Reversal Adoption Elements of Paper Media in Screen Learning Process

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Abstract: The purpose of this study is to explore elements of reversal adoption, the reason learners want to return from screen media back to paper media in learning situations. For the study, twenty-three college students were asked to write a journal about their experience in screen reading process for five consecutive weeks. They were also asked to describe their experiences after studying a summary of a learning content during a class session. Analysis of data was performed by open coding and axial coding processes of Grounded Theory. The reversal adoption elements were classified into twelve elements of four domains: cognitive domain (interferes engagement, decreases comprehension, interrupts memorization, and delays learning), affective domain (obsession with writing, learning anxiety, dissatisfaction with learning effects, desire for possession, and preference), interface domain (inconveniences in operation, and deterioration of quality), and physical domain (fatigue). All participants felt that they want to change to paper media while learning with screen media. Especially when learning via screen that required in-depth thoughts and understanding, they experienced being prevented from concentration and engagement, obsessed with psychological pressure and anxiety that their learning is failing. These results are expected to provide suggestions in designing digital textbooks.

Keywords: *technology adoption, screen reading, reversal adoption, digital textbook*

INTRODUCTION

Digital textbooks have long been touted as the next generation learning materials that will substitute paper textbooks. However, there are concerns about screen reading that it will hinder understanding compared to paper textbooks. Dillon (2004) reported that in screen reading accuracy and speed were lower than that of paper reading when given challenging tasks. Similar results were reported by David and Dobson (2001) in an experiment comparing linear paper novel reading versus hyperlinked web novel reading. The results showed that even though web-page readers invested more time in reading they were disorganized and understood less than their counterparts. While three-fourth of the participants of web reading reported difficulties in reading the novel, only one-fourth of the paper readers reported difficulties in reading the paper novel. Small and Vorgan (2008) conducted a study analyzing changes in cerebral activation comparing the two.

Despite many studies comparing paper reading versus screen reading, it is hard to find studies considering real learning situations. Learners not just *read* materials, but try to memorize, understand, and synthesize what they come across. This study is conducted in a *learning environment* which not only requires reading, but other learning habits and activities of learners. Furthermore, many studies that deal with screen reading uses quantitative approach which is meaningful in comparing the two different media, however, lacks the *why* and the *how* dimension of the learners. This study explores what the learners feel and experience when learning with *screen media*, and whether and why they chose to use paper media over them. The authors coined the term *reversal adoption* to explain the situation where new technology is not yet suitable to replace the old technology, and the users choose to readopt the old technology.

Research questions are as follows:

1. Will screen learning learners choose to use paper versions?
2. What are the elements that make learners readopt paper media?

RESEARCH METHOD

The participants of the study were 23 university undergraduate and graduate students who were enrolled in an *educational method and educational technology* course, a mandatory course for teacher education majors. The ages ranged from their twenties to thirties. Majoring areas varies: Korean language and literature, psychology, English language and literature, Korean education, biology, philosophy, arts, management, and etc.

The participants were asked to write a journal per week for five consecutive weeks about their experiences in a screen learning process. Due to saturated digital *screen* media surrounding people's everyday life, no restrictions were imposed on what kind of media they could use; smartphones, monitors, laptop computers, or tablet pcs. The participants were also asked to describe their experiences after studying a summary of a textbook during class through LED monitors. They were expected to take a short quiz after reading the summary.

The learners were to write in the journals about the following questions: When learning through screen media, did you ever have an urge to print the materials out or buy paper versions? Have you actually print them out or purchased a printed textbook? Why did you print the materials out? What were the experiences reading and studying through screen media?

Data were analyzed through a 3-step process: protocol reading, coding, and theme development. First, protocol reading was conducted by reading the journals and observation notes written by the participants. Researchers repeatedly read the writings to understand what the learners wanted to convey. Second, coding was done using open coding and axial coding of Grounded Theory (Strauss & Corbin, 1990). Two-hundred sixty-two concepts were identified, and were categorized into four. Third, the development of themes was conducted to find themes that are similar and related to each other. The organized contents were described using researchers' own terms. The data were analyzed using NVivo 10.

RESULTS

No participants claimed that studying through screen media was comfortable and all of them felt urges for paper media. The reversal adoption elements (or why learners chose back to paper version) identified were classified into twelve elements of four domains. They are as follows:

1. Cognitive domain: interferes engagement, decreases comprehension, interrupts memorization, and

delays learning
2. Affective domain: obsession with writing, learning anxiety, dissatisfaction with learning effects, desire for possession, and preferences
3. Interface domain: inconveniences in operation, and deterioration of quality
4. Physical domain: fatigue

Cognitive domain

Cognitive domain can be explained by the experiences in reasoning, memorizing, and comprehending in the process of studying through screen media. Four elements identified were *interferes engagement*, *decreases comprehension*, *interrupts memorization*, and *delays learning*. The participants described that they were distracted by searching Internet or chatting with friends using Social Network Services (SNS). Some said that they never returned to studying due to indulging into other activities. Screen learning resulted in incorrect understanding and was not easy to connect related contents. Due to sporadic reading, they did not grasp the key points and were perplexed by not being able to remember what they just studied. To overcome such incidents, learners tried to read over and over again, which led to delayed learning experiences. Many students reported that due to these unpleasant experiences they either printed out the materials or wanted to purchase printed versions.

Affective domain

Affective domain explains the feelings and attitude acquired during the learning process. Five elements were identified: *obsession with writing*, *learning anxiety*, *dissatisfaction with learning effects*, *desire for possession*, and *preference*. Writing on the learning materials enhances understanding. Some reported that they felt black out, missing something, and craved for writing on the materials when not being able to write on the screen. Anxiety overwhelmed them whether they are on the right track or are being exposed to electromagnetic waves too much. There were thoughts whether they are squandering their time and they are not learning anything. Some reported that they just prefer paper media over digital.

Interface domain

Interface domain refers to environmental issues that hinder learning such as screen size, scrolling, moving through pages, technical errors, and text quality. Two elements, *inconveniences in operation*, and *deterioration of quality* were identified. Students reported inconveniences when screens moved to unwanted areas during scrolling or touching the screen. Small screen size of smartphones irritated learners, and technical errors and deterioration of quality resulted in decrease of learning motivation.

Physical domain

Physical domain represents visual, auditory, tactile, and general health elements that interferes the learning process. *Fatigue* was the sole element identified. Majority of the learners reported that they experienced eyestrain and blurred vision. Pain in the index fingers due to use of mouse, and dizziness were also reported. Others reported neck and back pain. Some said that physical fatigue was too much for them to study through screen media.

CONCLUSIONS

Studies comparing paper reading versus screen reading do not perfectly describe learning that occur through screens since learners not just *read* materials, but they endeavor to memorize, understand, and synthesize what they come across. In the process, learners also engage in physical activities such as writing, marking, and highlighting on them. This study is conducted in a learning environment, which includes reading as well as other learning activities. This study used a qualitative approach to explore the *why* and the *how* dimensions of the learners that switch from screen learning back to paper.

All of the learners reported that they, at some point, felt an urge to use paper versions of learning materials instead of digital versions. The reasons to return back to paper media, *or* reversal adoption elements, were classified into twelve elements of four domains: cognitive domain (interferes engagement, decreases comprehension, interrupts memorization, and delays learning), affective domain (obsession with writing, learning anxiety, dissatisfaction with learning effects, desire for possession, and preference), interface domain (inconveniences in operation, and deterioration of quality), and physical domain (fatigue).

The participants reported that when reading via screen that required in-depth thoughts and understanding, they experienced being prevented from concentration and engagement, obsessed with psychological pressure and anxiety that their learning is failing. The reading devices that are currently out on the market may satisfy readers, however, screen media that learners encounter at present are not well suited for *learning*. When designing learning materials, including digital textbooks, should consider these findings.

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