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Readiness Assessment Tests versus Frequent Quizzes: Student Preferences

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This study compares the effectiveness of two different assessment techniques; readiness assessment tests (RATs) and frequent quizzing. We report student perceptions of the impact of these techniques on the number of readings done prior to the class period, thorough reading of assignments, ability to follow class discussions, ability to participate in class, ability to prepare for exams and exam scores. We also examined student's overall preferences for assessment technique as well as how preferences varied by learning styles. Readiness assessment tests were generally better than frequent quizzes at encouraging students to do the readings prior to class, follow class discussions, and participate in class. A majority of students preferred readiness assessment tests to frequent quizzes. However, whereas global and/or intuitive learners preferred the readiness assessment tests, sequential and/or sensing learners preferred the quizzes.

Frequent assessment enhances student learning. The more opportunities students have to work actively with course material and receive feedback, the better the chances that they will learn it. Classroom assessment techniques (Angelo & Cross, 1993), frequent quizzing (Maki & Maki, 2001; Roediger & Karpicke, 2006), and readiness assessment tests (Carkenord, D.M., 2004; Padilla-Walker, 2006) are some of the many available assessment strategies. Given so many possible strategies, how does an instructor make a choice? The most important factor in choosing a strategy is the match between the strategy and the learning objective. Beyond that, student perceptions and strategy effectiveness are important considerations.

Readiness assessment tests (RATs) require students to respond to questions about the assigned readings prior to class discussion (Cookman, 2004; Howard, 2004; Marrs Blake & Gavrin, 2003). The RATs can be done on paper at the beginning of class or electronically before coming to class. Theoretically, any question type could be used to assess students' readiness to engage in discussion, but most instructors using this technique employ either open-ended questions, such as short answer or essay (Corkenord, 2004; Connor-Greene, 2000; Cookman, 2004; Marrs, Blake & Gavrin, 2003), or a combination of both open-ended and multiple choice questions (Benedict & Anderson, 2004; Howard, 2004). The major objectives of RATs are to encourage students to come to class prepared for discussion and to keep up with the material to prevent cramming for an exam. When the instructor adapts her behavior based on responses to readiness assessments, she is doing "Just-in-Time" Teaching (JiTT) (Benedict & Anderson, 2004; Howard, 2004; Novak et al. 1999; Watson & Temkin, 2000). This strategy allows her to spend more time on certain concepts if student responses indicate the need and to incorporate student thoughts and examples into the class discussion. Researchers have shown that the JiTT technique is associated with increased number of students who do the readings (Howard, 2004), student perceptions of improvement in critical thinking ability (Cookman, 2004), and enhanced exam scores (Benedict & Anderton, 2004).

Frequent quizzing also helps students to keep up with the material and reduces the importance of each single test, which can mitigate students' perceived need to cheat. Instructors can use information gathered from quiz performance to help students prepare for exams. Instructors who use frequent quizzing typically employ multiple choice questions (Maki & Maki, 2001; Marcell, 2005). Research has shown that frequent quizzing, when compared to a few long tests, increases the chances that students will do the readings and is preferred to fewer tests by students who have experienced it (Connor-Greene, 2000).

Studies of assessment effectiveness, such as those cited above, typically report an overall preference for the assessment type or average increase in the measured outcome (e.g. student performance). However, the efficacy of any assessment strategy for an individual student may depend on how well it matches the student's learning style. According to Cassidy (2004) "there is general acceptance that the manner in which individuals choose to or are inclined to approach a learning situation has an impact on performance and achievement of learning outcomes." For example, Zywno and Waalen (2002) showed that engineering instruction enhanced by hypertext and multimedia was more effective than traditional instruction for Active and Global learners but less effective for Verbal learners. These individual differences impact learning through preferences for the type of information, the sensory channel through which information is perceived, the way information is organized, the way it is processed and the way that individuals come to understand (Felder & Silverman, 1988). Thus, learning styles may impact the

effectiveness of any assessment strategy for any single student.

The aim of the present study was to compare RATs and frequent quizzing with respect to the impact of each strategy on the number of readings completed, students' thorough reading of assignments, and students' ability to follow class discussions, participate in class, and prepare for exams. We also assessed the ability of each strategy to predict exam scores. A secondary goal was to determine the impact of learning styles on student preference for assessment strategy.

Method

Participants

Participants were 51 college students (29 women, 22 men) in the first author's upper level psychology course, "The Psychology of Fear and Stress," during the spring semester of 2006 (final enrollment = 60). The class met twice per week. Thirty-six students (22 women) completed all four surveys plus the learning styles questionnaire. Fifteen students didn't respond to one or more of the surveys or the learning styles questionnaire. These students were excluded from the data analysis.

Materials

Required course assignments. The four-unit course included two different assessment strategies. During the first and third units students completed readiness assessment tests (RATs) online prior to class. The RATs consisted of two to three open-ended questions asking for students to describe the major point of the article or areas that were most interesting and/or least understood. These broad questions were used to prevent students from skimming through the readings in search of answers to detailed questions. Each RAT was worth four points and students were required to complete five of six, for a total of 20 points.

During the second and fourth units, students completed short online quizzes, which were completed by midnight on Fridays. Quizzes included 10 multiple choice questions. Students were required to complete all four quizzes, each worth five points, for a total of 20 points. See Table 1. The quizzes were administered at the end of a week and covered material from two class periods, whereas the RATs were administered prior to each class period. Thus, there were fewer quizzes than RATs.

Students took an in-class, 50-point exam at the end of each unit. The exams included both multiple choice and essay questions.

Student perception surveys. On each of four surveys designed for this project, students rated four statements about the RATs or quizzes on a five-point Likert-scale from strongly disagree to strongly agree. The statements addressed the effect of the assessment strategy on thorough reading of the material, ability to follow class discussions, ability to participate in class, and ability to prepare for the exam. On the fourth (final) survey students indicated their preference for RATs or quizzes. They were also asked to provide any comments on how the assessment methods helped their learning as well as suggestions they had for improving the two assessment methods. The links to these surveys were sent to students within a week after each unit exam. Students completed the surveys online and the results were returned electronically to the second author.

Index of Learning Styles. This is a 44-item forced choice, Myers-Briggs Type Inventory-like questionnaire (Felder & Soloman, 1991). It combines aspects of several learning style models, including Kolb (1984) and Jung-Myers-Briggs (Felder and Silverman, 1988). The test-retest reliability of the ILS for a four-week interval ranges from .73 to .87 depending on the learning style. The instrument is administered online and easily understood by students (Zywno, 2003). The responses indicate where individuals fall along four learning styles dimensions, active-reflective (doing something with the information vs. thinking about it), sensing-intuitive (obtaining data through senses vs. indirect perception), visual-verbal (preference for pictures, graphs, charts, etc. vs. verbal information, either written or spoken) and sequential-global (learning in a step-by-step fashion vs. holistically).

Procedure

Participants completed the necessary course assignments (see above), the Index of Learning Styles, and four brief surveys, one after each unit exam. All students in the class were offered extra credit (up to 1% of the total grade if they completed the learning styles instrument plus all four surveys) to participate in the study. In addition, an alternative extra credit assignment was offered for students who did not want to participate in this study. The second author, who was not an instructor, obtained informed consent from interested students during a class period early in the semester and collected data to prevent the instructor from knowing which students participated until the course was completed. The informed consent assured students that their responses to the study instruments were anonymous; the instructor would not know who had or had not agreed to participate in the study until after the course.

Table 1
Assessment Timeline

	Unit 1 Definitions of Stress Physiology of Stress Response				**Unit 2** Health Effects of Stress			**Unit 3** Stress & Depression, Moderators of Stress, Coping				**Unit 4** Anxiety and Stress Disorders, Cognitive Aspects of Anxiety		
Date	1/12	1/17	1/19	1/26	2/3	2/10	2/16	2/21	2/23	3/14	3/16	2/24	3/31	4/4
Assessment	RAT1	RAT2	RAT3	Ex 1	Q1	Q2	Ex 2	RAT4	RAT5	RAT6	Ex 3	Q3	Q4	Ex 4
Points	4 pts.	4 pts.	4 pts.	50 pts.	5 pts.	5 pts.	50 pts.	4 pts.	4 pts.	4 pts.	50 pts	5 pts.	5 pts.	50 pts.

Data Analysis

Kolmogorov-Smirnov tests revealed the student perception data were not normally distributed. Thus, Friedman's ANOVAs were performed to test differences in student perceptions of the effect of RATs vs. frequent quizzing on reading the articles more thoroughly, following class discussions, participating in class, and preparing for exams. Friedman's ANOVA is a non-parametric technique used to test "differences between experimental conditions when there are more than two conditions and the same participants have been used in all conditions" (Field, 2005). The same statistic was used to investigate the effect of assessment method on the number of assigned readings completed prior to the class period and exam scores.

Learning styles were calculated by adding one point for each response that endorsed a particular dimension (11 questions for each dimension). Scores of 1 – 3 are considered fairly well-balanced; 5 - 7 indicates a moderate and 9 - 11 a strong preference (Felder & Soloman, 1991). Because scores of 1 – 3 indicate a person without a strong preference for one learning dimension over the other, only students with scores of 5 or greater were included in these analyses. A Chi-square test was performed on the learning styles dimensions to explore the relationship between learning styles and preference for assessment method.

Results

RATs vs. Frequent Quizzing – Student Perceptions

Student perceptions differed significantly with respect to enhancing their ability to follow class discussions (χ^2 (3) = 15.65, $p < .001$) and to participate in class (χ^2 (3) = 13.17, $p < .01$). The post hoc Wilcoxon signed-rank test with a Bonferroni correction set at .0083 was used to further explore the differences. This procedure is used to compare two dependent conditions when the data are nonparametric. The Wilcoxon test suggested that the students rated the first RAT significantly higher than the first quiz in enhancing their ability to follow class discussions (T = 149, r = .48, $p < .008$). In addition, students rated the second RAT significantly higher than both quizzes (T = 231, r = .49, $p < .008$; T = 203, r = .52, $p < .008$) in enhancing their ability to participate in class. No significant differences were found with respect to encouraging students to read articles more thoroughly or enhancing students' ability to prepare for exams. See Figure 1.

RATs vs. Frequent Quizzing – Readings

The rankings of the percentage of readings completed prior to class were significantly different (χ^2 (3) = 70.55, $p < .05$) across the four units. The Wilcoxon test suggested that the number of readings that students completed prior to class was significantly higher during the units that required RATs (mean = 3.36) than during the units that required quizzes (mean = 1.65).

RATs vs. Frequent Quizzing - Exam scores

The four exam score averages were significantly different (χ^2 (3) = 11.30, p = .01). The Wilcoxon test suggested that the first exam score average was significantly higher than the second exam score average (T =519, r = .49). See Figure 2.

Student Preference

About 56% of the students reported a preference for RATs and 33% reported a preference for quizzes. The remainder of students reported that their preference for one strategy over the other depends on the content. Students who preferred RATs indicated in their open-ended responses that the questions helped them look at the overall meaning of the articles and focus on the main points. In addition, having the RATs due before class helped them prepare to participate in the classroom discussions. Students who preferred frequent quizzes reported that their preference was due to quiz questions showing them what to expect from exams and having only one correct answer.

Figure 1
Student Perceptions on the Effectiveness of RATs and Frequent Quizzes on their Ability to Follow Class Discussion and Participant in Class

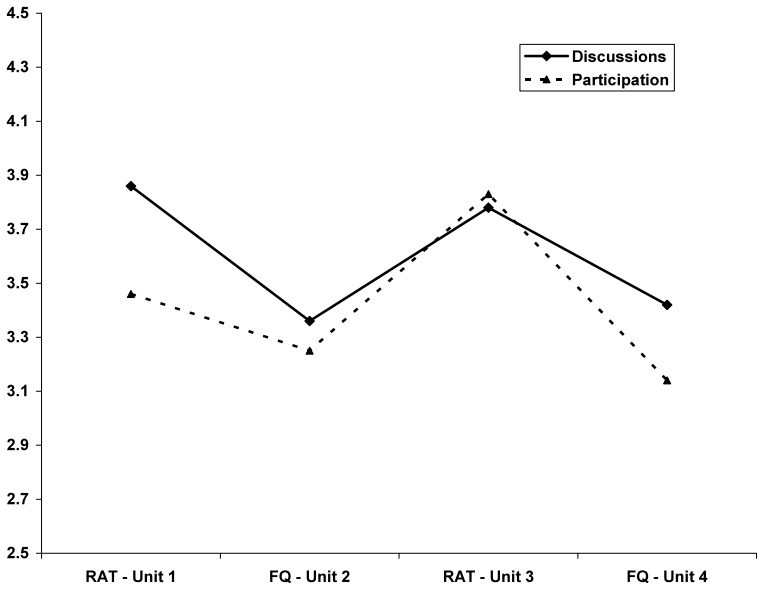
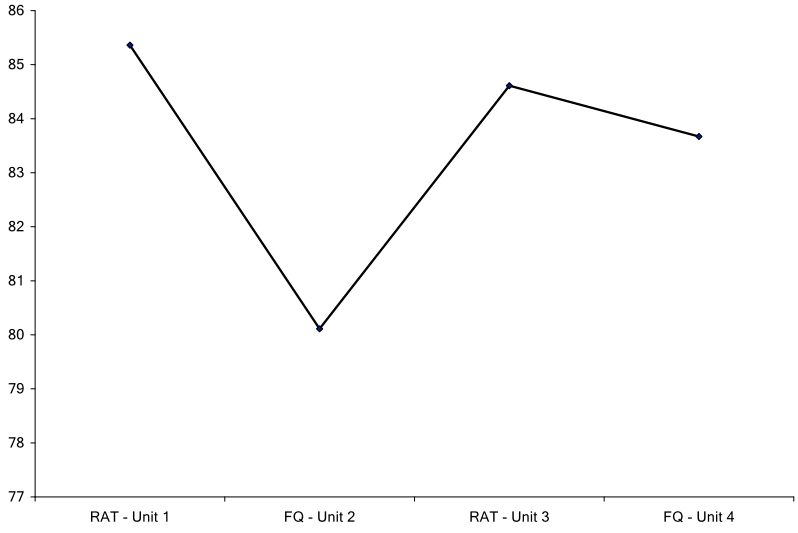


Figure 2
Exam Scores



RATs vs. Quizzes - Student Learning Styles

There was a significant association between the Sequential-Global dimension and preference for RATs or frequent quizzes, χ^2 (1) = 7.00, $p < .05$. The strength of the relationship was significant (Cramer's V = .73, $p < .01$). The result suggests that individuals classified as sequential are more likely to prefer quizzes over RATs, while individuals classified as global are more likely to prefer RATs over frequent quizzes (see Table 2).

The association between the Sensing-Intuitive dimension and preference for RATs or frequent quizzes was marginally significant (χ^2 (1) = 4.11, p = .058). The strength of the relationship was significant (Cramer's V = .45, $p < .05$). The result suggests that individuals categorized as sensing are more likely to prefer frequent quizzes over RATs and individuals categorized as intuitive are more likely to prefer RATs over frequent quizzes (see Table 3). No significant association was found between Active-Reflective or Visual-Verbal dimensions and assessment preferences.

Table 2
Preference for Frequent Quizzes
or RATs by Learning Style – Sequential or Global

	Learning Style		
	Sequential	Global	Total
RATs	2	5	7
Frequent Quizzes	6	0	6
Totals	8	5	13

Table 3
Preference for Frequent Quizzes
or RATs by Learning Style – Sensing or Intuitive

	Learning Style		
	Sensing	Intuition	Total
RATs	5	6	11
Frequent Quizzes	8	1	9
Totals	13	7	20

Discussion

The results of the current investigation suggest that both readiness assessment tests and frequent quizzing are equally effective at encouraging students to read articles thoroughly and prepare for exams. However, the RATs generally enhanced students' ability to follow and participate in class discussion more than the frequent quizzes did. These results are most likely a result of the fact that students completed more of the readings before class for RATs than they did for quizzes. Student narrative responses to the open-ended questions in the student perception survey suggest that students recognize the value of coming to class prepared but still need external motivation (such as a RAT) to encourage them to do so.

Although students' subjective reports revealed that RATs and frequent quizzing had equal effects on their ability to prepare for exams, the actual exam scores were different for the first unit (RAT) than for the second unit (frequent quizzing). Lower scores for the second exam is typical in this course due to the mixed course content ("psychology" and "biology"). The second unit covers the physiological effects of stress on the major body systems, material with which psychology majors, who make up the vast majority of this course, typically have less experience. Thus, it seems reasonable for exam scores to be lower for this unit than the other 3 units, which contain less biology.

Although the data indicate that, overall, the RATs were more helpful to students than the frequent quizzes, they also suggest that student learning styles had an impact on the types of assessment methods students preferred.

The preference for the open-ended RATs by students with a tendency for intuitive and/or global learning aligns well with the definition of these learning styles (see Soloman & Felder, 1991). Intuitive learners prefer seeing relationships over learning facts and are more comfortable with abstract concepts than sensing learners. Global learners are able to make connections in content without the need for step-by-step explanations. Thus, it makes sense that individuals who prefer either of these styles would prefer questions that require them to comment on the readings overall by stating the main points or the areas about which they still have questions. For example, they might be asked to explain the main point of a chapter that addresses why we have a stress response. In contrast, sensing and/or sequential learners may have been more likely to prefer the multiple choice quizzes due to their comfort learning facts in a linear, step-by-step fashion. The multiple choice questions were more likely to address specific facts, such as the hormones involved in the stress response, and sequential events, such as the cascade of physiological events that make up a stress response.

Constraints related to the practical aspects of the course, such as the timing and question-type differences between RATs and frequent quizzing, and the small sample size suggest caution in interpreting these data. The RATs were due prior to a single class period and addressed a single reading. The quizzes, however, occurred at the end of a week after two class periods and typically addressed two readings. Perhaps students prefer to do their course work during the week rather than worrying about taking a quiz by Friday night. Also, the RATs tended to be subjective and were scored based on whether or not students completed the assignment rather than correctness of the responses. In

contrast, the quiz scores were more objective – answers were either right or wrong. Thus, the scoring variation may be an explanation for the students' RAT preference. In addition, although the study design attempted to balance the assessment methods across more biologically-oriented and more psychologically-oriented topics, this could not be done perfectly. It might be that the students preferred the topics associated with the RATs over those associated with the quizzes. Alternatively, material for which quizzes were used might be more difficult than that for which RATs were used. Future studies that address these methodological issues are warranted.

Further investigation is also important to substantiate our interpretation of the learning styles data. If the preference for RATs vs. quizzes is a result of variation in question format rather than other aspects of the assessment method, a simple follow-up investigation in which only question type is varied could substantiate the conclusion. In addition, future studies might also explore how self-regulated learning, which is a person factor, is related to preference for assessment method (see Pintrich, 2004; Zimmerman, 1998).

Nevertheless, the present data do suggest some reasonable conclusions. Firstly, if an instructor's objective is for students to do the readings prior to class and be prepared to participate fully in class discussions, she should consider using RATs to provide some external motivation. However, if an instructor's objective is for students to learn the material in any way possible and/or there isn't enough time to score student responses every class period, he might consider weekly quizzes as an alternative. In either case, a good strategy for addressing the variation in learning styles is to include open-ended, subjective questions and objective, multiple choice questions in a course assessment strategy.

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