

A Learning Strategy to Compensate for Cognitive Overload in Online Learning: Learner Use of Printed Online Materials

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Abstract

The purpose of this study was to investigate the relationship between achievement and the quantity of online course materials that students printed and the frequency with which they reported using them. One hundred thirty-two graduate students from one of 11 hybrid or online classes voluntarily completed a self-report survey asking how much they printed (0%, 25%, 50%, 75%, 100%), how often they used printed materials (almost never, rarely, sometimes, often, almost always), and preference for either print, onscreen, or none. Neither quantity printed nor frequency used was related to achievement. But learner preference was associated with achievement; onscreen preference learners had higher mean rank scores than print and no preference learners. There were no achievement differences between the online and hybrid learner groups. Learners, who printed more, used more and preferred print online materials and experienced more onscreen reading difficulty than learners who printed less. Learners who used print materials more preferred reading printed materials, had difficulty reading onscreen, and were older.

The convenience and accessibility of online courses attract educators and students; 90% of United States' public universities offer online courses and half of them offer online degree programs; over 1.3 million students were enrolled in public university online courses by 2002-2003 (Allen & Seaman, 2003). Online learners conveniently study anytime and anywhere while accessing rich online resources through course website links. However, online learning inherently requires more cognitive resources than does face-to-face learning and places a cognitive load on online learners that may affect their learning achievement (Bruggen, Kirschner, & Jochems, 2002; Brunken, Plass, & Leutner, 2003; Gerjets & Scheiter, 2003). The purpose of this study was to investigate the relationship between online student use of printed online materials and their learning achievement.

Educators suggest learners adopt appropriate online learning strategies that can compensate cognitive load in online learning and some suggest online courses should be grounded in cognitive load theory (CLT) (Bruggen et al., 2002; Gerjets & Scheiter, 2003; Shapiro & Niederhauser, 2004). A good selection of online learning strategies can minimize learning difficulties and maximize learning performance (Pressley & McCormick, 1995). However, which online learning strategies most effectively alleviate cognitive load and optimise learning are yet to be discovered although students may already be using strategies to compensate for the cognitive load associated with online learning.

The majority of online learners print online course materials (Joinson, 1998). Learners have reported various reasons for printing online materials: convenience, ability to highlight and write comments on the materials, avoidance problems associated with onscreen reading, etc. (Hatch, 2002; Joinson, 1998; Martin & Platt, 2001). Learners in these studies may be

unconsciously attempting to reduce cognitive load by moving online materials to a printed materials format. However, few studies reporting learners' reasons for printing online materials have identified how or whether the practice substantively contributes to learning achievement. Cognitive load theory suggests that printing online instructional materials may be a learning strategy to compensate for the cognitive load inherited in online learning. If this is the case, printing online materials may improve learning achievement. We therefore expected students who reported printing more materials and using them more frequently would earn higher course grades than those who did not.

Cognitive load refers to "the manner in which cognitive resources are focused and used during learning and problem solving" (Chandler & Sweller, 1991, p.294). Two sources of cognitive load, intrinsic and extraneous, have implications for instruction; the former cannot be avoided and the latter should be reduced. Intrinsic cognitive load refers to the number of elements and the degree of interactivity required by the learning materials (Sweller & Chandler, 1994; Sweller, Merrienboer, & Paas, 1998). Just how many cognitive elements have to be processed simultaneously for schema construction or element interactivity depends on the relational complexity of the learning content and the learner's schema (Gerjets & Scheiter, 2003). "Intrinsic cognitive load through element interactivity is determined by an interaction between the nature of material to-be-learned and the expertise of the learner" (Sweller et al., 1998, p.262). For example, to learn that $2 \times 2 = 4$, a learner unavoidably must read and apply multiplication rules on the information. Therefore intrinsic cognitive load is solely determined by the nature, or the element interactivity, of the learning materials that are inherent to the desired learning outcome and cannot be reduced through instructional design (Sweller & Chandler, 1994). In sum, learning requires intrinsic cognitive load by the very nature of the process.

On the other hand, "extraneous cognitive overload is one that is imposed purely because of the design and organization of the learning materials rather than the intrinsic nature of the task" (Sweller & Chandler, 1994, p.192). Extraneous cognitive load occurs when learners are required to engage in irrelevant cognitive activities not directed toward schema acquisition and automation; it does not facilitate and may even hinder learning (Sweller & Chandler, 1994; Sweller et al., 1998). Therefore all aspects of course design should eliminate irrelevant cognitive activities, reduce extraneous cognitive load, and subsequently, facilitate learning (Sweller & Chandler, 1994; Sweller et al., 1998). Based upon empirical evidence, Chandler and Sweller (1991; 1992) identified two sources extraneous cognitive load cost the learner time and effort: split attention and redundancy. Split attention effect occurs when the learner must divide his or her attention among multiple information sources and then cognitively integrate segments of information to make them intelligible. Whereas attending to multiple sources, such as the audio and video tracks of one movie; or of the pictures that complement text, enhances learning, split attention undermines it. Redundancy effect occurs when learners process duplicate information from two different sources although each can be understood in isolation. Learner attention to redundant material interferes with schema acquisition and automation (Chandler & Sweller). Therefore, eliminating redundant materials and arranging information to avoid splitting the learner's attention should enhance learning.

Cognitive Load in Online Learning

Studies report that online learning places more cognitive load on learners than does traditional face-to-face learning because online learners engage in various activities that do not directly facilitate schema acquisition and automation (Bruggen et al., 2002; Gerjets & Scheiter, 2003; Mayer & Chandler, 2001). These irrelevant cognitive activities contribute to extraneous cognitive load for online learners (Eveland & Sharon, 2000; Niederhauser, Reynolds, Salmen, & Skolmoski, 2000; Shapiro, 1999). Online learning involves activities such as accessing course websites, navigating multiple-linked materials, determining the relevance among hyperlinks, getting lost in cyberspace, and solving technical and Internet connection problems, all of which split the learner's attention and increase extraneous cognitive load (Harter, 1986; Marchionini, 1988; Nielsen, 1990). Although information presented on multiple web pages and in two or more formats (e.g. text, graphic, audio, video, animation, etc.) is common in online learning, it causes redundancy effects and increases extraneous cognitive load for online learners (Bruggen et al., 2002; Brunken et al., 2003; Sweller et al., 1998). While these activities may be necessary to engaging in successful online learning, they are not directed to schema acquisition and automation for the to-be-learned materials (Sweller & Chandler, 1994; Sweller et al., 1998) and, therefore, can contribute to extraneous cognitive load.

Using Printed Online Materials to Decrease Extraneous Cognitive Load

Extraneous cognitive load arising from split attention and redundancy effects in online learning might be reduced by printing online materials, a common practice among online learners (Barker & Tedd, 1999; Cakir, Hart, & Stewart, 1980; Muter, 1982). By using printed online materials for study, the learner should reduce irrelevant access and navigation cognitive activities. Furthermore learners should be able to more easily identify and compare redundant information presented on multiple web pages or in two or more formats. They should be able to scan much more text by arranging multiple pages on a surface and relatively easily and quickly move suspected redundant printed sources adjacent to each other, compared to scrolling up and down computer screens, arranging multiple small application windows, or switching among several windows. Regardless whether the learner uses onscreen or printed materials, finding, organizing, and comparing multiple information sources imposes an extraneous cognitive load. While both onscreen and printed materials impose an extraneous cognitive load, evidence suggests that onscreen materials may impose more cognitive load than printed materials. Learners may not only prefer printed materials to onscreen materials (Barker & Tedd, 1999; Cakir, Hart, & Stewart, 1980; Muter, 1982) but they may also be using them to reduce the extraneous cognitive load; concomitantly, they may have more time and effort to spend on the inherent intrinsic cognitive load presented in the to-be-learned materials.

Therefore, learners who spend more time and effort on learning, that is, intrinsic cognitive load, should learn better than learners who spend less, although there have been few studies investigating the relationship between printed online materials and learning achievement. If learners are compensating for the extraneous cognitive load by printing online materials and using printed online materials, does the practice improve their learning? This study investigated two research questions. First, do higher-achieving learners report printing a greater amount of the online materials than lower-achieving learners? Second, do higher-achieving learners report using printed online materials more often than lower-achieving learners?

Method

One hundred thirty-two graduate students, 97 females and 35 males, participated in the study. Each was enrolled in at least one of four courses in an instructional technology program at a southwest public university. Participants reported completing an average of three online courses; 4 had no previous online experience while 128 had completed at least one online course (*Mdn* = 2, *mode* = 0). Twenty-one of the 132 participants were between 18 and 25 years old; 55 were between 26 to 35 years old; 56 were 36 or more years old. One-hundred-and-nine of the 132 participants spoke English as a native language. Participants' prior online course experience, native language, and gender were not associated with learning achievement or the quantity or use frequency of printed online materials.

Courses

This study was conducted in multiple sections of four graduate courses in one of two delivery modes. Table 1 lists the instructors, delivery modes, semester section was offered, and number of participants for the four courses. Each course was taught using the same online instructional website and materials in the same website by the same instructor. There were two course delivery modes, online and hybrid. Online courses were delivered online exclusively with course websites; there were no face-to-face class meetings. All participants accessed course websites for instructions, assignments, online discussions, and online activities. Hybrid courses had at least 8 face-to-face class meetings, while the remaining class meetings were replaced with online activities conducted through course websites. Regardless of online or hybrid delivery mode, each course had identical course materials and activities included textbooks, syllabi, instructions, assignments, quizzes, and emails within the course websites. The instructor presented selected online materials, elaborated upon key concepts, and answered questions face-to-face only in the hybrid class, while there were no analogous activities in the online classes.

Course 1, Cognition and Instruction, required participants to read online materials and textbook, participate in online activities including posting concept definitions onto online discussion board and taking online quizzes, and then create instructional methods as instructed in assignments. Course 2, Web Design & Development, asked participants to read online materials and textbook, participate in online or face-to-face class discussions, and then, individually, design and develop instructional websites proposed by him/herself. Course 3, Project Management, required participants to read online content, 3 textbooks, participate in online activities, take online quizzes, and, in assigned teams, write a team grant proposal. Course 4, Performance Technology, required participants to read an online syllabus, 3 textbooks, and individually complete 3 problem-solving activities using performance technology analytical techniques.

Table 1
Instructors and Delivery Modes for Courses

Course Title	n	Instructor	Delivery Mode	Semester
1: Cognition & Instruction	59	A	Online	Fall, Spring, Summer
2: Web Design & Development	12	A	Online	Fall
2: Web Design & Development	7	A	Hybrid	Spring
3: Project Management	9	B	Hybrid	Spring
4: Performance Technology	35	B	Online	Fall, Summer
4: Performance Technology	10	B	Hybrid	Spring

Note. N=132. Academic Year: 2002-2003.

Measures

Learning achievement. The dependent variable, learning achievement, was the total score (0-100 points) a participant earned in a course excluding the 5% bonus points for participating in the research. The instructor of record, one of the two researchers, determined each participant's total score in a course. Then, each total score was converted to a 100-point scale based on the course maximum score.

Quantity and use frequency of printed online materials. A self-report survey asked participants to estimate what percentage (0%, 25%, 50%, & 100%) of the online course content they printed and how frequently (almost never, sometimes, often, & almost always) they used printed online materials. Self-report surveys are appropriate, if not ideal, measures for behaviors that are difficult to observe directly (Needle, Jou, & Su, 1989; Sudman & Bradburn, 1982; Tourangeau, Jobe, Pratt, & Rasinski, 1997) as was the case for printing online materials. On the other hand most students keep the printed materials and would therefore have physical evidence to reference when self-reporting the quantity they printed. In this study, a self-report survey was appropriate since students had physical evidence of what they printed. The behavior of interest was difficult for researchers to observe but was easy for students to report with physical evidence, printed materials. There was one self-report item to measure quantity printed and one to measure frequency use. Each item had content validity since the item asked respondents to report their recollection of each for the course. Given that there was one self-report item to measure the quantity of printed materials and one item to measure the use of materials, it was not possible to calculate the reliability for either measure of the two variables of interest.

Material format preference and onscreen reading difficulty. The material format preference was a participant's reported choice of learning among one of three formats (computer-screen, no-preference, or printed-paper). Participants reported onscreen reading difficulty by indicating yes or no in response to the item asking if they had experienced onscreen reading difficulty. Each participant reported his or her preference for online materials or printed

materials, prior experience in online courses, and his or her reasons for printing online materials, by writing a brief statement.

Procedure

The self-report survey was administrated online during the last two weeks of each course. In each course the instructor-researcher invited learners to participate with a message on the course discussion board that contained a link to the online form. In the hybrid courses, instructors reminded students to read the instructor's online invitation to participate in this study. Voluntary participants earned an incentive, bonus points equivalent to 5% of the course grade. The instructor recorded participants' names for giving bonus points although data were analyzed without including participant names and bonus points.

Data Analysis

The learning achievement data failed homogeneity of variance tests (Levene's test $p < .05$), thereby violating an assumption required for parametric statistical analysis. Thus, nonparametric data analyses with an a priori .05 significance level were used. Kruskal-Wallis tests determined if learning achievement, an interval dependent variable, was related to either quantity of printed materials and use frequency of printed materials, two ordinal independent variables. Mann-Whitney tests determined if learning achievement was associated with either delivery mode or onscreen reading difficulty, two dichotomous independent variables; or if age was related to the learner's onscreen reading difficulty. Also Kruskal-Wallis tests determined if there were any relationship between age and quantity of printed materials or between age and use frequency of printed materials, all three operationally defined as ordinal variables. The participants' open-ended responses to one item asked their reason for using print materials and one researcher read and classified responses into categories representing the same kinds of activities.

Results

Of the 132 (97 female and 35 male) graduate student participants, 106 (80%) were in online courses and 26 (20%) were in hybrid courses. Nonparametric descriptive statistics for quantity of printed materials use frequency of printed materials, format preference, and onscreen reading difficulty are displayed in Table 2. The learning achievement median was 91.53 (mode = 97.00; range: 61 to 100) on a 100-point scale. Eighty-seven (66%) of participants printed 75-100% of online materials and 92 (76%) of participants reported that they often or almost always relied on printed materials for study. Among the 87 participants who printed 75% or more of the materials, 64 preferred reading printed-paper, and 57 indicated they had difficulty reading onscreen. Of the 92 who often or more frequently used printed materials, 65 reported they experienced onscreen reading difficulty. Among the 79 participants reporting onscreen reading difficulty, 72 preferred the printed-paper, 45 were 36 years of age or older; and 28 were between age 26 and 35.

Table 2
Frequencies and Percentage of Observed Variables

Observed Variable	Level	Frequency	Percentage
Quantity of printed materials (<i>Mdn</i> = 3)	0 = 0% of material printed	4	3%
	1 = 25% of material printed	20	15%
	2 = 50% of material printed	21	16%
	3 = 75% of material printed	63	48%
	4 = 100% of material printed	24	18%
Use frequency of printed materials (<i>Mdn</i> = 3)	0 = I almost never look at the printed materials	3	2%
	1 = I rarely look at the printed materials	5	4%
	2 = I sometimes use the printed materials	24	18%
	3 = I often rely on the printed materials	66	50%
	4 = I almost always rely on the printed materials	34	26%
Preference of material format	Computer-screen	12	9%
	No preference	35	27%
	Printed-paper	85	64%
Onscreen reading difficulty	Yes	79	60%
	No	53	40%

Note. N=132.

Learning Achievement

A Kruskal-Wallis test indicated that learning achievement was not significantly associated with either the quantity ($\chi^2(3, N = 132) = 5.91, p = .20$) or the use frequency ($\chi^2(3, N = 132) = 0.53, p = .97$) of printed online materials. However, a Kruskal-Wallis test ($\chi^2(2, N = 132) = 7.79, p = .02$) indicated a significant association between learning achievement and the learner preference of material format. The computer-screen preference learners had the highest mean rank (78.38) followed by the printed-paper preference learners' mean rank (71.04) and the no-preference learners' mean rank (51.41). Course delivery mode was not significantly related to learning achievement (Mann-Whitney $U(N = 132) = 1364.50, p = .94$).

Quantity and Use Frequency of Printed Materials.

A Kruskal-Wallis test indicated quantity of printed materials was significantly associated with three other factors: the use frequency of printed materials ($\chi^2(3, N = 132) = 14.87, p = .00$), learner format preference ($\chi^2(2, N = 132) = 24.75, p = .00$), and reporting onscreen reading difficulty (Mann-Whitney $U = 1488.50, p = .01$). Furthermore a significant relationship was found between the use frequency of printed online materials and onscreen reading difficulty (Mann-Whitney $U = 1384.50, p = .00$) and age (Kruskal-Wallis $\chi^2(2, N = 132) = 10.24, p = .01$). Also, participant age was significantly associated with onscreen reading difficulty (Kruskal-Wallis $\chi^2(2, N = 132) = 20.03, p = .00$). Overall, the most common documents printed were syllabi and assignments.

Purposes of Using Printed Online Materials

Participants reported five reasons for using printed online materials. These reasons followed by the number of participants reporting the reason are: locating specific information, 50; accessing printed online materials, 28; making notes on materials, 24; avoiding reading onscreen, 12; and monitoring learning progress, 9. Each of the operationally defined categories emerged from the responses. Locating information referred to statements related to rearranging the printed materials for finding information easily and efficiently. Accessing materials included statements about accessing printed course materials for study anywhere and anytime without an Internet connection. Making notes on materials included statements associated with writing comments and highlighting important points. Avoiding onscreen reading referred to statements concerning participants' preventing physical discomfort such as eyestrain and headache induced by reading on screens. Monitoring learning progress referred to statements about keeping up with the course calendar and checking off items that were completed.

Age

Although not hypothesized, the data indicates older learners used print materials more often than younger learners (Kruskal-Wallis $\chi^2(2, N = 132) = 9.58, p = .01$) while they printed the same amount of materials (Kruskal-Wallis $\chi^2(2, N = 132) = 4.61, p = .10$). The mean rank of use frequency of printed materials for older learners (36 and more year-old) was 77.02, for 26-35 year-old learners was 61.19, and for less than 26 year-old learners was 53.36. Older learners also encountered onscreen reading difficulty more often than younger learners (Kruskal-Wallis $\chi^2(2, N = 132) = 20.02, p = .00$). The mean rank of onscreen reading difficulty for older learners (36 and more year-old) was 80.04, for 26-35 year-old learners was 60.60, and for less than 26 year-old learners was 45.86.

Discussion

Like earlier studies, most participants reported printing most online materials and using them very often; this finding confirmed previous findings (Hatch, 2002; Joinson, 1998; Martin & Platt, 2001). Furthermore, students who printed more were more likely to use the materials, prefer printed materials, experience more difficulty reading on-screen, and were older. Overall, these findings lend support to cognitive load theory, which suggests that using printed online materials may be a strategy to compensate for high demand cognitive load arising from online learning.

Contrary to our hypotheses, there was no relationship between achievement and either the quantity or use of printed online materials, but evidence suggests participants used printed online materials to decrease irrelevant cognitive activities in both hybrid and online classes. Consistent with previous findings learning achievement was unrelated to delivery mode (Carini, Hayek, Kuh, Kennedy, & Ouimet, 2003; Clark, 1994; Russell, 1999). Participants' self-reported purposes for using printed materials further confirmed learners' intentions to reduce extraneous cognitive load; the three most commonly identified purposes were to easily and efficiently locate specific information, to access course materials, and to make notes on materials. The first two purposes implicitly indicate participants' intentions to decrease the frequency and necessity for accessing, navigating, and scrolling up and down in the course websites. The third purpose may have been an activity for reducing extraneous cognitive load or an artifact of intrinsic cognitive load. Making notes, depending upon what kind of notes they make, may be either the learner cueing some logistical action, such as, a learner making a note to his/herself to read text assignment, or explicitly integrating information into his or her schema, such as, a learner making a note to compare definitions from online materials to those in the textbooks. The learners' comments were insufficient to determine whether his/her intention was a logistical action or information verification and which of the actions were intended to decrease extraneous cognitive load or were initiated by intrinsic cognitive load.

Many learners in the study intentionally printed online materials as a strategy to compensate for the extraneous cognitive load inherent to online learning. About two thirds of the learners printed more than three-fourths of the online materials and about two-thirds stated locating or accessing information as their primary purpose for printing. Consistent with previous findings, accessing, navigating, and scrolling on screen in course websites neither promoted schema acquisition nor automation of the intended learning, both of which impose extraneous cognitive load (Chandler & Sweller, 1991; Sweller & Chandler, 1994; Sweller et al., 1998). Learners' effort to decrease their extraneous cognitive load may have decreased the time and effort to complete assignments without increasing their learning achievement.

The quantity and use frequency of printed materials were associated with each other but unrelated to learning achievement. Learners who printed more materials and used them more often did not earn more course points than those who printed less or used them less often. This fact suggests that printing and using online materials may improve learning efficiency but may not be sufficient to improve learning effectiveness. Using printed materials, a single online learning strategy, was sufficient for decreasing extraneous cognitive load but not for increasing learning achievement. Learners may require additional learning strategies to improve learning achievement since online learning requires "sophisticated individual management and evaluation of one's learning process" (Land & Hannafin, 1996, p.40). Therefore online learners must use multiple cognitive and metacognitive strategies in order to manage and construct their understanding (Hill, 1997; Land & Hannafin). Using printed online materials may have reduced extraneous cognitive load, however, it was not sufficient to promote schema acquisition and automation any better than using onscreen materials would have been.

The majority of learners preferred printed materials to computer-screen materials, which is consistent with previous results (Barker & Tedd, 1999; Cakir et al., 1980; Muter, 1982). However, computer-screen preference learners earned higher course scores than did printed-paper or no-preference learners. The computer-screen preference learners may have already developed effective online learning strategies while print preference learners may have yet to discover effective online learning strategies, and the no-preference learners may have been in the

process of developing online learning strategies. The online learning format may require specific online learning strategies to decrease extraneous cognitive load and to increase learning achievement. Good accommodation to any new learning format, a critical element to effective online learning, minimizes learning difficulties and maximizes learning effects (Li, 2003; Pressley & McCormick, 1995). Although both print and no-preference learners may have consciously or unconsciously used printed online materials to accommodate the online learning format and to improve their learning efficiency, they have yet to develop effective online learning strategies.

Learning problems associated with age influenced online learning processes. Older learners experienced onscreen reading difficulties more often than younger learners did. This finding suggests that older learners may have experienced difficulty mastering online learning strategies, such as accessing, navigating, and reading online materials. Online course design for older learners could decrease the amount of onscreen reading to facilitate older learners as they develop online learning strategies.

These results must be interpreted with caution given two limitations of this study: using a self-report measure and providing an incentive for participation. Self-report surveys have been identified as a threat to validity (Brown, 1999; Supple, Aquilino, & Wright, 1999) given the possibility that participants may misrepresent their behaviors to researchers (Goffman, 1959; Welte & Russell, 1993). Goffman suggests that individuals consciously portray themselves in a manner that conforms to social norms or instructor expectations. On the other hand online instruction is so new there are no widely accepted norms or expectations for printing course materials which means that social conformity was probably not an issue for self-reporting printing and using print materials. Lower-achieving students may have over-reported study activities unintentionally since they may be prone to over-estimating their learning activities when asked if they use a particular strategy (Ley & Young, 1998; Young & Ley, 2000, 2001). Another source of data bias may have been from learners who participated to earn bonus points without regard to the accuracy of what they reported. While we could not verify any bias, we have interpreted the results with appropriate caution.

Conclusions

This study investigated the role of print and online materials in extraneous cognitive load and learning achievement. The findings revealed that learners used printed online materials to compensate for the extraneous cognitive load inherent to online learning. Learners sought to reduce extraneous cognitive load from irrelevant cognitive activities in course websites. Although unrelated to learning achievement, learners used printed online materials to provide anytime, anywhere access to online materials. Online learning achievement was not affected by just printing and using materials; therefore enhancing online learning achievement may require online learners to use more effective learning strategies and online courses to provide more effective instructional strategies. The results are consistent with previous findings that instructional media do not affect learning achievement significantly (Carini et al., 2003; Clark, 1994; Russell, 1999).

Findings of the current study strongly suggest that using printed online materials decreases extraneous cognitive load in online learning and make learning more efficient. Further research should explore how to reduce extraneous cognitive load and increase online learning achievement. Would suggesting a guideline such as printing online text with explanation of how to use printed materials help inexperienced online learners learn more efficiently and effectively than if they do not receive the guidance? Future studies should explore if higher achievers use

printing online materials with other strategies to reduce extraneous cognitive load and increase learning. Future studies could identify which learning strategies expert, online learners use to reduce extraneous cognitive load and, correspondingly, if lower-achieving learners use fewer or different online learning strategies to reduce extraneous cognitive load. Last but not least, future studies should investigate whether learners who use more efficient strategies to reduce extraneous cognitive load spend more time on learning, that is, more time and effort on intrinsic cognitive load, and, subsequently, learn more with less time and effort than learners who do not.

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