

The relationships among science-related major students' information commitment, mental load and mental effort

Ya-Hui HSIEH^{a*} & Chin-Chung TSAI^b

^{a*}*Graduate Institute of applied science and technology, National Taiwan University of Science and Technology, Taiwan*

^b*Graduate Institute of Digital Learning and Education, National Taiwan University of Science and Technology, Taiwan*

*only_no1@hotmail.com

Abstract: This study was conducted to explore the relationships among science-related major students' information commitment, mental load and mental effort. The sample included 314 college students in Taiwan. The correlation analysis revealed the obvious relationships between ICs and mental load. Students who have sophisticated information commitment tended to experience low mental load. On the other hand, students who have superficial information commitment experienced more mental load. The finding was suggested that students may need an appropriate training for learning in the web-based environment with information seeking activities indispensably. Educators could help students develop superior searching strategy and the ability of information commitment to reduce the experience of cognitive load.

Key words: Information commitment, mental load, mental effort.

Introduction

The development of computer technology has changed people's way of learning and has nurtured numerous innovations in education. Prior studies have shown that online searching strategy was one of the important factors that determine the successful learning in web-based learning environment [1]. A conceptual framework named "information commitment" was referred to the evaluative standards which web users utilize in order to assess the accuracy and usefulness of web-based materials [1]. Different searching results can be viewed as an indicator of their online learning performance [2]. Comparison with experts, relative research found out that the students expressed more inferior strategies to information searching and lower criterion of utilizing it for further information [1]. Also, individual with maturely internet experience will express superior searching strategies and tend to utilize divers information commitment standards to judge information [2].

Online learning scenarios could be more complex for learners when they have to face the material without additional instructional explanations. According to the cognitive load theory, the amount of information human can handle are rather limited in working memory [3]. Human working memory can handle only a very limited number of novel interacting elements [4]. Therefore, the improper design of learning contents is likely to increase the mental load experience for students [4]. Thus, the more uncertain, complicated and conflict the information is, the more mental load the students will experience and have to engage in more mental effort to understand the inappropriate structure web

materials. With using the web information, learners have to do more effort to help mentally integrate the resources to achieve more understanding and perhaps influence learning outcome. Relative research found out that learners with the ability to use sophisticated strategies were experienced less load and showed better performance [4]. It is inevitable to concern how the correlations between the mechanisms of individual's cognition are related and how they possess the online information. However, the issue of the relationship between cognitive load and information commitment has been lacking. Mental load and mental effort can be conceptualized as the basic measurement of cognitive load [4]. Authors [4] describe that "Mental load is imposed by the task and subject characteristic; mental effort refers to the amount of capacity or resource that is actually allocated to accommodate the task demands." The objective of this study was to explore the relation between students' information commitment and mental load and mental effort experience. The detail research questions are described:

1. What are the correlations between students' information commitment and mental load?
2. What are the correlations between students' information commitment and mental effort?

Methodology

1. Participant

The participants of this study included 341 college science-related major students (245 male and 96 female), from higher education institutes in Taiwan. According to the survey data, the students aged from 19 to 25 years old with experiences of using Internet and online search engines.

2. Instruments

In this study, all of the participants answered two questionnaires online. The information commitment survey used in the present study was designed by Wu and Tsai [1], including six scales: multiple sources, authority, content, technical, elaboration and match. According to Tsai [1], the three information commitments—that is, "multiple sources," "content" and "elaboration"—were sophisticated information commitment while the others were considered less sophisticated. The total 30 items were presented with 1-5 Likert scale, from "strongly disagree" to "strongly agree." The reliability coefficients for these scales ranged from 0.70, 0.81, 0.87, 0.79, 0.84 and 0.74, with an overall alpha value of .87. It indicated satisfactory reliability of assessing students' ICs.

The cognitive load survey, proposed by Sweller et al. [3], was adopted to measure students' mental load and mental effort experience. The survey included two categories: mental load and mental effort. The mental load concerns the task-based dimension that refers to the instructional design; the mental effort, the learner-based dimension that refers to the extent of individuals' working memory engagement [3]. Each category included two items presented with 1-5 Likert scale from "strongly disagree" to "strongly agree." The reliability coefficients for these scales were ranged from 0.88 and 0.74, with an overall alpha value of .83. It indicated the satisfactory reliability of assessing the experience of mental load and mental effort.

Results and conclusion

Table 1 suggests the relations between students' ICs and experience of mental load and mental effort, revealing that the students with sophisticated ICs tended to have less mental load. The correlation analysis revealed that the mental load was positively related to the factors "Authority" and "Match" yet negatively correlated with the scales of "Multiple source", "Content" and "Elaboration", which were considered as more mature information commitments. The result indicated that students who tended to access the accuracy through "Multiple sources" judge the usefulness through "Content" and employ the "Elaboration" strategy experienced less mental load. Students with more sophisticated ICs are more capable of using more refined strategies to avoid the load of instructional design. Also, the result indicated that the mental effort was positively related to the "Match", and negatively related to the "Authority". Mental effort was relevant to the load that students need to use more efforts while interacting with the learning material in the learning environment [4]. As above result of the relationship between "match" and "mental effort", the students in this study were just eager to find relevant information without purposefully integrating the information when they search for the websites. On the other hand, students who tended to use the "Match" searching strategy may experienced more mental effort, probably because it was harder to find the best answer in the online learning environment. However, it is worth to note that the inferior strategy also leads students to experiencing more mental load. The inappropriate design of online material will increase more cognitive load of students and thus may hinder their learning [4]. For instructors, it is amiss to leave students learning in the web which as vast as ocean and without any supplementary measure. Thus, it is safe to suggest that students who accessed the accuracy of science information through "Authority" tended to experience lower mental effort. For example, when they accessed the information from government website, students did not need to use too much effort. However, the result also indicated that students have more mental load experience as regard to examine the unknown online information by the authority of the websites. Do the websites which wrapped in the feature of authority such as the famous, governmental, and professional websites require more mental load experience on students? It may be interesting to further investigate how students identify the authority in the online environment.

To sum up, the result indicated that the mental load was more relative to ICs. It suggested that it is necessary to guide appropriate sophisticated strategies for students in online environment to reduce the cognitive load. Moreover, future research can use observations, interviews to conduct an experiment design to further confirm the relationships.

Table1 The correlations analysis CIs and experience of mental load and mental effort.

	Multiple source	Authority	Content	Technical	Elaboration	Match
Mental load	-.13**	.16**	-.17**	.06	-.13**	.35**
Mental effort	-.10	-.18**	-.06	.03	-.01	.31**

**p<.01

References

- [1] Tsai, C. C. (2004). Information commitments in Web-based learning environment. *Innovations in Education and Teaching International*, 41, 105-112.
- [2] Wu, Y. T., & Tsai, C. C. (2005). Information commitment: evaluative standard and information searching strategies in web-based learning environments. *Journal of Computer Assisted Learning*, 21, 374-385.
- [3] Sweller, J., Van Merriënboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10(3), 251-297.
- [4] Paas, F. R. A., & Sweller, J. (2003). Cognitive load theory and instructional design: Recent developments. *Educational Psychologist*, 38(1), 1-4.