CyberPsychology & Behavior
Volume 12, Number 1, 2009

DOI: 10.1089/cpb.2008.0107

Rapid Communication

Distractions, Distractions: Does Instant Messaging Affect College Students' Performance on a Concurrent Reading Comprehension Task?

Annie Beth Fox, B.A., Jonathan Rosen, B.A., and Mary Crawford, Ph.D.

Abstract

Instant messaging (IM) has become one of the most popular forms of computer-mediated communication (CMC) and is especially prevalent on college campuses. Previous research suggests that IM users often multitask while conversing online. To date, no one has yet examined the cognitive effect of concurrent IM use. Participants in the present study ($N = 69$) completed a reading comprehension task uninterrupted or while concurrently holding an IM conversation. Participants who IMed while performing the reading task took significantly longer to complete the task, indicating that concurrent IM use negatively affects efficiency. Concurrent IM use did not affect reading comprehension scores. Additional analyses revealed that the more time participants reported spending on IM, the lower their reading comprehension scores. Finally, we found that the more time participants reported spending on IM, the lower their self-reported GPA. Implications and future directions are discussed.

Introduction

With the growth in popularity of instant messaging (IM) programs, an increasing number of people are multitasking while communicating online.[1] It is possible that IM use may negatively impact performance on a concurrently performed task. Research has demonstrated that the concurrent use of media (e.g., television) during an intellectual task (e.g., reading) negatively affects recall and recognition memory.[2] Most college students spend a significant amount of time engaged in intellectual activities like studying, and many students likely study while socializing over IM. College students who multitask in this way may be putting themselves at a disadvantage.

Most research has used IM to deliver an interruption (thereby dividing attention or forcing a switch between tasks) rather than to examine how sustained concurrent use of IM affects memory or performance. An exception is a study by Cummings,[3] who found that concurrent use of IM during a cognitively demanding task led to a decrease in performance. Instead of focusing on directing and controlling missiles (the primary task), participants were focused on IM, through which they received messages and queries, which inhibited their performance on the primary task. These results are consistent with the findings of a qualitative study of IM in the workplace. Workers reported that concurrent IM use can be interruptive and detrimental to their attention.[4] Considering the limited research on the effect of IM on concurrent task performance, the purpose of the present study was to examine whether concurrent use of IM hinders students' abilities to perform a learning task—reading prose for future recall. Participants were given an easy or difficult reading passage and then asked to answer multiple-choice and free-recall questions about the passage. Half of the participants held concurrent IM conversations while reading and answering questions. We made three predictions:

H1: Participants who IM while reading the passage and answering questions should perform worse on recall and recognition tests than those who perform the task uninterrupted.

H2: Participants who read the high-difficulty passage should perform worse than those who read the low-difficulty passage.

Department of Psychology, University of Connecticut, Storrs, Connecticut.

H3: There will be an interaction between IM condition and task difficulty such that participants who IM while reading the difficult passage will perform worse on the task than participants in any other condition.

Method

Sixty-nine undergraduate students participated for course credit in an introductory psychology course. All participants used *AOL Instant Messenger* (AIM) to communicate anonymously with a confederate partner. Two reading passages of varying difficulty were used: an SAT-level passage (low difficulty) and a GRE passage (high difficulty). Passages were taken from SAT and GRE practice exams. A 14-item reading comprehension test containing seven multiple-choice questions (to test recognition memory) and seven fill-in-the-blank questions (to test free-recall memory) was created for each of the passages. Presentation order of the tests was counterbalanced across conditions. A survey of computer and Internet use and attitudes was also administered.

A 2 × 2 (CMC condition: IM versus no IM × passage difficulty: high versus low) factorial design was used. Participants were randomly assigned to conditions upon arrival at the lab, were assigned a (confederate) partner, and were told to communicate with that partner over AIM for 5 minutes to get to know one another. After 5 minutes, participants were given either the high- or low-difficulty reading passage and instructed to take as much time as they needed to read and understand the passage. A hard copy of the reading passage was presented to resemble the type of offline reading in which participants may engage. Half the participants ended their IM conversation immediately before reading the passage (no-IM condition); half continued IMing while reading the passage (IM condition). An instruction screen on the computer served as a hidden timer. When participants finished reading, they completed the reading comprehension test and then filled out the survey of computer use and attitudes.

Results

Participants were highly experienced and frequent users of IM ($M = 5.3$ years experience; $M = 1.76$ hours a day spent on IM). A 2 × 2 (CMC condition: no IM versus IM × passage difficulty: high versus low) ANOVA was performed on multiple-choice score, free-recall score, total score, time to complete multiple-choice questions, time to complete free-recall questions, and total time to complete all questions. We did not find a significant main effect of CMC condition on free-recall, multiple-choice, or total test score, nor did we find the expected interaction between CMC condition and difficulty. Thus, neither hypothesis 1 nor hypothesis 3 was supported.

A main effect of CMC condition emerged for time to respond to multiple-choice questions, time to complete the entire test, and time to read the passage. Participants in the IM condition ($M = 4.66$, $SD = 1.87$) took significantly longer to complete the multiple-choice section than did those in the no-IM condition ($M = 2.63$, $SD = 0.89$), $F(1, 66) = 31.60$, $p = 0.001$. Similarly, those in the IM condition ($M = 12.56$, $SD = 4.39$) took significantly longer to complete the entire test than did those in the no-IM condition ($M = 8.23$, $SD = 2.48$), $F(1, 66) = 24.36$, $p = 0.001$. Participants in the IM condition also took longer to read the passage ($M = 5.53$, $SD = 2.86$) than did those in the no-IM condition ($M = 3.33$, $SD = 1.29$), $F(1, 66) = 16.39$, $p = 0.001$.

Hypothesis 2 was supported for free-recall and total scores but not for multiple-choice scores. Participants in the difficult condition ($M = 3.58$, $SD = 1.52$) scored significantly worse than those in the easy condition on the free-recall test ($M = 5.23$, $SD = 1.03$), $F(1, 66) = 27.61$, $p = 0.001$. Participants in the difficult condition ($M = 5.96$, $SD = 2.95$) also had significantly lower total scores than did those in the easy condition ($M = 8.11$, $SD = 1.64$), $F(1,66) = 13.96$, $p = 0.001$. Additionally, those in the difficult condition ($M = 2.23$, $SD = 0.73$) took significantly longer to answer the free-recall questions than did participants who read the easy passage ($M = 1.77$, $SD = 1.16$), $F(1, 66) = 4.20$, $p = 0.044$. These results validate our difficulty manipulation in that the GRE passage was indeed more difficult than the SAT passage for participants to complete. That an effect of difficulty was not found for multiple-choice questions is consistent with research suggesting that recognition is easier than recall. No other main effects or interactions were found with respect to the reading comprehension data.

We also examined whether experience with IM predicted test scores, holding IM and difficulty condition constant. Multiple regression analyses demonstrated that average daily use of IM (in minutes) was a significant predictor of multiple-choice ($\beta = -0.30$, $t(65) = -2.56$, $p = 0.01$), free-recall ($\beta = -0.20$, $t(65) = -1.96$, $p = 0.05$), and total score on the test ($\beta = -0.30$, $t(65) = -2.82$, $p = 0.01$). The more time participants reported spending on IM, the lower their comprehension scores.

Given this unexpected finding, that self-reported IM use was negatively related to cognitive performance, we conducted an exploratory analysis using another measure of cognitive performance: grade point average. Participants who reported lower GPAs were more likely to also report spending more time per day on IM ($\beta = -0.23$, $t(68) = -1.97$, $p = 0.05$). Thus, there was a negative association between IM use and two independent self-report measures of cognitive performance.

Discussion

Two of our three hypotheses were not supported. These result are inconsistent with prior research indicating that interruptions negatively affect task performance.[5] There may be several explanations. First, because the participants were highly experienced IM users, they may frequently converse with more than one person while performing a concurrent task. Conversing with one person may not have challenged the participants' multitasking abilities. Relatedly, reading and IMing at the same time may also not have stretched their abilities as multitaskers. However, our data contradict this explanation. We found that average daily IM use was negatively related to performance on the reading comprehension test, indicating that expertise did not help participants successfully complete the task. In fact, expertise with IM predicted lower scores on the comprehension test. Interestingly, GPA also was negatively related to time spent on IM. Our results suggest that poorer students spend more time in online communication with others, and the more time spent IMing, the lower the scores on the reading comprehension test. Future studies involving IM and reading comprehension should include measures that assess these factors.

Another potential explanation for not finding a detrimental effect of IM is that IM may be a type of negotiated interruption in which a participant decides when to switch tasks rather than being forced to do so upon an intrusive interruption.[6] IM may be viewed as a form of negotiated interruption because participants were free to decide when to switch between tasks and were able to continue the primary activity (reading and/or answering questions) until ready to switch tasks. Because participants were able to negotiate the interruption, they also likely took preparatory action regarding the primary task (i.e., noting where they left off) that would allow them to transition back to the original task once they completed the interruption task. Research has demonstrated that performance on a primary task is disrupted less when participants are warned before an interruption is to occur.[7] The time between the warning and the interruption allows the individual to make preparations for returning to the primary task.

Where we did see an effect of IM was in the time to complete the multiple-choice questions. Participants who IMed took significantly longer to complete the multiple-choice test as well as to complete the entire test. This is consistent with previous research demonstrating that interruptions increase the time required to complete a primary task.[8] We did not, however, find a significant effect of IM on time to complete the free-recall questions. This is an anomalous finding that needs to be investigated further.

Limitations and future directions

The present study has several limitations, including a relatively small sample size and limited generalizibility of the reading comprehension task. The reading passages were short, and although they tapped an important study skill (comprehension), the task itself may not be generalizable to the type of reading and writing college students may actually do when concurrently IMing.

Despite the ubiquity of IM, little is known about its cognitive consequences. To our knowledge, the present study is the first to specifically examine the cognitive consequences of IM. We did not find a cognitive decrement in experienced IM users. However, we did find that concurrent IM use decreased efficiency, and more importantly, there was an association between self-reported IM use and poor performance on the cognitive test. Our results suggest that IM could impact college students' academic performance, although the extent of that impact needs further examination. Additional research is needed in this area because IM and similar CMC technologies that foster rapid processing and multitasking have become an important part of the cultural landscape.

Disclosure Statement

The authors have no conflict of interest.

References

1. Shiu L, Lenhart A. (2004) How Americans use instant messaging. Pew Internet & American Life Project. www.pewinternet.org/pdfs/PIP_Instantmessage_Report.pdf.
2. Armstrong GB, Chung L. Background television and reading memory in context. Communication Research 2000; 27: 327–52.
3. Cummings ML. The need for command and control instant message adaptive interfaces: lessons learned from tactical Tomahawk human-in-the-loop simulations. CyberPsychology & Behavior 2004; 7:653–61.
4. Cameron AF, Webster J. Unintended consequences of emerging communication technologies: instant messaging in the workplace. Computers in Human Behavior 2005; 21:85–103.
5. Gillie T, Broadbent D. What makes interruptions disruptive? A study of length, similarity, and complexity. Psychological Research 1989; 50:243–50.
6. McFarlane D. (1999) Coordinating the interruption of people in human–computer interaction. In Sasse A, Johnson C, eds. *Proceedings of Human–Computer Interaction* (*INTERACT'99*), Amsterdam: IOS Press, pp. 295-303. http://interruptions.net/literature/McFarlane Interact99-Coordinating.pdf.
7. Trafton JG, Altman EM, Brock DP, et al. Preparing to resume an interrupted task: effects of prospective goal encoding and retrospective rehearsal. International Journal of Human-Computer Studies 2003; 58:583–603.
8. Adamczyk PD, Bailey BP. (2004) If not now, when? The effects of interruption at different moments within task execution. In *Proceedings of the ACM Conference on Human Factors in Computing Systems, CHI 2004*, pp. 271-8. http://orchid.cs.uiuc.edu/publications/acm-chi-2004-adamczyk.pdf.

Address reprint requests to:
Annie Beth Fox
Department of Psychology
University of Connecticut
406 Babbidge Road, Unit 1020
Storrs, CT 06269

E-mail: annie.fox@uconn.edu