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Using Reading Guides and On-line Quizzes to Improve Reading Compliance and Quiz Scores

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Using Reading Guides and On-line Quizzes to Improve Reading Compliance and Quiz Scores

Abstract
This study compared students' daily in-class reading quiz scores in an introductory Child Development course across five conditions: control, reading guide only, reading guide and on-line practice quiz, reading guide and on-line graded quiz, and reading guide and both types of on-line quizzes. At the beginning of class, students completed a 5-item quiz over the assigned readings. With the exception of the control section, all students had access to an instructor-designed reading guide for each of the 20 assigned readings. Results revealed that reading guides significantly increased student learning as demonstrated by increased scores on the in-class reading quizzes, with marginal additional gains when practice quizzes were also utilized. The addition of on-line graded quizzes resulted in lower scores on in-class quizzes. Results held even after multiple subsidiary analyses controlling for time spent studying. These findings suggest that reading guides may be a valuable study aid for improving student learning.

Keywords
reading guide, reading quiz, on-line quiz, study time, student learning

Introduction

The increased use of active learning strategies in classes requires students to be familiar with the content to be covered. Students cannot contribute in meaningful ways to discussions or participate in debates, role plays or other activities if they have not completed the assigned reading and comprehended the basic concepts under discussion (Koontz & Plank, 2011). Most professors believe that textbook reading increases students' understanding of course content "and that the more a student reads, the greater his/her facility with the content will be" (Vandsburger & Duncan-Daston, 2011, p. 6). However, empirical studies show that college students' reading compliance has declined substantially over the past 30 years from over 80% to less than 20% (Burchfield & Sappington, 2000). Data from the National Survey of Student Engagement [NSSE] indicates that over 80% of college seniors report attending class without reading or preparation (Nathan, 2005). Even in textbook-reliant introductory courses, students read less than one-third of the assigned pages (Gurung & Martin, 2011). Students who have not completed assigned readings on time are unprepared for class activities based on that material, making it difficult for instructors to move beyond content-delivery lectures. Solving the problem of low reading compliance requires that professors find new ways to motivate students to complete assigned reading.

One strategy for encouraging reading compliance is a graded reading quiz, which provides an external incentive for doing the readings (Ruscio, 2001). Students are increasingly taking a consumerist approach to higher education, suggesting a shift from intrinsic to extrinsic motivations (Labaree, 1997), and a corresponding focus on external incentives. Recent work on students' academic motivations has revealed that students' strongest motivations are primarily extrinsic (Maurer, Allen, Gatch, Shankar, & Sturges, 2013, 2012), so connecting reading compliance directly to grades via reading quizzes may be an effective strategy to increase reading compliance.

Further, short quizzes at the start of class, when paired with prompt feedback, are an effective teaching strategy, particularly in introductory courses (Connor-Greene, 2000). They

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reduce "massed practice" (practice that occurs without rest between practices in contrast to "distributed practice") and procrastination (Maki & Maki, 2000), essentially diminishing the frequency of the pattern suggested by Gurung and Martin (2011) of waiting until just before an exam to do the assigned readings. Such quizzes also provide feedback to students on the effectiveness of their studying (Rosenthal & McKnight, 1996), which is far more useful before the first major exam, when changes can still be made that may improve performance on the exam. Moreover, reading compliance significantly predicts exam scores and final grades (Sappington et al., 2002). However, students also report that reading the textbook is one of the most common ways to study for course examinations (Gurung, 2005). In short, research findings suggest that quizzes motivate students to complete assigned reading when it is due rather than waiting until just before exams.

In addition to motivating students to read before class, professors must also help students understand what they are reading (Koontz & Plank, 2011). Although faculty generally assume students have the skills need to handle reading assignments by the time they get to college, Kaback (2012) reports that some think students "don't have the skills to read effectively, so they don't even try" (p.21). National data support this perception. According to the most recent National Assessment of Educational Progress (NAEP), twelfth-grade students scored lower in reading in 2013 than they did in 1992, with only 38 percent performing at or above "Proficient." Shanahan and Shanahan (2008) write that "the proportion of students on track for successful college work actually diminishes as students advance through U.S. schools from eighth through twelfth grade" (p. 42). In fact, 21 percent of first-year undergraduate students at public institutions report taking remedial courses (Sparks & Malkus, 2013). Culver and Morse (2012) point out that the results of this perceived lack of literacy skill by students is that "many instructors have developed a 'sink or swim' policy, assuming that students will either gain the necessary skills or drop out" (p. 15). Given the declining graduation rate (Bound, Lovenheim, & Turner, 2009), this data suggests that more students are not developing the necessary

literacy skills and are dropping out. It has thus become necessary for professors to assume greater responsibility for supporting the reading development of students. This is predicated on the notion that any given text has discipline-specific demands which may be unknown to novice learners. Kaback (2012) posits that, as disciplinary experts, professors have experience navigating and interpreting text in their disciplines and are, therefore, "obliged to think of themselves as master artisans apprenticing their students to the craft of reading" (p. 19). Spencer and Jordan (1999) speculate that the pedagogic shift from the traditional teacher-centered to a student-centered approach "requires a fundamental change in the role of the educator from that of a didactic teacher to that of a facilitator of learning" (p.1280).

Adding to this problem is the passive approach many students have towards reading assigned text. Instead of actively reading assignments, they typically focus on memorizing and "looking over" (Simpson & Nist, 1990), rather than actively engaging with the material or attempting to understand it. First and second year students—the primary population in many introductory courses—are especially likely to take such passive approaches, as they are less likely to be independent and self-regulatory learners (Cukras, 2006). Thus, the problem is not just getting students to complete the assigned readings on time, but getting them to engage with the readings in a meaningful way and *learn* from them.

One way to help novice learners get more out of the readings and increase their motivation to complete reading assignments is the use of reading guides. Reading guides, also known as text guides, are teacher-developed resources that serve as "tutorials in print" (Holsgrove, Lanphear, & Ledingham, 1998). They are designed to help students understand material as they read informational text. "As the name implies, [reading] guides provide students with the purposes and directions for reading a particular section or unit of text while the students are engaged in reading" (Montelongo, 2008, p. 289). Carefully prepared reading guides that present material "in a logical and accessible way can be an important aid to learning" (Holsgrove et al., p. 103). In addition to being beneficial for students,

reading guides can also support professors in the planning process because they require instructors to determine the learning outcomes associated with the assigned text. Once the learning outcomes are identified, the professor uses them to create a structured series of questions to guide students through the text, helping them to determine meaning and achieve basic comprehension and vocabulary (Horning, 2007). Reading guides "model how to select, decide, and focus upon what textbook material is important to learn" (Helms & Helms, 2010, p. 109) and "serve as a basis of lively classroom discussion, small group work, and a source of peer pressure to make sure students actually DO the reading" (Horning, 2007). As such, they can be viewed as a form of active learning and, as numerous research studies have demonstrated, active learning strategies are superior to lectures in promoting the development of students' problem solving and thinking skills (Koontz & Plank, 2011).

From the student perspective, reading guides can be helpful in learning lesson objectives and preparing for graded assessments (Helms & Helms, 2010), and students who complete them score higher on graded assessments (Meiss, 1983). These findings suggest that the *combination* of reading guides and daily reading quizzes may have a significant impact on both student reading compliance and student learning, but no prior study has simultaneously investigated the use of both methods. This study proposes to be the first.

Additionally, this study proposes to incorporate on-line quizzes as an additional element to improve student reading compliance and student learning. On-line quizzes have been used in the prior literature investigating student learning (Brothen & Wambach, 2004; Daniel & Broida, 2004; Marchant, 2002; Maurer, 2006) with mixed results, and on-line quiz scores have been reported to significantly predict scores on subsequent assessments over the same material, such as exams (Anthis & Adams, 2002). However, no prior investigation has used the combination of both on-line and in-class daily reading quizzes over the same material. This is a critical distinction because the degree of overlap between assessments is an important factor in determining the effectiveness of the quizzes (Burns & Vinchur, 1992) and their utility in addressing other concerns, such as

illustrating the types of questions that will appear on future assessments and providing students constructive feedback on their level of mastery of the material (Thorne, 2000). According to the results of these studies, students who were given on-line quizzes before their daily in-class quizzes should perform better on the in-class quizzes, especially if the types of questions on the two assessments were similar in format. This study proposes to test that prediction.

Specifically, this study will compare students' average daily reading quiz scores in an introductory child development course across five conditions: control, reading guide only, reading guide and on-line practice quiz, reading guide and on-line graded quiz, and reading guide and both on-line quizzes. When possible, controls for students' self-reported reading compliance, self-reported reading guide completion, and self-reported study hours, will be included. It is hypothesized:

H1: Students in the four sections that receive reading guides will earn higher average daily reading quiz scores than students in the control section who do not receive reading guides.

H2a: Students in the reading guide and on-line practice quiz section will earn higher average daily reading quiz scores than students in the control section or the reading guide only section.

H2b: Students in the reading guide and on-line graded quiz section will earn higher average daily reading quiz scores than students in the control section, the reading guide only section, or the reading guide and on-line practice quiz section.

H2c: Students in the reading guide and both types of on-line quizzes section will earn higher average daily reading quiz scores than students in the other four sections.

Method

Participants

Participants were students in five sections of an introductory child development course taught by the first author. One section was taught each semester over a three year period. All five sections of the course met on Tuesdays and Thursdays

for 75 minutes each day over a 15 week semester. Students who withdrew from the course were excluded from data analyses, leaving a final sample of 290 students: control (*n* = 64), reading guide only (*n* = 79), reading guide and on-line practice quiz (*n* = 78), reading guide and on-line graded quiz (*n* = 39), and reading guide and both on-line quizzes (*n* = 40). IRB restrictions prevented the collection of demographic data about the participants, but the modal participant was a traditional-aged white female who was taking the course to satisfy a requirement for a major or minor in Child & Family Development.

Materials

The primary dependent variable in this investigation was students' average daily reading quiz scores; missed quizzes were counted as zeros, consistent with course policy. Twenty quizzes of five items each were developed by the course instructor for each of 20 content days in the course. All quiz items covered material from the assigned readings for that day, approximately one half of a textbook chapter. All quiz items assessed learning at the "remembering" level of Anderson et al.'s (2001) Taxonomy. Over 90% of quiz questions were multiple choice, with the remainder being fill in the blank numeric questions. Additionally, the instructor created 20 on-line practice quizzes and 20 on-line graded quizzes of five questions each over the same assigned readings. Due to restrictions with the learning management system [LMS] software, all on-line questions were multiple choice.

The instructor also created detailed reading guides for each of the assigned readings (20 total). All questions on the reading guide were organized in the order that students would encounter the answers in the text and contained a specific page number or numbers where the answers to that question could be located. Each reading guide required approximately two hours to develop and approximately two hours for a student to complete.

The instructor also created a daily self-report survey for students to complete immediately before each day's daily reading quiz. This survey contained three questions: a) How much of today's assigned reading did you complete? b) How much of today's reading guide did you complete? c) How many hours did you spend studying for this day's class? The first two

questions used a five-point scale of: *none, 25%, 50%, 75%,* and *All.* The third question used a five-point scale of: *<0.5, 0.5-1.5, 1.5-3.0, 3.0-4.5,* and *>4.5*. Average scores were computed for each of the three items across the semester. Missing data was counted as the lowest response option because anecdotal evidence suggested that students who missed class typically had not done the readings.

Finally, the instructor created a seven-item end-of-course self-report survey. The first two items were identical to the first two items on the daily survey, except that they asked students to reflect on their reading compliance and reading guide completion for the entire semester. The third item asked students to report their average weekly time spent studying for the class over the semester, with response options double what appeared on the daily survey (e.g., *<1* instead of *<0.5*). The remaining four items used a five-point Likert-type scale from *Strongly Disagree* to *Strongly Agree* and presented students with the statements: a) The reading guides were helpful in determining what to get out of the readings, b) The reading guides were helpful in preparing me for the class activities, c) The reading guides were helpful in preparing for the daily quizzes, d) The reading guides were helpful in preparing for the exams.

Procedure

Students in all five sections of the course received a closed-book, closed-note daily quiz over the assigned readings at the start of each of twenty content days in the course. Except for the control section, the daily quiz was immediately preceded by the daily self-report survey. The reading guide only section received only the first two questions on the daily self-report survey, whereas the other three sections to receive reading guides also received the question on hours studied.

With the exception of the control section where reading guides were not used, the instructor explained how to complete and use the reading guides on the second day of class. The first assigned readings were due on the third day of class which was also when the daily quizzes began. All 20 reading guides were available from the first day of class in the on-line learning management system (LMS).

For the reading guide and on-line practice quiz and reading guide and both on-line quizzes sections, daily on-line practice quizzes opened immediately after each class period and remained open until 30 minutes prior to the next class period. Students could attempt each practice quiz only once and only during the time window when the quiz was open. After submitting their answers for the entire quiz, students would receive feedback about how many questions they correctly answered, which answer they selected for each question, and the correct answer for each question. For the reading guide and on-line graded quiz and reading guide and both on-line quizzes sections, daily on-line graded quizzes were administered in the same way. Both the practice and graded on-line quizzes were open book and open note.

On the last day of the course, students completed the end-of-course self-report survey (except for the control section).All in-class quizzes, daily self-report surveys, and end-of-course surveys were administered via "clickers" (i.e., classroom response systems). For the in-class quizzes, the instructor displayed both the correct answer to each question and the distribution of responses from the class immediately after each question. For both of the surveys, the instructor did not display the distribution of class responses.

Results

Plan of Analysis

Because this project used an incomplete experimental design, multiple methods of analysis were planned to explore potential differences between experimental groups and control for potential confounds. The first analysis will be a simple Analysis of Variance [ANOVA] using average daily reading quiz score as the dependent variable and condition as the independent variable. The second analysis will be an Analysis of Covariance [ANCOVA] adding as covariates three items from the end-of-course self-report survey: reading compliance, reading guide completion, and hours studied. Because the control condition did not receive the end-of-course survey, that group will be excluded from this analysis. The third analysis will be an ANCOVA using the daily self-report survey questions on reading

compliance and reading guide completion as covariates. Because the control condition did not receive the daily surveys, that group will be excluded from this analysis. The fourth analysis will be an ANCOVA using the daily self-report survey questions on reading compliance, reading guide completion, and study hours as covariates. Because the control condition and reading guide only condition did not receive the daily survey question on study hours, those groups will be excluded from this analysis. The final analysis will be a Multivariate Analysis of Variance [MANOVA] using condition as the independent variable (excluding the control condition) and the seven items on the end-of-course survey as dependent variables.

Differences in Quiz Scores by Condition

ANOVA. An ANOVA with condition as the independent variable and average daily quiz score as the dependent variable revealed a significant effect for condition, F (4, 285) = 18.19, p < .001, partial η^2 = .20. This effect size meets the criteria for "large" as established by Cohen (1988). Post hoc comparisons using least significant differences [LSD] revealed that most sections were significantly different from one another. The general pattern of results was that the reading guide only section and the reading guide and on-line practice quiz section had higher quiz scores than the control section, but the two sections that used on-line graded quizzes were not significantly different from the control section. Effect sizes for the contrasts, calculated using Cohen's d, were as follows: control < reading guide only (0.85), control < reading guide and on-line practice quiz (1.11), reading guide only > reading guide and on-line graded quiz (1.06), reading guide > reading guide and both on-line quizzes (0.61), reading guide and on-line practice quiz > reading guide and on-line graded quiz (1.33), reading guide and on-line practice quiz > reading guide and both on-line quizzes (0.88), and reading guide and on-line graded quiz < reading guide and both on-line quizzes (0.45). Most of these effect sizes meet the criteria for "large" effects as established by Cohen (1988). See Table 1.

Table 1
Daily Quiz Means and Standard Errors by Section

Section									
Control (N = 64)		RG Only (N = 79)		RG and Practice (N = 78)		RG and Graded (N = 39)		RG and Both (N = 40)	
M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
51.22_{ab}	1.87	63.80_{c}	1.69	67.78_{c}	1.81	48.00_{a}	2.40	54.70_{b}	2.37

Note. RG = Reading Guide. Means with different subscripts significantly different at p < .05.

ANCOVA with end of course survey. An ANCOVA with daily average quiz score as the dependent variable, condition as the independent variable, and three items from the end-of-course self-report survey as covariates (reading compliance, reading guide completion, and hours studied) was computed next. Again, a significant main effect for condition emerged, F (3, 178) = 23.63, $p < .001$, partial $\eta^2 = .29$, with a "large" effect size and the same general pattern of results by condition as the ANOVA analyses. Of the covariates, only self-reported reading guide completion significantly emerged as predictor, F (1, 178) = 22.62, $p < .001$, partial $\eta^2 = .11$; $r = .41$, $p < .001$, consistent with prior research (Meiss, 1983). Neither self-reported reading compliance, $r = .28$, $p < .001$, nor self-reported study time, $r = .07$, *ns*, were significant predictors.

To explore potential differences between daily and end-of-course self-reports, a series of three paired *t*-tests were computed. The first two tests, reading compliance and reading guide completion, compared students in all but the control condition, who did not receive those surveys. The third test, hours studied, compared students in the reading guide and on-line practice quiz, reading guide and on-line graded quiz, and reading guide and both on-line quizzes conditions only, as they were the only ones to receive that question on both surveys. All three tests were significant, with end-of-course self-report numbers higher than daily self-report averages. See Table 2. Because of these differences, ANCOVA analyses using daily self-reports were also necessary.

Table 2
Daily and End-of-Course Self-Report Comparisons

	Report									
	Daily		End-of-course							
Variable	*M*	*SE*	*M*	*SE*	*t*	*df*	*p*	Cohen's *d*	*r*	*p*
Reading compliance	3.63	.06	4.05	.06	7.36	190	.000	0.51	.63	.000
Reading guide completion	3.64	.08	4.16	.07	9.38	188	.000	0.50	.75	.000
Study hours	2.78	.06	3.17	.08	6.16	125	.000	0.49	.65	.000

ANCOVA with daily surveys without study hours. An ANCOVA using the daily self-report survey questions on reading compliance and reading guide completion as covariates was computed next. Because the control condition did not receive the daily surveys, that group was excluded from this analysis. A significant main effect for condition emerged, F (3, 229) = 20.87, $p < .001$, partial $\eta^2 = .22$. Again, the effect size was "large" and again the pattern of results by condition was the same. Both covariates emerged as significant predictors: self-reported reading compliance, F (1, 229) = 37.89, $p < .001$, partial $\eta^2 = .14$, $r = .73$, $p < .001$; and self-reported reading guide completion, F (1, 229) = 32.66, $p < .001$, partial $\eta^2 = .13$, $r = .74$, $p < .001$.

ANCOVA with daily surveys with study hours. An ANCOVA using the daily self-report survey questions on reading compliance, reading guide completion, and study hours as covariates was computed next. Because the control condition and reading guide only condition did not receive the daily survey question on study hours, both groups were excluded from this analysis. A significant main effect for condition emerged, F (2, 149) = 25.20, $p < .001$, partial $\eta^2 = .25$. Again, the effect size was "large" and again the pattern of results by condition was the same. Both self-reported reading compliance, F (1, 149) =

19.59, $p = .001$, partial $\eta^2 = .12$, and self-reported RG completion, F (1, 149) = 21.83, $p < .001$, partial $\eta^2 = .13$, emerged as significant covariates. However, self-reported study time, *ns*, $r = .59$, $p < .001$, did not.

Differences in End-of-Course Survey by Condition

The final analysis was a MANOVA using condition as the independent variable (excluding the control condition) and the seven items on the end-of-course survey as dependent variables. A MANOVA was chosen because of significant intercorrelations between the seven dependent variables and to reduce the risk of Type I error. A significant multivariate main effect for condition emerged, Wilks' Lamba = .73, F (21, 474.34) = 2.57, $p < .001$, partial $\eta^2 = .10$, reflecting a "medium" effect size (Cohen, 1988). Significant univariate models emerged for only two items: self-reported reading compliance, F (3, 171) = 4.15, $p = .007$, partial $\eta^2 = .07$, and perception of reading guides as helpful in preparing for exams, F (3, 171) = 3.57, $p = .015$, partial $\eta^2 = .06$. Both effect sizes were "medium." Students in the reading guide only section reported higher levels of reading compliance than students in the other three sections. As the number of graded assessments increased, students reported greater utility of the reading guides in preparing them for course exams. No significant differences were observed for reading guide completion, study hours, helpfulness of reading guides during reading, helpfulness of reading guides in preparing for class activities, or helpfulness of reading guides in preparing for quizzes. See Table 3.

Discussion

This study compared students' average daily reading quiz scores across five conditions: control, reading guide only, reading guide and on-line practice quiz, reading guide and on-line graded quiz, and reading guide and both on-line quizzes, controlling for students' self-reported reading compliance, self-reported reading guide completion, and self-reported study hours. The first hypothesis, that students in the four sections receiving reading guides would earn higher average daily reading quiz scores than students in the control section who did not receive reading guides, was partially supported. Results of the

ANOVA analysis revealed that students in the reading guide only and reading guide and on-line practice quiz sections did indeed score significantly higher on their daily reading quizzes than students in the control section. The average effect size for these two contrasts was nearly a full standard deviation (Cohen's *d* = 1.00), an extremely large effect for SoTL research. However, students in both of the sections with on-line graded quizzes did not score significantly better than students in the control section on their daily reading quizzes.

Table 3
End-of-Course Survey Means by Section

	Section							
	RG Only		RG and Practice		RG and Graded		RG and Both	
Item	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Reading compliance	4.40_a	.11	3.93_b	.10	3.94_b	.14	4.00_b	.13
Reading guide completion	4.23	.13	4.31	.13	4.07	.16	4.03	.16
Hours studied	3.04	.11	3.24	.11	3.36	.14	3.00	.14
Helpful—Readings	4.38	.16	4.33	.16	4.27	.20	4.30	.20
Helpful—Activities	4.23	.13	4.47	.13	4.36	.17	4.27	.17
Helpful—Quizzes	4.51	.12	4.53	.12	4.30	.16	4.59	.15
Helpful—Exams	4.06_a	.12	4.27_{ab}	.12	4.46_{bc}	.16	4.68_c	.16

Note. RG = Reading Guide. Means with different subscripts significantly different at $p < .05$.

Hypotheses 2a, 2b, and 2c, which predicted improvement in students' daily quiz scores with the addition of on-line quizzes,

were not supported. Students in the reading guide and on-line practice quiz section did earn higher average daily reading quiz scores than students in the control section, but there was no significant difference between the scores for the reading guide only and reading guide and on-line practice quiz sections. Students in the reading guide and on-line graded quiz section actually earned *lower* scores than students in either the reading guide only or reading guide and on-line practice quiz sections, and equivalent scores to the students in the control section. Students in the reading guide and both on-line quizzes section did earn higher scores than students in the reading guide and graded quiz section, but *lower* scores than students in the reading guide only or reading guide and on-line practice quiz sections, and equivalent scores to the students in the control section. The pattern of results for all hypotheses held even after multiple subsidiary analyses (ANCOVAs) controlling for both daily and end-of-course self-reported reading compliance, reading guide completion, and study hours.

Taken together, the results obtained here provided evidence that student performance on daily reading quizzes improved in a curvilinear fashion across sections, improving with the addition of reading guides (with or without on-line practice quizzes), but falling again with the addition of further graded assessments. The initial addition of the reading guides resulted in roughly a 13% raw increase in average student reading quiz scores (and a 25% proportionate increase). The addition of practice on-line quizzes resulted in a further roughly 5% raw increase beyond impact of reading guides (for combined proportionate increase of greater than 33%). Graded on-line quizzes, whether alone or in conjunction with practice on-line quizzes, appeared to fully offset the effect of reading guides and return quiz averages to that of control section. It is possible that because additional graded assessments decreased the relative contribution of daily reading quizzes to the final course grade, the addition of those on-line quizzes may have unintentionally disincentivized preparing for the daily reading quizzes.

It is also possible that the addition of any on-line quizzes may have given students a false sense of confidence in their ability to score well on the daily reading quizzes, as student

reading compliance was identical in all three sections with on-line quizzes, but significantly lower than the reading guide only section. The on-line practice quizzes were designed to give students a way to test their knowledge and receive formative feedback (Rosenthal & McKnight, 1996) without undermining the importance of the in-class quizzes for their grades. However, although students in the reading guide and on-line practice quiz section did score significantly higher than students in either of the on-line graded quiz sections, their reading compliance was identical. Because there was no difference between the sections in their self-reported study time, this suggests that the time students spent taking the on-line quizzes came from a fixed pre-established pool of time dedicated to studying the material, and that every minute spent taking the quiz(zes) was a minute not spent completing the readings, reading guides, or learning the material. Thus, if a zero sum approach to student study time was used, the feedback provided by the on-line quizzes would have had to have been superior to the benefits of spending that same time studying the material in other ways in order to have shown a difference here. The fact that it did not may suggest that additional quizzes have no significant value to student learning over other forms of student-selected study time.

The results of the multivariate analyses suggested that students across the four sections that received reading guides did see significant value in them, regardless of the presence or absence of on-line quizzes. The average response to the last four questions on the end-of-course survey about the helpfulness of the reading guides in getting the most out of the readings, preparing for the daily activities, preparing for the daily quizzes, and preparing for the exams, was *agree*. It is highly unlikely that this was a mere halo effect for two reasons. First, the first three questions on the survey about reading compliance, reading guide completion, and hours studied were strongly correlated with daily reports, suggesting only minor inflation, if any. Second, the quiz average in all four sections was below a 70%, meaning that on average, students were failing the daily quizzes. Under these circumstances, a halo effect would be extremely unlikely. If anything, one would expect a negative response bias due to the cognitive dissonance associated with failing the quizzes, yet the

response to the reading guides was overwhelmingly positive (cf. Helms & Helms, 2010). These results suggest that reading guides could have real value in not only improving what students "get out of" assigned reading, but also in helping students to see the utility of study tools like reading guides particularly with respect to student learning.

Limitations and Future Directions

Like many SoTL investigations, this project has significant limitations. First, the organic design of the project—adding measures like study hours along the way as they became of interest—meant that there was partial missing data from two sections and that a full comparison could not be made. Ideally, an *a priori* design would have had all five sections collect daily and end-of-course self-reports on both reading compliance and study hours so that only two ANCOVA analyses would have been necessary to control for the potential impact of reading compliance and study hours on quiz grades across sections. Further, there was no way in this investigation to conclusively establish equivalency between sections in student abilities. It is possible that one (or more) sections had students of higher (or lower) ability than others. Although random assignment is seldom possible in classroom-based research, future investigations should at least collect additional data to control for potential pre-existing differences between students (e.g., GPA).

Additionally, this investigation used one course in one discipline taught by a single instructor at a single university. Replication in other courses (especially textbook-reliant introductory courses) and other disciplines at other institutions is necessary to further explore the potential impact of reading guides and on-line quizzes on student reading compliance, performance, and learning. Some prior research has suggested that for first-year orientation courses that do not use reading guides or on-line quizzes, student reading compliance is not influenced by the presence, absence, or point value of reading quizzes (Maurer, 2011, 2010). Additional research has suggested that in specific contexts, students' academic behaviors may be immune to external incentives (Maurer et al., 2009). Given these findings, it is possible that reading guides and/or on-line quizzes may *enable* external incentives (such as reading quizzes) to

influence students' academic behaviors by increasing students' expectations for their own learning efficacy. For example, students with poor literacy skills may understand the importance of doing well on reading quizzes to their ultimate grade in the course, but may feel powerless to improve their quiz scores because their poor literacy skills prevent them from reading effectively. Reading guides that help such students develop their literacy skills may empower those students with a new sense of efficacy which allows them to successfully learn from the assigned readings and consequently perform better on reading quizzes. More qualitative investigations that probe *how* students use the reading guides and on-line quizzes and to what extent those uses really are active learning and literacy and efficacy promoting could be especially valuable (e.g., content analyses of completed reading guides, focus groups, interviews, etc.). This project was a collaboration between a faculty member and a faculty developer; such collaborations are ideally suited to these types of future investigations, as faculty developers can represent neutral parties to interview students about their study practices.

Finally, it is important to note that the adoption of instructor-created reading guides comes at a significant cost which must be weighed against the benefit to student learning. Reading guides can be time-consuming to create (Helms & Helms, 2010; Shepherd, 2005). For the course in this investigation, the instructor had to create 20 reading guides. Each reading guide took approximately two hours to create, representing a full work week worth of effort to create them all. These reading guides would need to be completely recreated any time a new textbook (or new edition of a textbook) was adopted. Although reading guides appear to have significant benefits to student learning (Cherry, 2004; Shepherd, 2005), it is important to note that not all instructors may be able to invest the amount of "up front" time required to create them for a course and especially for multiple different courses. It is recommended that future research also explore how to "streamline" the process of creating reading guides to reduce the preparatory burden on instructors who wish to use them. One possibility is for instructors of the same course to work together to create both

the quizzes and the reading guides. Another is to work collaboratively with former students who have successfully passed the course to co-create reading guides. This latter approach is consistent with Felten's (2013) principles of good practice in SoTL in directly involving students as co-investigators in topics related to their own learning.

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