

BRIEF

The Myth of Multitasking and What It Means for Future Pharmacists

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Objective. The primary purposes of this study were to determine the extent to which multitasking affects the speed and accuracy with which Doctor of Pharmacy students identify prescription errors and whether there is a relationship between students' self-perception of their multitasking ability and their actual ability.

Methods. One hundred twenty-one second-year pharmacy students enrolled in the required course Introduction to Dosage Forms spent one week in an experimental (multitasking) condition and one week in a control (undistracted) condition. Subjects were given 10 minutes to check 10 prescriptions and record any identified filling errors. A cellular phone was placed in each room. Subjects in the experimental (multitasking) condition answered a call from a researcher posing as a talkative customer during the prescription-checking task while subjects in the control condition were not interrupted by a cell phone call during the task. Subjects' completion times and accuracy were recorded.

Results. When subjects were multitasking, they took significantly longer to complete the prescription-checking task than when they were not multitasking. Furthermore, when subjects were multitasking, they scored significantly lower on the prescription-checking task than when they were not multitasking. Finally, students' self-perceptions of their multitasking abilities were not related to the speed with which they completed the prescription-checking task nor to their accuracy.

Conclusion. Multitasking negatively affects speed and accuracy of prescription verification in student pharmacists. Our procedure can be used as an in-class activity to demonstrate the limits of attention and to shape how future pharmacists practice.

Keywords: multitasking, distractions, sterile cockpit, cellular phone use

INTRODUCTION

In his book, *CrazyBusy*, Edward Hallowell states that "multitasking is a mythical activity" and, even 2000 years ago, Publius Syrius knew "to do two things at once is to do neither."¹ A visit to any college campus will provide many opportunities to witness young people using their cell phones while reading, studying, and attending lecture, even though there is a wealth of research showing that learning, memory, and cognitive efficiency suffer when attention is divided during multitasking.²⁻¹⁰

In the clinical setting, cellular phones are used to prescribe, consult, monitor, and access drug and disease information, but cell phone use can be distracting. In one specific case, a patient undergoing an atrioventricular

node ablation procedure died because the anesthesiologist, who was texting and posting on Facebook, did not notice the patient's falling blood oxygen level.^{11,12}

For many health care professionals, distractions and interruptions are part of daily life; they draw attention from the primary task and often lead to behaviors that contribute to medication errors.¹³⁻¹⁶ Although research on interruptions in pharmacy settings is limited, Flynn and colleagues reported a significant relationship between distractions in a pharmacy and medication dispensing errors.¹⁷ Pharmacists do recognize that distractions and interruptions can increase the likelihood of medication errors.¹⁸⁻²¹ However, when faced with high-volume performance expectations and being rewarded for speed over accuracy, they resort to multitasking behaviors when, in reality, multitasking actually decreases efficiency.²²

The primary goal of our study was to determine the extent to which multitasking affects pharmacy students' accuracy and efficiency in identifying prescription-processing errors. We hypothesized that engaging in

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multitasking behavior would result in a decrease in accuracy and efficiency. Our secondary goal was to compare (and to determine if there is a relationship between) students' self-perception of their multitasking ability and their actual ability.

METHODS

This study used a one-way repeated measures design with experimental and control conditions to compare subjects' accuracy and efficiency in a simulated prescription-checking exercise. Each subject completed the exercise two times, once without distraction (control) and once while attempting to multitask (experimental), in a counter-balanced design to control for order effects.

Subjects were 121 second-year professional pharmacy students enrolled in a skills-based laboratory course. The study was introduced at the beginning of the semester and all students provided informed consent. Once enrolled, subjects categorized their own multitasking ability as below average, average, or above average.

To create experimental materials, the researchers "filled" 20 prescriptions, 10 used in control sessions and 10 in multitasking sessions. Errors were intentionally incorporated into seven of the 10 prescriptions for each session. The errors in both sets were similar in nature and included wrong patient, drug, strength, or directions. Each prescription was placed in a basket with a hard copy of the prescription, the stock bottle, and a labeled vial containing the medication. Subjects were instructed to mark each of the prescriptions error-free or to record any identified errors. Subjects were given 10 minutes to complete the task. A timer was placed in the room so they could gauge their own progress.

During both the control and experimental conditions, a cellular phone was placed in the prescription checking area. Subjects were told to answer the phone if it rang and to engage in conversation while they continued checking the prescriptions. In the control setting, subjects completed their task without distraction. In the experimental setting, a co-investigator, playing the role of a "chatty" customer, called the subject at the one-minute mark. The same script was used for all calls and was designed to keep subjects distracted from their primary task for eight minutes (excerpt: "Do you think you could go out and grab me a travel toothbrush and toothpaste so I can just swing through the drive-thru window when I come by to pick up my prescriptions?").

If subjects completed the task before the time expired, they were told to end the phone call and leave the room. If time expired before the task was completed, investigators recorded subjects' time to completion as 10

minutes as well as the number of unchecked prescriptions. All results were de-identified and students were not assigned a grade for this activity.

Immediately following the experimental session, each subject was asked three questions related to the conversation (eg, "What items did the person on the phone ask you to get for them?"). If the subject was not able to answer at least two of the three questions correctly, they were excluded from the study because of their lack of engagement in the conversation.

The design and implementation of this activity required allocation of time and funds. The time to prepare the materials and script was approximately four hours. The total time to have each student complete both the control and experimental sessions was 80 hours. This course utilized upperclassmen as laboratory assistants (salary \$8/hour) who assisted with the flow of the activity.

The SPSS, version 24 (IBM) was used for data analysis. All tests were non-directional, and a .05 alpha level of significance was used. Analyses of variance (*F*-tests) were used to evaluate group mean differences.

RESULTS

One hundred twenty-nine students (30% identified as male and 70% identified as female) participated in this study (data from eight participants were omitted due to lack of engagement in the phone conversation). Twenty (17%) believed themselves to be below average multitaskers, 84 (69%) described themselves as average, and 17 (14%) categorized themselves as above average. A chi-square analysis revealed no gender differences in self-ratings of multitasking, $\chi^2(2) \geq 3.31, p = .19$.

To determine the effects of multitasking on task completion time and prescription-checking accuracy, we conducted a two-way repeated-measures analysis of variance with condition (multitasking vs control) and measure (time vs score) as factors. Results revealed that, when they were multitasking, subjects took an average of 23% longer to complete the task ($M = 7.5$ min, $SD = 1.9$) than when they were not multitasking ($M = 6.1$ min, $SD = 1.7$), $F(1, 120) = 2129.66$, Wilks' $\lambda = .05, p < .001$, partial $\eta^2 = .95$. This analysis also revealed that, when they were not multitasking, subjects scored 26% better on the prescription-checking task ($M = 8.5$, $SD = 1.4$) than when they were multitasking ($M = 6.7$, $SD = 1.7$), $F(1, 120) = 71.13$, Wilks' $\lambda = .63, p < .001$, partial $\eta^2 = .37$. Finally, the condition x measure interaction was significant as accuracy was higher in the control condition and times were higher in the multitasking condition: $F(1, 120) = 76.30$, Wilks' $\lambda = .61, p < .001$, partial $\eta^2 = .38$.

To determine the relationship between self-perception of multitasking and task-completion time, we conducted a one-way between-groups analysis of variance with self-perception of multitasking category (below average, average, or above average) as the independent variable and difference between task completion times while multitasking and while not distracted as the dependent variable. Mean task completion times and accuracy scores as a function of multitasking self-rating and condition are presented in Table 1. The analysis revealed no significant difference between self-rating groups: $F(2, 118) = 0.92$, $MSE = 202.18$, $p = .40$. Therefore, subjects' self-perceptions of their multitasking abilities were not related to their speed in completing the task. Furthermore, a one-way analysis of variance with self-perception of multitasking category (below average, average, or above average) as the independent variable and difference between prescription-checking accuracy score while multitasking and while not distracted as the dependent variable revealed no relationship between self-rating of multitasking and the effect of multitasking on prescription-checking accuracy, $F(1, 118) = 0.32$, $MSE = 4.29$, $p = .724$. Therefore, students' self-perceptions of their multitasking abilities were not related to the accuracy with which they completed the prescription-checking task.

DISCUSSION

The primary purpose of our study was to determine to what extent multitasking affects accuracy and efficiency in identifying prescription-processing errors. Consistent with the findings of Sinclair and colleagues, we found that multitasking during prescription checking resulted in decreased efficiency.²² Although there is limited

published research on the association between pharmacists' multitasking behaviors and their error rates, there is empirical evidence of a relationship between distractions and errors made while checking prescriptions.¹⁷ Our results are consistent with this finding and provide stronger evidence of a causal link, as we experimentally manipulated the presence of distraction.

One additional consideration in the study of multitasking ability is the extent to which individuals believe themselves to be proficient at multitasking. A study by Sanbonmatsu and colleagues suggested that people tend to overestimate their ability to multitask.²³ Ophir found that people who think they are the most capable multitaskers are actually the least capable, yet they are the most likely to engage in multitasking behavior.²⁴ Although we did not find a similar inverse relationship between self-perception and performance, our study could be expanded to include a post-intervention survey to determine if students' self-assessment of their own multitasking ability can be adjusted by the implementation of this exercise.

As noted in the Methods section, subjects were halted if they had not completed the task after 10 minutes. Although we do not have exact completion times for subjects who did not complete all 10 prescriptions during this time, we expect that, if they had been permitted to work to completion, the time difference between experimental and control conditions would have been even greater. This prediction is based on our finding that a larger percentage of subjects did not complete the task within 10 minutes when they were in the experimental condition (17%) than when they were in the control condition (2%). Furthermore, participants had more incomplete (ie, unchecked) prescriptions when they were in the experimental condition ($M = 0.35$, $SD = 0.92$) than when they were in the

Table 1. Pharmacy Students' Completion Time and Accuracy When Checking Medication Orders While Multitasking Compared to Not Multitasking (N = 121)

	Below Average Multitasking Ability (n = 20) ^a		Average Multitasking Ability (n = 84)		Above Average Multitasking Ability (n = 17)	
	Multitasking Trial ^b M (SD)	Control Trial ^c M (SD)	Multitasking Trial M (SD)	Control Trial M (SD)	Multitasking Trial M (SD)	Control Trial M (SD)
Time to complete task (min) ^d	8.02 (1.83)	6.14 (1.86)	7.51 (1.96)	6.11 (1.69)	6.78 (1.94)	5.72 (1.69)
Accuracy score ^e	6.75 (1.80)	8.30 (1.08)	6.60 (1.75)	8.46 (1.36)	7.35 (1.17)	8.88 (1.93)

^a Participants were divided into groups based on whether they described their multitasking ability as "below average," "average," or "above average"

^b During multitasking trials, participants answered a phone call from a researcher posing as a customer while they checked the accuracy of prescription orders

^c During control trials, participants checked prescription order accuracy without interruption

^d Total time, in minutes, to check the accuracy of 10 filled prescriptions presented to them and to record any errors

^e Average number of prescriptions that participants checked accurately (out of 10)

control condition ($M = 0.03$, $SD = -.22$), $t(120) = 3.64$, $p < .001$.

Future research could assess the extent to which students found the experiment to be impactful, as we revealed students' results to them but did not assess their impressions of the activity. Additional multitasking research could investigate other common sources of distraction within a pharmacy setting and their impact on accuracy and efficiency. Similarly, future research could compare multitasking abilities of pharmacy students to those of practicing pharmacists to determine whether experience and familiarity with setting affects accuracy and/or efficiency.

Strategies that are being taught in medical and nursing schools for navigating interruptions and distractions can easily be translated into a pharmacy setting.²⁵⁻²⁷ One design intervention is called the *sterile cockpit*, a reference to the federal regulation that allows pilots to focus on critical phases of flight without distraction.²⁸ In a pharmacy, a sterile cockpit or No Interruption Zone (NIZ) is a designated area in which a pharmacist can perform duties that require focused attention. Implementation of a NIZ for nurses to use during preparation and administration of medications resulted in a 40% decrease in interruptions.²⁹ Attri and colleagues recommend a sterile cockpit rule to eliminate cell phone distraction during critical phases of surgeries.³⁰ One important aspect of the NIZ is the use of a visual cue to indicate a request for the attention of the person working in the NIZ. This creates a boundary that allows the person to complete one primary task before diverting their attention elsewhere. When interruptions can occur at a boundary between tasks in this manner, one study found that error rates decreased by 50%.³¹

CONCLUSION

The Agency for Healthcare Research and Quality states that distractions in health care are "threats to human performance and safety."²⁵ In a pharmacy setting, engaging in multitasking behavior can result in medication errors and patient harm. The ability to identify medication safety issues is listed as an Entrustable Professional Activity expected of all pharmacy graduates.³² It is our responsibility as educators to ensure our graduates understand that attempting to multitask is cognitively taxing and can result in decreased efficiency and an increased rate of errors. Educators should also strive to provide learners with the tools necessary to design systems that minimize unsafe multitasking behaviors.

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