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Procrastination and other learning behavioral types in e-learning and their relationship with learning outcomes

Q2 Q7 Yoshiko Goda [a,1,2], Masanori Yamada [b], Hiroshi Kato [c], Takeshi Matsuda [d], Yutaka Saito [e], Hiroyuki Miyagawa [f]

[a] Kumamoto University, 2-29-1, Kurokami, Chuo Ward, Kumamoto, Kumamoto Prefecture, 860-0862, Japan
[b] Kyushu University, 6-10-1 Hakozaki, Higashi Ward, Fukuoka, Fukuoka Prefecture 812-8581, Japan
[c] The Open University in Japan, 2-11 Wakaba, Mihama Ward, Chiba, Chiba Prefecture 261-8586, Japan
[d] Shimane University, 1060, Nishikawazu, Matsue, Shimane Prefecture 690-8504, Japan
[e] Tsukuba University, Tennodai, Tsukuba, Ibaraki Prefecture 305-0006, Japan
[f] Aoyama Gakuin University, 4-4-25 Shibuya, Tokyo 150-0002, Japan

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ABSTRACT

Q4 The aims of this longitudinal study were to describe undergraduates' learning behavioral types in e-learning and to investigate their relationship to learning outcomes over an entire semester. This study had two main focuses in respect to those aims: (1) categorization of students' self-paced learning behavior and (2) the relationship between categorized behaviors and learning outcomes. In the first part of the study (Phase 1), 441 students registered in one of five computer assisted language learning (CALL) courses at a national university in Japan were analyzed with regard to their visualization of learning progress. Seven distinct types of learning behavior were identified: (1) procrastination, (2) learning habit, (3) random, (4) diminished drive, (5) early bird, (6) chevron, and (7) catch-up. In the second part of this study (Phase 2), data from 226 students was analyzed. The results showed significant relationships between their learning type and ultimate learning outcomes or TOEIC-IP scores. The students who exhibited the learning habit type scored significantly higher on the test than those students of the procrastination type. The results imply that regulated learning (i.e., forming a learning habit) could increase learning effectiveness and lead to better learning outcomes in e-learning, which is consistent with the findings of previous research in traditional educational settings. Q3

1. Introduction

In higher education, over 70% of students postpone the acts that are necessary for them to reach their goals through a behavior known as procrastination (Schouwenburg, Lay, Pychyl, & Ferrari, 2004), with Ellis and Knaus (1977) reporting that up to 95% of students may in fact be procrastinators. Even in online educational settings such as e-learning, procrastination has been viewed as a problematic behavior. Previous research has indicated that procrastination can lead to students failing academic courses and developing physical and psychological problems (Hussain & Sultan, 2010), consequently lowering their satisfaction with their life (Özer & Saçkes, 2011). Many studies have been conducted on procrastination and they have all found a negative correlation between procrastination and learning outcomes (Tan et al., 2008). However, most of these studies have been conducted in a traditional face-to-face educational setting while few have dealt with the online learning setting (Klingsieck, Fries, Horz, & Hofer, 2012).

Rotenstein, Davis, and Tatum (2009) summarized the procrastination measures utilized in the previous research and reported that valid and reliable measures have not yet been established. Most previous studies employed self-reported scales to measure procrastination. This led to Phase 1 of the present study, which was intended to propose a categorization method for learning behavioral types such as procrastination and other hyperbolic patterns, focusing on the e-learning setting and being based on actual learning behavior.

The aims of this study were to describe definite learning types in e-learning, considering timing and progress of learning, and to investigate the relationships between these learning types and the ultimate learning outcomes. Our research project therefore aims to develop a learning support system for e-learning to provide appropriate and customized feedback in a timely manner, based on learners' actual learning types. The study was positioned to match learning types and their necessary support and to determine the appropriate timing for such learning support.

2. Literature review

2.1. Procrastination

Procrastination has been defined as the delay of initiation or of completion of important tasks (Lay, 1986). In previous research,

E-mail addresses: ygoda@kumamoto-u.ac.jp, yoshikog@gmail.com (Y. Goda).
[1] Permanent address: 1-36-2, Hashiba, Taito-ku, Tokyo 111-0023, Japan. Tel.: +81 80 3096 7884.
[2] Current address: Meinohana-Jutaku #6-21, 5-7, Odo, Nishi-ku, Fukuoka-shi, Fukuoka 819-0001, Japan.

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Table 1
Unit numbers, item numbers, and learning hours of learning materials.

Section	Part	Category	Task	Unit #	Item #	Required learning hours
Listening	1	Photographs	Dictation	13	130	2
			American English	6	30	2
			Other English	6	30	2
	2	Question–response	Dictation	20	166	2
			American English	9	45	2
			Other English	9	45	2
	3	Conversations	Dictation	20	199	3
			American English	18	90	3
			Other English	18	90	3
	4	Talks	Dictation	11	93	3
			American English	13	47	2
			Other English	13	47	2
Reading	5	Incomplete sentences (short passage)	Practices	20	400	7
	6	incomplete sentences (longer passage)	Practices	10	50	5
	7	Reading comprehension	Fast-reading	10	275	4
			Practices	10	50	3
		Total		206	1787	47

procrastination and its effects have garnered much interest. Most research has found that procrastination has a negative effect on learning performance and can also lead to physical and psychological problems (Hussain & Sultan, 2010). These results were consistent even in longitudinal studies (Tice & Baumeister, 1997). Recently, however, procrastination research has entered a new phase, with some researchers suggesting the positive effects of procrastination. Chu and Choi (2005) for example introduced the new perspective that not all procrastination behaviors may be harmful or have negative consequences. They refer to this positive type of procrastination as active procrastination. They describe active procrastinators as those who prefer to work under pressure and who make deliberate decisions to procrastinate. Choi and Moran (2009) developed a new active procrastination scale and identified four factors of active procrastination: (1) outcome satisfaction, (2) preference for pressure, (3) intentional decision, and (4) ability to meet deadlines. Strunk, Cho, Steele, and Bridges (2013) proposed a 2 × 2 model of procrastination with two dimensions of time-related academic behavior and motivational orientation.

2.2. Measuring procrastination

Concerning instrumentation in the research, self-reported scales such as the Procrastination Assessment Scale—Students (PASS), which was initially proposed by Solomon and Rothblum (1984), and Lay's (1986) scale were employed in many of the previous studies. However, the scales' correlation with actual learning behavior was found to be low in the content analysis by Rotenstein et al. (2009). They summarized the procrastination measures used in previous research in a table (p. 225); most of the research used self-reported scales and analyzed the data with the scales inferentially. Other studies reported a weaker relationship between the Procrastination Scale scores and behavioral measures of procrastination ($r = -.54$ in Tuckman, 1991; $r = -.38$, in Howell, Watson, Powell, & Buro, 2006). Although the correlation seems low, the inferential statistics show the significance. Thus, the categorization method of learning behavioral types based on actual learning records should be further investigated. There is a plausible explanation for the inconsistency in research results between the measurements and actual procrastination. According to Steel's (2007) meta-analysis, actual postponing (state procrastination) is affected by a personal tendency to delay tasks (trait procrastination), and trait procrastination tends to be stable regardless of situations and time durations. If the trait procrastination is relatively constant, these two kinds of procrastination may affect the results of the relationship between scores on scales and actual behavior. Thus, more longitudinal research on the matter should be conducted.

2.3. Dynamic nature of procrastination and modeling

Some researchers challenge the model of learners' academic procrastination. Moon and Illingworth (2005) employed a latent growth curve analysis with actual procrastination behavior, test performance, and self-reported levels of trait procrastination for 303 students. They pointed out that self-reported measures did not predict temporal changes in procrastination and test performance. They also found that both high and low procrastinators followed the same trajectory over time. From our own observation, there seem to be differences as well as similarities between high and low procrastinators' behavioral patterns.

Wäschle, Allgaier, Lachner, Fink and Nückles (2014) focused on the relationship between procrastination and self-efficacy in self-regulated learning cycles through a weekly web-based self-monitoring protocol. In their longitudinal research, they found amplifying feedback loops of low self-efficacy and perceived goal achievement in procrastination. They concluded that students exhibiting low self-efficacy are vulnerable to the undesirable loop of procrastination. The regression results of McElroy and Lubich (2013) showed that a marked delay in making a first class posting could be an alert for possible procrastinators. This implies that a delay in initial activities could be a useful clue in identifying possible procrastinators.

Several indicators of procrastination have been suggested in previous research. However, our research interests are to find appropriate support for learners' needs for all types of learning behaviors. The uniqueness of this study is to identify other learning behavior types besides procrastination in the online educational setting.

2.4. Learning behavioral types for e-learning

e-Learning provides less restrictions on learning as students can learn at any time and in any place. However, the lower constraints of this learning setting necessitate self-regulation by students (Authors, 2013; Lynch & Dembo, 2004; Michinov, Brunot, Bohec, Juhel, & Delaval, 2011) and intrinsic motivation (Wighting, Liu, & Rovai, 2008). Unlike traditional instruction, in e-learning it is easy to accumulate learning logs and records from inside and outside the classroom. This helps researchers to analyze the learning process even when there is a large amount of data. Hung and Zhang (2008) tried to study online learning behavior and activity using the data mining technique on 17,934 server logs. They found that most learning activities were passive, involving just reading or accessing course materials, although collaborations were strongly emphasized during the classes.

Some studies focusing on the online educational setting have also demonstrated that procrastinators experience negative effects in their

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