

# Analysis of Youngsters' Media Multitasking Behaviors and Effect on Learning

Ki-Sang Song<sup>1</sup>, SangChun Nam<sup>1</sup>, HyunKyoon Lim<sup>2</sup> and JaeKyung Kim<sup>3</sup>

<sup>1</sup>*Korea National University of Education, Korea 363-791*

<sup>2</sup>*Korea Research Institute of Standard Science, Korea 305-340*

<sup>3</sup>*Paichai University, Korea 302-735*

<sup>1</sup>{kssong, happynsc}@knue.ac.kr, <sup>2</sup>{hlim}@kriss.re.kr, <sup>3</sup>{jkkim}@pcu.ac.kr

## Abstract

*Because of heavy media multitasking and the possibility of youngsters with current smart and handheld mobile computing devices, many controversies exist on the effects of media multitasking on an individual's learning and behavior. To analyze the effects of media multitasking on youngsters, we have applied eye tracking technology to see their switching patterns between a primary task and interference ones. We also observed their performance given the task of taking an e-learning course while interference media such as web surfing and chatting were available. The analysis results show that frequent task switching occurs in High Media Multitasking (HMM) groups, and their performance was far below that of Low Media Multitasking (LMM) groups in the task of taking an e-learning course. From these results, it can be said that media multitasking definitely interferes with the primary tasks performance, and needs to be avoided for better performance\*<sup>1</sup>.*

**Keywords:** *media multitasking, smart devices, e-learning, youngster's behaviors, performance*

## 1. Introduction

According to the rapid changes in mobile computing and Internet accessibility environments, users are vulnerable to media multitasking, using TV, the Web, radio, telephone, print, or any other media in conjunction with another [1] at the same time. As it was noted at the Stanford seminar [2], this behavior has emerged as increasingly common, specifically among younger media users [3] and has gained attention significantly in terms of affecting the way of human thinking, learning, retention, and other processing information [2].

Few researchers have reported the affect media multitasking has on learning, but the importance of this issue has been stressed in many places [4-9]. Brasel and Gepps conducted a laboratory experiment recording both younger and older individuals as they used a computer and television concurrently, multitasking across television and Internet contents [9]. This experiment focused on the switching eye fixation time while users used both computer and Internet concurrently. Ophir and his colleagues have contributed very important information pertaining to media multitasking research where they showed that heavy media multitaskers are distracted by the multiple streams of media they are consuming. Alternatively the research showed that those who infrequently multitask are more effective at volitionally allocating their attention in the face of distractions [4].

---

\*<sup>1</sup> Some part of this paper has been presented at the 5th International Conference on Advanced Science and Technology on April 26-27 in Yeosoo, South Korea.

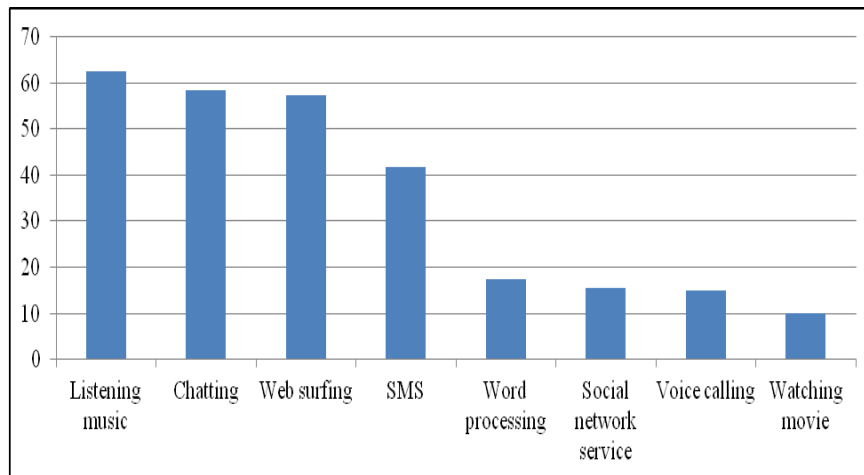
Both Brasel and Ophir's research show the behavioral and cognitive aspects of media multitasking under extremely isolated situations using various computer and Internet devices. The purpose of the experiment was to simplify the task of effectively measuring media multitasking devices. However, the situations observed may not reflect on current computing or media assess environments where people use different media within the same devices. Therefore, we experimented to observe and measure the impact of media multitasking on youngsters in real-life situations where the user can be easily distracted due to media accessibility being very close and under their control.

From this rationale, we want to present media multitasking under real-life situations where youngsters use computers for learning while distractible contents are provided so that it is plausible to access distractible media while they are performing the main task of learning.

## 2. Media Multitasking Behaviors and Effect on Learning

### 2.1. Undergraduate Students' Media Multitasking Behaviors

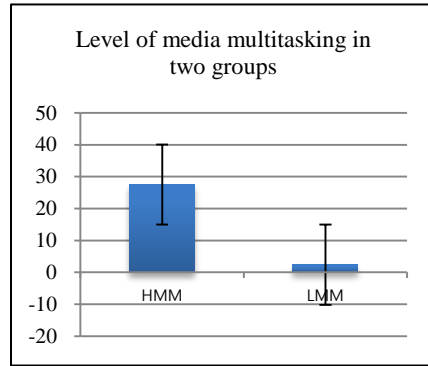
Among the survey questionnaires for checking media multitasking behaviors in youngsters, we counted the responded types of media congruently used in conjunction with the main task. While those surveyed performed the main task they were also using Internet web surfing, chatting, listening to music, watching moving pictures, word processing, and playing games.



**Figure 1. The Media used most often in Media Multitasking**

From the survey of 866 undergraduate students in 2011, 315 male and 551 female students, 70.4% students partake in media multitasking and 29.4% students do not. The reasons behind media multitasking were due to boredom (40.2%), the allowance of a device's capability (31.8%), saving time (17.8%), and for enhancing work performance (8.1%). The statistics of individuals surveyed who partake in media multitasking while performing the main task are given in Figure 1.

After the survey, we selected 10 female and 15 male undergraduate students majoring in computer education without any predecided conditions among the 866 students. The reason for selecting students in computer education was due to the convenience of computer education being within the same building as the laboratory. From the survey data we have divided these 25 students into a high media multitasking group (HMM), and a low media multitasking group (LMM). The students media multitasking levels are depicted in Figure 2.



**Figure 2. The Two Groups responded Level of Media Multitasking. The y Axis Numbers indicate the Total Types and Cases of Media used by each Student while Media Multitasking. The Average Number of Different Media usage in HMM is 25.8, and 2.38 in LMM**

Interestingly, those surveyed partake in media multitasking during class hours through sending short messages (63.4%), messenger (40.3%), web surfing (36.9%), social network service (19.1%), and games (10.2%) [10].

## 2.2. Effect of Media Multitasking on Students' Performance

Since it is often indicated that media multitasking may effect a human's cognitive control under certain environments [2, 4, 5, 8], we have designed an e-learning course as the primary task, chatting and web surfing utilities are provided to function as interfering media in the same screen so that the subject may use them at any time. Before the experiments, the subjects are told that they will perform the e-learning course as their primary task, and they may use chatting or web-surfing if they want while completing the primary task.

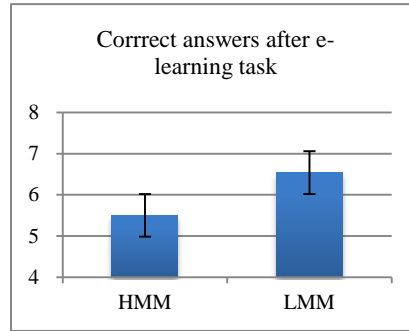


**Figure 3. A Snap Shot of Experiment's Display; e-learning as the Primary Task (Left Top), Chatting (Left Low) and Web Surfing (Right) as Interfering Media**

### 2.2.1. E-learning Course Taking with Distractible Media

In this experiment, the primary task is an e-learning course titled “successful communication skills” from the web site (<http://www.hstudy.co.kr>) for 10 minutes. 5 minutes

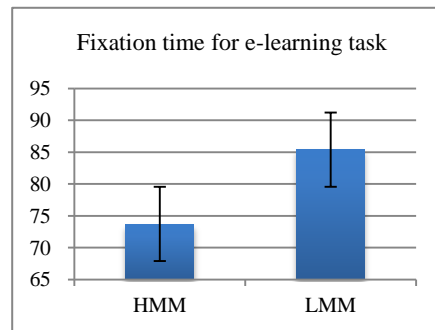
after starting the experiment, the experimenter started to chat with the subject for 5 minutes, after 5 minutes the experimenter stopped chatting and left the student to complete the work.



**Figure 4. The Two Groups' Number of Correct Answers after the e-learning Task. The y axis Numbers indicate the Number of Correct Answers in each Group in terms of Mean and Deviation. The Average Number of Correct Answers in HMM is 6.54 and 5.50 in LMM**

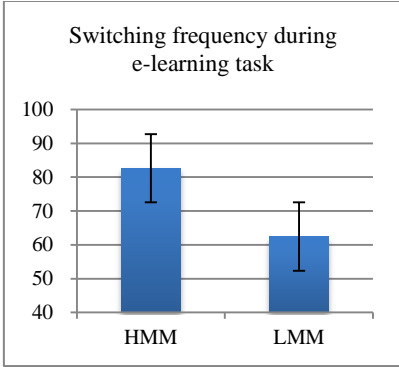
Of the 8 given questions the average correct answer of the HMM group was 18.9% more than that of the LMM group as shown in Figure 4. From this, we can say that media multitasking may negatively affect students learning. The eye movement observation can support the result of media multitasking negatively affecting students learning.

Figure 5 shows the subject's eye fixation statistics while they took e-learning courses. The eye fixation time was measured using SMI's Facelab 4.6 machine and the data was analyzed with EyeWorks 3.7 from EyeWorks™.



**Figure 5. The Two Groups Eye Fixation Time on the Primary Task. The Average Time of the HMM Group is 73.72 Seconds, and 85.40 Seconds in the LMM Group to a specific Area of Interest (AOI)**

The areas of interest (AOI) set up for the experiment are the specific screen regions where important lecture points are located, the instructor expects the students taking the class to visit and spend time in those regions in order to grasp the class material. From this experiment, it is possible to say that the LMM spends 15.8% more time in the expected regions leading to better performance in the e-learning class.



**Figure 6. The Switching Frequency in the e-learning Course Task. The Average Frequency per Student in HMM is 82.67, and 62.46 in LMM**

Figure 6 shows the switching frequency while taking an e-learning course. The HMM group shows 32.2% more frequent switching happening between the primary task and interfering media. The frequent switching between jobs may cause a cognitive overload, a phenomenon that has been studied in various psychological researches.

### 3. Media Multitasking and the Issue of Motivation

Controversy surrounds the advantages and disadvantages of multitasking, and similar discussions exist in media multitasking. To check the consistency of media multitasking's negative effects we have devised another experiment to compare what happens when students' motivation is different than the aforementioned e-learning experiment.

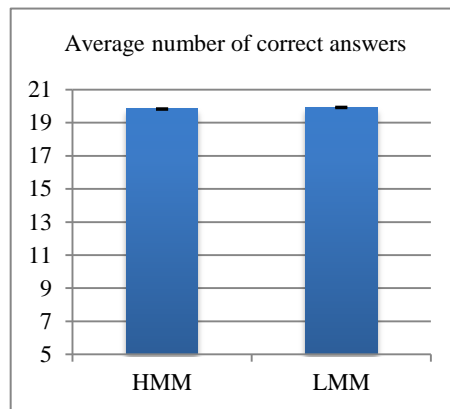
**Table 1. The Correlation between Switching Times and Eye Gaze Time to Multitaskers' Level of Media Multitasking and Number of Correct Answers**

| Item  |                                  | Level of media multitasking | Number of correct answers |
|---|----------------------------------|-----------------------------|---------------------------|
| Switching times between primary task and interferential tasks | - Person correlation coefficient | .497*                       | -.103                     |
|   | - Significance level             | .011                        | .623                      |
| Eye gaze time to primary task                                 | - Person correlation coefficient | .496*                       | .067                      |
|   | - Significance level             | .012                        | .749                      |
| Eye fixation time to primary task                             | - Person correlation coefficient | -.566**                     | .082                      |
|   | - Significance level             | .003                        | .697                      |

(\* satisfies the 0.05 and \*\*satisfies 0.01significance level respectively).

For this experiment, the primary task was changed; this experiment presented patterns of blocks in the primary task window as in Figure 3, and the subjects were asked to find the changed block from previous block patterns. Chatting and Web surfing windows are functioned to interrupt the subject while performing the primary task. To control the difficulty, number of blocks arranged as 2x2, 2x3, 3x3, and 3x4 blocks.

As Table 1 shows individuals who do high media multitasking (HMM) show more switching between the main task and interferential tasks, this causes individuals to spend less time on the main task than that of lower media multitasking subjects. However, it is very interesting that these factors do not affect the number of correct answers in block pattern identification tests as shown in Figure 7. The LMM group shows only 0.45% more than that of the HMM group. This result is quite different from the e-learning course as the primary task where the LMM group scored 15.9% more than the HMM group.



**Figure 7. The Two Groups' Number of Correct Answers to the Block Pattern Matching Test. The y Axis Numbers indicates the Number of Correct Answers in Each Group in Terms of Mean and Deviation. An Average Number of Correct Answers in HMM are 19.83 and 19.92 in LMM**

How to explain these differences? Only the primary task has been changed and interferential conditions are the same in both experiments. According to the cognitive load theory (CLT) [11], and the limited capacity of the amount of information that can be processed in the visual and auditory channels at once in the human information processing model (HIPM) [11, 12], excessive information needs to be controlled to effectively use information processing at capacity. When a user often switches between media or multiple windows on a computer screen, he may lose time focusing on an object other than the main task causing degraded performance [8].

After the experiments, the subjects were asked how they performed the block pattern matching tasks, and many of them said that they actively paid attention to the primary task even though they were distracted by interferential tasks such as web surfing and chatting. It is interesting that the subjects that participated felt finding the correct answer to the block pattern matching task was similar to a game, some of the subjects got competitive asking for the scores of other subjects. This implies that the motivation for the block pattern matching task was a competition between subjects, and this attitude may come from the characteristics of a computer generation. For the e-learning task, the participants do not show a competitive attitude, implying that they relate the e-learning task to learning. We did not check the issue of competition verses learning during the experiments, but if the answers are clear to

recognize then the subjects want to compare their achievements with others similar to a computer game.

From the eye tracking data analysis and achievement test, it is clear that media multitaskers' eyes switch often between the interferential tasks and the primary task, but if the user pays attention to a specific task, then the performance degradation from interferential tasks can be minimized even in the HMM group.

#### 4. Conclusions

Because of ease of access to various media within a device, youngsters are usually eager to use new devices in their lives, thus the importance of preventing overexposure to media multitasking is necessary. In this paper, we have performed two experiments on media multitasking with multiple windows open on the computer.

From the e-learning course experiment, the HMM group is distracted since their attention is on interferential media while performing the primary task, causing frequent switching between primary and interfering media. Eventually this frequent switching results in poor performance and hinders the learning process. However, if a HMM user has a stronger motivation for a specific task under the multiple windows condition, the performance for the specific task may be not degraded significantly as shown in the block pattern matching experiment.

The eye movement observation via the eye tracking system showed that under a real-life working environment, it is crucial that the youngsters be trained to refrain from over exposure to media multitasking. Also it may be necessary for an instructor to control the informational devices usages so that media multitasking does not become a distraction, students as well need to control themselves so that excess media multitasking does not become a habit.

#### Acknowledgments

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2012S1A52A01021351). The authors also express thanks to KRISS for sharing utilities.

#### References

- [1] Wikipedia, [http://en.wikipedia.org/wiki/Media\\_multitasking](http://en.wikipedia.org/wiki/Media_multitasking).
- [2] C. Wallis, "The Impact of Media Multitasking on Childrens's Learning and Development; Report form a research seminar", The Joan Ganz Cooney Center and Stanford University, (2010).
- [3] U. G. Foehr, "Media Multitasking Among American Youth: Prevalence, Predicators and Pairings", The Henry J. Kaiser Family Foundation, (2006).
- [4] E. Ophir, C. Nass and A. D. Wagner, "Cognitive control in media multitaskers", PANS, vol. 106, no. 37, (2009), pp. 15583-15587.
- [5] L. Lin, "Breadth-biased versus focused cognitive control in media multitasking behaviors", PANS, vol. 106, no. 37, (2009), pp. 15521-15522.
- [6] Kirch, "A few thoughts on cognitive overload", Intellectica, vol. 30, (2000), pp. 19-51.
- [7] M. Prensky, "Engage Me or Enrage Me; What today's learners demand", Educause review, (2005) September/October, pp. 60-62.
- [8] S. Monsell, "Task Switching, Trends in Cognitive Science", vol. 7, no. 3., pp. 134-140, (2003).
- [9] S. A. Brasel and J. Gips, "Media Multitasking Behavior: Concurrent Television and Computer Usage", Cyberpsychology, Behavior, and Social Networking, vol. 14, no. 9, (2011) September, pp. 527-534.
- [10] K.-S. Song, S. C. Nam and J. K. Kim, "Pre-service teachers' media multitasking behaviors with smart devices", IEEE 2012 International Conference on Information Technology Based Higher Education and Training (ITHET), Istanbul, (2012) June 21-24.
- [11] R. E. Mayer, "Multimedia Learning (Second Edition)", Cambridge University Press, (2009).

- [12] J. Sweller, "Cognitive load during problem solving: Effects on learning", *Cognitive Science*, vol. 12, no. 2, (1998), pp. 257-285.
- [13] C. Rogobete1, G. Peters and J. Seruga, "Cross Media and E-Publishing", *International Journal of u- and e-Service, Science and Technology*, vol. 5, no. 2, (2012), pp. 17-30.