the general questions and questionnaires (i.e., MQ and DAC). Eight of them had been formally diagnosed to have dyslexia, the rest of them showed few to mild signs of dyslexia. All participants were users of e-learning systems in their daily learning activities, including Brightspace ($N = 32$), LinkedIn Learning ($N = 11$), YouTube ($N = 8$), others ($N = 3$).

3 Results

Except Perceived Usefulness and Confirmed Fit, the remaining variables had non-normal distributions according to Kolmogorov-Smirnov tests, so Spearman's correlation was adopted to investigate the association between dyslexia and the motivational factors. Results revealed significant, negative correlations between DAC scores ($M = 31.20$, $SD = 8.17$) and seven of the twelve motivation factors on MQ ($p < .05$), shown in Table 1. There was a moderate, significant correlation between DAC and Perceived Ease of Use, Confirmed Fit, Utilization, and Perceived Control, and a small but significant correlation between DAC and Feedback, Learning Experience, and Reading Experience.

Table 1. Significant correlations (at the .05 level) between DAC and motivation factors.

Motivational factors	Mean (SD)	R coefficient (df=52)	P value
Perceived Ease of Use	3.86 (.81)	-.39	.002*
Confirmed Fit	3.56 (.76)	-.37	.003*
Feedback	3.19 (.72)	-.23	.044*
Utilization	3.49 (.66)	-.32	.009*
Perceived Control	3.43 (.84)	-.30	.013*
Learning Experience	3.46 (.60)	-.26	.028*
Reading Experience	3.32 (.77)	-.27	.026*

4 Discussion and Conclusion

This study advanced the understanding about the relationship between dyslexia and the motivational factors that were found to significantly influence sustained motivation in e-learning environments in previous research [8], providing insights for advancing inclusive e-learning for dyslexic learners from a motivational perspective. The results disclosed significant negative relationships between dyslexic characteristics and seven motivational factors. Perceived Ease of Use were found to be most significantly related to dyslexia, implying that finding an e-learning platform not easy to use might cause dyslexic learners to doubt themselves and negatively affect their literacy skills such as word recognition, which could in turn worsen their perceived ease of use. Similarly, this negative correlation and vicious cycle could apply to the remaining six motivational factors, i.e., Confirmed Fit, Utilization, Perceived Control, Feedback, Learning Experience, and Reading Experience. These factors represent learners' different motivational needs in e-learning environments that should be addressed for continued interaction and engagement, and thus there is no one-size-fits-all solution.

Motivational strategies targeting these motivational needs can be applied to e-learning systems. Further, with the possibility of real-time data collection and computing in e-learning environments, learners' motivational states can be analyzed in real time and used to deliver personalized services or interventions. Previous research found that behaviour data and sensor data including eye gaze and brain activities can be used to predict motivational states in e-learning accurately [11, 15]. Examples of design and motivational strategies include navigation tour, problem probing, progress bar, as well as informative, explanatory and encouraging feedback targeting different motivational needs [8], and some of these strategies have been evaluated [11]. To make e-learning more inclusive to learners with dyslexic traits, the seven motivational factors found related to dyslexic characteristics in this study can be prioritized to be monitored to detect their motivational needs and offer personalized design, assistance, or strategies. Meanwhile, dyslexic learners' fundamental needs relating to accessibility should not be neglected and can be incorporated more widely into universal design for learning and usability evaluation in future, such as the considerations outlined by the Web Content Accessibility Guidelines [16] and Dyslexia Style Guide [17] in relation to accessible font, color contrast, use of images, structure of content and responsive design.

Although this study provides valuable insights, it is a preliminary study and an initial exploration into the topic. Given the limitations about the sample, future research can replicate this study with a larger sample size and a sample with formal diagnosis of dyslexia, considering gender, age, and cultural perspectives. Further, future practice can attempt to integrate more assistive technology software into e-learning systems with empirical research to test its effect on dyslexic learners' motivation. Finally, to improve inclusivity and accessibility for dyslexic learners and all, an iterative, user-centred, inclusive design approach should ensure users with specific learning needs are not excluded from the process so that their needs and requirements are incorporated into design, implementation, and evaluation of e-learning systems.

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