Full Length Article

A model of online reading engagement: Linking engagement, navigation, and performance in digital reading

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ABSTRACT

A model of online reading engagement is outlined. This model proposes that online reading engagement predicts dedication in digital reading. Dedication in digital reading according to the model is reflected in task-adaptive navigation, and task-adaptive navigation predicts digital reading performance over and above print reading skill. Information engagement is assumed to positively predict task-adaptive navigation, while social engagement is assumed to negatively predict task-adaptive navigation. These hypotheses were tested using OECD PISA 2009 Digital Reading Assessment data from 17 countries and economies ($N = 29,395$). Individual task responses served as the primary unit of analysis. Linear mixed models were used to predict navigation behavior from the interaction of information and social online reading engagement with navigation demands. High information engagement was associated with more task-adaptive navigation behavior, as shown by significant positive interactions between information engagement and tasks' navigation demands. In contrast, high social engagement was associated with less adaptive navigation behavior, as shown by negative interactions between social engagement and navigation demands. Generalized linear mixed models were used to predict task performance by the interaction of navigation demands and navigation behavior. Adaptive navigation behavior predicted digital reading task performance, as shown by significant interactions between navigation behavior and navigation demands. These results are in support of the proposed model of online reading engagement.

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1. Introduction

The aim of the present article is to outline a model of online reading engagement, and put forward a test of two crucial parts of this model. In a nutshell, this model assumes that long-term online reading habits (online reading engagement) predict task-adaptive navigation. Task-adaptive navigation means navigation behavior that is responsive to task demands, as information is accessed and processed as required by the task, while task-irrelevant information is discarded. Different effects are assumed for online reading engagement targeted at information seeking (information engagement), versus online reading engagement targeted at social interaction (social engagement). While information engagement is assumed to positively predict task-adaptive navigation, social engagement is expected to

negatively predict task-adaptive navigation. Task-adaptive navigation according to the model predicts digital reading performance over and above print reading skill. These assumptions will be tested in 17 samples of 15-year olds.

1.1. Reading engagement

As of 2014, over 2.4 billion people have access to the Internet worldwide (Miniwatts Marketing Group, 2012). The Internet has grown a major resource for the dissemination of news, opinion, and knowledge. A person who for whatever reason is unable to access these resources will be cut off major streams of societal and political debate. Being in command of online reading skill is crucial for participation in 21st century societies, both in private and occupational contexts. For example, online reading skill will be required to successfully employ ICTs in daily (e.g. OECD, 2013), or occupational life (e.g. when engaging in the process of knowledge sharing using ICTs in the workplace, see Zhang, de Pablos, & Zhou, 2013 and Zhang, Vogel, & Zhou, 2012). One predictor of reading skill in general is reading engagement (Guthrie, Wigfield, & You, 2012). Reading engagement is specifically shaped

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in online reading, as online reading cannot perfectly be mapped upon print reading (e.g. Leu, Kinzer, Coiro, & Cammack, 2004; Rouet, 2006). Engaged reading is motivated, strategic, knowledge-driven, and socially interactive (Guthrie et al., 2004, 2012). Motivated means that readers do not only read for external gains, but are curious about a text's contents, or enjoy reading itself. Strategic means that they employ cognitive and metacognitive strategies such as summarizing, or monitoring comprehension. Knowledge-driven means that readers use their prior knowledge to better understand a text, and use the text to increase their knowledge. Socially interactive means that readers engage with significant others in debating a text's stance, or to share their reading experiences. Guthrie et al. (2012) proposed a framework in which these components of reading engagement are put into a causal order. In this framework, classroom practice and conditions impact motivations to read, which in turn impact behavioral engagement and dedication in reading. These latter processes, behavioral engagement and dedication, ultimately predict reading competence (see also Wigfield et al., 2008).

1.2. Model of online reading engagement

The model of online reading engagement is depicted in Fig. 1. While the model shares a number of assumptions with Guthrie et al.'s (2012) model of general reading engagement, it also makes some additional assumptions. Most importantly, it discriminates between a student level and a task level. Through this, the effects of student level variables, the effects of task level variables and their interactions can explicitly be modeled.

1.2.1. Prediction of digital reading performance

The model seeks at predicting performance in digital reading tasks, a variable that is located at the task level. First, performance is predicted by a student's print reading skills (path p1 in Fig. 1). This is because reading digital text is reading in the first place, and thus skills involved in reading printed text such as word decoding, sentence integration, and situation model formation will impact performance in reading digital text as well. Second, digital reading task performance is predicted by the task, and a student's engagement with that task. In reading digital text, one important part of task engagement is "navigation" (see Lawless & Schrader, 2008, for an in-depth discussion of the 'navigation' metaphor). Digital texts frequently come as hypertexts (e.g. Afflerbach & Cho, 2008). This means that the text is not being read linearly from beginning to end, but the contents is distributed across a number of distinct pages, or 'nodes', which are interconnected through hyperlinks. It is thus left to the reader to find an appropriate selection of text materials. This is even more so as reading digital text typically not only requires selecting relevant text materials, but also not getting distracted by non-relevant materials, be it parts of the text, or accompanying media such as movies, animations, or photos. Previous research has shown that students who get distracted by task-irrelevant contents ("feature explorers", Lawless & Kulikowich, 1996) achieve less in comprehension (see also Salmerón, Kintsch, & Cañas, 2006). These findings are very well aligned with Guthrie et al.'s (2012) general description of behavioral engagement in reading, who coin behavioral engagement in reading 'dedication' (p. 604, Fig. 29.1). It is those students who do a good job in selecting text contents (e.g. Cress & Knabel, 2003; Hsu & Schwen, 2003; Naumann, Richter, Christmann, & Groeben, 2008; Puntambekar, Stylianou, & Hübscher, 2003; Richter, Naumann, & Noller, 2003) and organizing text contents (e.g. Amadieu, Tricot, & Mariné, 2009; Puntambekar & Stylianou, 2005; Richter, Naumann, Brunner, & Christmann, 2005; Salmerón, Cañas, Kintsch, & Fajardo, 2005; Su & Klein, 2006) who

perform well in digital reading. Digital reading performance is thus expected to be predicted by navigation (path p2 in Fig. 1).

Navigation behavior is a broad construct, and can be measured by a multitude of indicators. These may e.g. encompass the linearity or connectedness of a navigational path (e.g. McEneaney, 2001; Richter et al., 2003), the semantic coherence of a navigational path (e.g. Salmerón et al., 2005), or the attendance to task-relevant pages (e.g. Naumann et al., 2008), or the number of page visits overall (e.g. Su & Klein, 2006). How one particular instance of navigation behavior, e.g. the number of page visits, will be associated with digital reading performance is moderated by task demands. Consider integrating information from multiple pages, vs. accessing a piece of information from one page. In case of a complex task requiring a multitude of pages to be accessed, the number of page visits will positively predict task performance. In a simple task, however, where only one page needs to be accessed, a large number of page visits is not task-appropriate behavior and is likely to be negatively associated with performance (interaction i1 in Fig. 1).

1.2.2. Prediction of navigation behavior

Navigation behavior according to the model is predicted by the task (see path p3 in Fig. 1). In general, students will adapt their navigation behavior according to task characteristics. For example, in a complex task that requires the student to integrate information from multiple pages, their navigation will entail more page visits and re-visits than in a simple task that needs retrieval of information that can be found on one single page. On the student level, navigation behavior is assumed to be predicted by online reading engagement. Different predictive patterns are expected for different dimensions of online reading engagement. As previous factor-analytic work has shown, online reading behaviors form two distinct dimensions, one that entails information-seeking activities (information engagement) and one that entails activities directed at social interaction and entertainment (social engagement, see Lee & Wu, 2013; OECD, 2011, chap. 4). Both from theory and previous research, these two dimensions are assumed to have different associations with navigation behavior.

1.2.2.1. Information engagement and navigation behavior.
Information seeking online reading activities (information engagement) comprises behaviors such as reading online news, using online encyclopedia or dictionaries, or using the internet to search for specific information. Activities such as these are frequently carried out while studying. Information seeking activities, such as searching the Internet for a specific topic for a school assignment, often require the student to carefully evaluate search results, to judge whether or not to follow the hyperlinks encountered, and to integrate the contents of the accessed documents into a coherent mental model. In line with these considerations, information engagement has been found to be positively associated with reading skill (Lee & Wu, 2013), and online reading skill (OECD, 2011). There is however no evidence yet regarding the association between information engagement and navigation behavior. The model presented here assumes the following: Information engagement will strengthen a student's skill to navigate adaptively. A student high in information engagement will show a particular instance of navigation behavior, such as a high number of visits and re-visits to hypertext pages, according to task demands. Thus, in statistical terms, the association between information engagement and navigation behavior will be moderated by task demands (interaction i2 in Fig. 1).

1.2.2.2. Social engagement and navigation behavior.
Social interaction oriented online reading activities (social engagement), such as participating in social networks, E-mailing, or playing collaborative games that involve reading online (e.g. Rama, Black, van Es, & Warschauer, 2012; Thorne & Black, 2007), have been reported to