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# Evaluating the Use of an Online Video Training Program to Supplement a Graduate Course in Applied Behavior Analysis

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## ABSTRACT

The primary purpose of the present article was to evaluate the effects of a supplemental online video program on student quiz performance for an online course in applied behavior analysis. Nineteen graduate students, in ages ranging from 22 to 40, agreed to participate in this study. A within-subject group design was used. The control condition contained textbook readings and accompanied self-guided notes, while an online video training program was added to supplement the experimental condition. Results indicated that the students scored significantly higher in their weekly quizzes under the condition supplemented with the online video training program. The students perceived the video training program as equally helpful as the textbook, but they enjoyed the online videos significantly more than the textbook. Students' self-reported enjoyment of the online videos was also positively correlated to their quiz performance under the condition supplemented with the videos.

## KEYWORDS

Applied Behavior Analysis, Higher Education, Online Instruction, Textbook Instruction, Video Instruction

## INTRODUCTION

Interventions for individuals with autism spectrum disorder (ASD) guided by the principles of applied behavior analysis (ABA) are recommended as evidence-based practices (Wong et al., 2015). As the number of young children diagnosed with ASD increases, so does the demand for qualified professionals providing ABA services. Additionally, professionals in related disciplines (e.g., special educators) who work with individuals with ASD also seek ABA knowledge. To meet the demands of consumers, online programs in higher education designed to prepare inter-disciplinary service providers for ABA interventions have increased dramatically in recent years (Behavior Analyst Certification Board, 2016). Online programs become an alternative to traditional on-campus programs due to schedule flexibility and convenience of accessibility to the students as well as contributing to cost-savings for the universities (Buzhardt & Semb, 2005).

The quality of instruction is the foundation of quality programs. Pedagogy consisting of empirically validated instructional practices for learners at all ability levels has traditionally been a research focus of ABA (e.g., Keller, 1968; Skinner, 1968). This body of research has suggested several effective instructional practices should be applied to college-level courses, including sequenced materials in units to criterion performance, active student responding, academic engagement, repeated measures

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with immediate or specific feedback, individualized pacing, and creating motivation to learn through positive reinforcement rather than escaping from aversive contingencies (Boyce & Hineline, 2002; Fienup, Hamelin, Reyes-Giordano, & Falcomata, 2011; Heward, 1994; Keller, 1968).

The increases of ABA online courses in higher education require effective teaching methods be retested when implemented as part of an online format. For example, effective pedagogy derived from behavioral research in the traditional classroom setting may require modification when transferred to online virtual classroom settings in higher education. With the advancement of technology, the online format of instruction has been recognized to potentially facilitate individualized, active, and independent learning processes; however, a review of existing research suggests that empirical support for the applications of effective teaching strategies or online instructional programs in higher education remains limited (Means, Toyama, Murphy, Bakia, & Jones, 2010).

Web- or computer-based educational programs have been developed to teach principles of ABA, and some of these incorporate effective instructional practices. For example, research studies on college instruction addressed the need to incorporate effective teaching practices into an online training program by developing a fully online personalized system of instruction to deliver psychology courses to college students (Martin, Pear, & Martin, 2002a, 2002b; Pear & Crone-Todd, 1999). The components of the above online personalized system of instruction included self-paced unit tests to mastery criterion and the use of proctors to provide quick feedback. Their findings highlight the potential utility and feasibility of a personalized system of instruction in university online courses. However, the use of proctors in the online system to provide accurate and timely feedback on frequent short essays can be challenging to most instructors (Pear & Crone-Todd, 1999).

Other programs have incorporated effective teaching practices through the development of online video training programs. The programs have been found to be effective in teaching parents, staff, and professionals to acquire ABA knowledge (Fielding, 2012; Granpeesheh et al., 2010; Hamad, Serna, Morrison, & Fleming, 2010; McCulloch & Noonan, 2013; Young-Pelton & Doty, 2013). One example of such online video training programs is the video-based textbook produced by Autism Training Solution (ATS), currently housed on the Relias Learning website. ATS was designed to teach ABA knowledge by incorporating behavioral tactics or components of behavioral instruction models, including self-paced instruction, sequenced instructional modules with small units, video demonstrations of teaching procedures with narratives or scripts, and competency checks with unlimited attempts to complete unit quizzes until achieving mastery.

Fielding (2012) reported that graduate students in an ABA course reached a high level of mastery of materials presented through ATS, as measured in the ATS pre and posttests. However, further information regarding the use of other course materials was not available, and it was not clear whether ATS materials were supplemental to the textbook or the only source of instruction in that course. Subsequently, Young-Pelton and Doty (2013) conducted state-wide professional training using ATS and surveyed participating teachers to obtain feedback about the training. Their survey indicated positive responses on the implementation of evidence-based practices from teachers receiving the ATS online training. Unfortunately, the effects of ATS on teachers' knowledge and skill acquisition of evidence-based practices was not assessed and cannot be inferred from the survey.

Finally, McCulloch and Noonan (2013) trained paraprofessionals to deliver mand training to children with ASD using the mand training modules of ATS. In addition to ATS, the researchers added a checklist for paraprofessionals to self-monitor their own mand implementations. They found that ATS combined with the self-checklist effectively taught two out of three paraprofessionals to implement mand training with relatively high levels of fidelity. Only one ATS module was used, and no comparison or component analysis of their training package was evaluated. Thus, the isolated or additive effects of ATS on staff implementation skills remain unclear.

Additional online video training programs have taught ABA skill acquisition, such as training university students or direct therapists to implement discrete trial instruction (Pollard, Higbee, Akers, & Brodhead, 2014) and backward chaining (Nosik & Williams, 2011). These studies also involved

packaged instruction with multiple components (e.g., self-checklist along with video-based instruction) that did not allow evaluation of the effect of the video-based instruction.

Previous research indicates that online video training programs, such as ATS, might be an effective and readily available tool to increase knowledge and skill acquisition for students studying ABA through an online university course. However, the effects of class-wide implementation of ATS modules to supplement online courses need further research (Fielding, 2012). In addition, professionals report a high level of satisfaction with course content, but the learning outcomes were not evaluated (Young-Pelton & Doty, 2013). Although current evidence does not support the use of multi-media in online instruction as a replacement for the traditional textbook (Means et al., 2010), it is not yet known whether video or multi-media instruction can be used to supplement textbooks to enhance student learning. Given the added cost of supplemental web-based video textbooks, it would be beneficial to examine the additive effect of video training programs on student learning and satisfaction.

The purpose of the present study was to evaluate the supplemental effects of ATS to facilitate the acquisition of basic ABA knowledge contained in a standard textbook for graduate students enrolled in a fully online ABA course. The control condition included textbook readings accompanied with self-guided notes without the supplement of an online video training program as the control condition, and the experimental condition consisted of the control condition with the addition of the online video training program (ATS). The dependent variables were student weekly quiz scores under the two conditions. Social validity in regard to student self-reported satisfaction with the materials was also assessed.

The main research question was: did students perform better on weekly quiz scores when ATS was used as a supplemental material, compared to the control condition? The hypothesis was that students performed significantly better on weekly quizzes with materials taught under the ATS condition than quizzes with materials taught under the control condition. In addition, we also conducted correlational analysis on student quiz performance under each condition in relation to their reported satisfaction with the course materials.

## METHOD

### Participants

Nineteen students (all females) between the ages of 22 to 40 participated in this study. The students were informed that the study concerned evaluations of effective instructional methods but were not aware of various conditions being examined in this study. The students were enrolled in a Masters of Arts in Special Education with an emphasis in ASD program and had various levels of previous knowledge and experience in ABA. Six students were dually enrolled in the ABA graduate certificate program currently undergoing the supervision of independent field experiences with the goal of pursuing a board-certified behavior analyst credential. The other 13 students were either special education teachers in schools or full-time graduate students of special education having limited experiences in ABA practices. The course consisted of a total of 22 students. The three students who elected not to participate had similar characteristics to the 19 participants and completed all of the assigned requirements for this course.

### Setting and Materials

The study took place in an introductory graduate-level course entitled, "Applied Behavior Analysis." The instruction was delivered 100% online via the university's long-distance learning platform (*Desire2Learn; D2L*) in an unsynchronized format, where the instructor posted the materials and the students retrieved the materials at the time of their convenience within a specified period of time (e.g., one week). The course used the *Applied Behavior Analysis* Second Edition textbook (Cooper, Heron, & Heward, 2007) and selected video modules from the ATS web-based video textbook.

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The ATS program contains learning modules related to specific ABA concepts that are presented through a series of instructional videos. Each module consists of several 5- to 10-minute videos with narratives or demonstrations of teaching procedures followed by competency check questions. Progression to the next video is contingent upon 100% accuracy on the competency questions with unlimited opportunities to mastery. If a learner fails to reach the criterion on competency checks, the system automatically goes back to the video presentation and repeats the competency check questions until the learner reaches criterion. Modules within each topic vary, and the total duration to complete one topic ranges from 1.5 to 2.5 hours.

All ATS modules were delivered through the company's website with each participant's history of completion recorded automatically in the participants' individual accounts accessible to the course instructor. Other materials used in this course consisted of self-guided notes accompanied with assigned readings to ensure the students go through the key content of the readings. The self-guided notes were also delivered via D2L in the fill-in-blank format graded by D2L immediately upon submission with correct answers shown.

**Dependent Measures***Weekly Quizzes*

The primary dependent variable was student scores on weekly quizzes. Each quiz consisted of 20 questions, with 14 multiple-choice questions, two multiple-select questions, and four fill-in-the-blank questions. The content of quiz questions involved memorization of terminology, comprehension of key concepts, and the application of concepts in applied settings. Each multiple-choice question had one designated correct answer, and each multiple-select question had two to four correct answers. Each fill-in-the-blank question had one or two blanks of key terms for students to complete. Students had 30 minutes to complete each quiz, with quizzes automatically submitted by the learning management system at the conclusion of the 30-min period. The students were required to complete the quizzes independently without sharing the content with other students. The quiz questions, regardless of condition, were created based on the content of the assigned textbook readings for the week, such as key concepts, principles, and applications of these concepts and principles.

*Course Material Evaluation Survey*

Student responses to 13 survey questions with six textbook-related questions and seven ATS-related questions were used to assess participant perceptions of the usefulness of and satisfaction with the instructional materials (textbook readings and ATS). The survey questions were modified from the questionnaire in Fienup and Critchfield (2011). The survey contained questions in regard to whether the textbook/ATS were helpful for learning content and preparing for quizzes and course projects, as well as whether they enjoyed the material presented in each format. Each item of the survey was rated with a 5-point Likert scale (0 = strongly disagree to 4 = strongly agree).

Survey questions were grouped into two categories: learning-related items (items 1 to 10) and enjoyment-related items (items 11 -12). The first 10 items were further grouped into five textbook-related items (Cronbach's  $\alpha = .80$ ) and five ATS-related items (Cronbach's  $\alpha = .81$ ). Student responses on perceptions about the textbook and ATS were used to explore the correlations between their perceptions and actual quiz performance.

**Experimental Design**

The study employed a combination of a non-randomized within-subject group design and an alternating treatments single case design (Wolery, Gast, & Ledford, 2014) to examine the additive effects of ATS used as a supplement on student quiz performance in an online course. As a within-subject group design, all students in the study experience both the control and experimental conditions in the same sequence. As an adapted alternating treatments design, the sequence consisted of A-B-A-B-B-B-A-

A-A with A representing the control condition and B representing the ATS condition. The textbook and self-guided notes were implemented in the control condition, while the experimental condition contained the textbook, self-guided note, and the addition of the ATS videos relevant to the textbook materials of the week.

Only 10 out of 15 course sessions, with 10 different topics, were selected for assessment within the current study. Sessions with content that continued from the preceding session were excluded to avoid a potential carry-over effect. The sessions involving ethics and the final exam week were also excluded. The order of conditions was determined by identifying ATS content that was applicable to the textbook content in a given week in the course sequence, which had been established ahead of time by three doctoral level board certified behavior analysts to align with the Behavior Analyst Certification Board Fourth Edition Task list items taught in the course.

### **Procedure (Independent Variables)**

The course was delivered fully online via Desire2Learn (D2L) over the course of a 15-week semester. All instructional materials were prepared and uploaded to D2L, and students retrieved the materials and completed the requirements at their convenience within the time period specified in the course syllabus.

The course had one instructor and one teaching assistant responsible for grading the written assignments. Each week (regardless of condition), the students were required to complete the assigned readings from the textbook (Cooper et al., 2007) and the accompanied self-guided notes. All students in this study completed 100% of the course requirements. In addition to textbook readings with self-guided notes and weekly quizzes, participants completed two written projects associated with completion of a functional behavior assessment and behavior change plan. These two written assignments were broken down into a total of nine components submitted by participants for grading throughout the semester.

The self-guided notes consisted of key points derived from the textbook readings and posted online as fill-in-the-blank questions graded automatically by D2L. The students were given unlimited opportunities and time to complete the notes until a mastery criterion of at least 80% was achieved. Each week's self-guided notes contained approximately 120 to 180 fill-in-the-blank questions.

Access to each weekly quiz was contingent upon the student reaching criterion performance on the notes. That is, D2L would unlock the weekly quiz once a student scored 80% or higher on the notes. Under the ATS condition, access to the weekly quiz was also contingent on the completion of assigned ATS modules. When students completed the ATS modules, they self-reported to D2L in order to unlock the quiz of the week. The teaching assistant checked the accuracy of student reports on ATS module completion to ensure that students completed the assigned ATS modules prior to taking the quiz. All students accurately reported their ATS completion. Students were allowed to take each quiz up to two times with the average of the scores as their final grade. For this study, only the first quiz score was used. Upon the completion of each quiz attempt, D2L automatically graded the quiz and displayed the results to the students.

#### *Control Condition*

The control condition was implemented during the first, third, 10th, 12th, and 13th weeks of the course covering the topics of ABA introduction, evaluation/analysis of behavior change, antecedent control, contingency/self-management, and generalization. The students were required to complete assigned textbook readings and the self-guided notes before they obtained access to the corresponding quiz. There were five quizzes completed under this condition.

#### *ATS Condition*

The ATS condition was implemented during the second, fourth, fifth, seventh, and ninth weeks of the course covering the topics of defining/measuring behavior, reinforcement, functional assessment,

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function-based intervention, and antecedent interventions. The students had to complete the assigned textbook readings and self-guided notes as well as the assigned ATS module prior to completing the quiz. There were a total of five quizzes under this condition.

**Course Material Evaluation Survey**

The survey was administered through D2L during the 13<sup>th</sup> week of the course. Students were required to complete the survey to access the quiz for that week.

**Data Analysis**

Considering the relatively small sample size ( $n = 19$ ) in a group design, we used non-parametric analytic approaches to compare the differences between conditions. We also used correlational analysis to examine the relationship between student quiz performance and the results of the course material evaluation survey. The *IBM SPSS Statistics 23* package was used for statistical analyses.

**Weekly Quizzes**

The Wilcoxon signed-rank test was used to compare the difference in the means of the five quiz scores under the control condition and the five quiz scores under the ATS conditions. We then calculated the between condition effect size using the formula  $d = (M_{\text{diff}} / SD_{\text{control}}) / \sqrt{2(1 - r)}$  with the consideration of dependence between conditions in correlated samples (Morris & DeShon, 2002). In the formula,  $M_{\text{diff}}$  is the pretest-posttest mean difference,  $SD_{\text{control}}$  is the standard deviation of the control condition, and  $r$  is the pretest-posttest Spearman's rho correlation. An effect size of 0.2 indicates a small effect, 0.5 a moderate effect, and 0.8 a large effect (Cohen, 1988).

**Course Materials Evaluation Survey**

We first compared the mean ratings of student perceptions and satisfaction of using the textbook and ATS with the Wilcoxon signed-ranks test. Next, we used Spearman's rank correlation to analyze the associations between student perceptions and satisfaction on using the textbook and ATS and their quiz performance under both conditions.

**RESULTS****Weekly Quizzes**

Overall, students performed significantly higher scores in their weekly quizzes ( $z = -1.85$ ,  $p = .03$ ,  $\alpha = .05$ , one-tailed) under the ATS condition ( $M = 83.09$ , range = 74.5-92.0) than under the control condition ( $M = 81.21$ , range = 75.5-86.5). The relative effect size between conditions was moderate ( $d = 0.52$ ).

Table 1 displays descriptive data of means and standard deviations ( $SD$ ) for each student across the two conditions. Of the 19 students, 14 students had a higher mean score under the ATS condition compared to the control condition, while 5 students had a higher mean score under control condition. The  $SD$ s ranged from 3.71 to 16.43 (10 students with an  $SD$  greater than 8) under the control condition and from 6.71 to 29.18 (15 students with an  $SD$  greater than 8) under the ATS condition, indicating a relatively large variance in quiz scores under the ATS condition, compared to the control condition.

**Course Materials Evaluation Survey**

Results of the survey for individual students are reported in Table 2. The Wilcoxon signed-rank test indicated no significant difference ( $z = -.76$ ,  $p = .23$ ,  $\alpha = .05$ , one-tailed) between the student perceived ratings of learning related to the textbook items ( $M = 3.18$ ) and ATS items ( $M = 3.32$ ), suggesting that students perceived they learned similarly from each. In addition, there was not a

**Table 1. Mean, range, standard division (SD) of student quiz scores performed under the control and ATS conditions for each student and across all students**

	Control		ATS	
	Mean (Range)	SD	Mean (Range)	SD
Student 1	84 (65-95)	15.17	89 (70-100)	9.08
Student 2	81 (65-95)	12.94	82 (60-100)	15.25
Student 3	83 (75-90)	5.70	79 (65-90)	9.62
Student 4	85.5 (85-95)	6.22	78.5 (65-90)	9.94
Student 5	82 (65-95)	12.04	84.5 (62.5-95)	12.80
Student 6	77 (60-90)	12.04	74.5 (22.5-90)	29.18
Student 7	85.5 (75-92.5)	7.58	92 (80-95)	6.71
Student 8	85.5 (80-90)	3.71	84.75 (70-90)	8.50
Student 9	75.5 (65-92.5)	11.51	79 (55-90)	15.97
Student 10	78 (75-85)	4.47	79.5 (52.5-90)	16.81
Student 11	77 (65-95)	13.04	78 (65-90)	10.37
Student 12	77 (55-95)	16.43	86 (75-95)	7.42
Student 13	84 (65-100)	15.57	84.5 (67.5-95)	10.95
Student 14	84 (75-95)	7.42	87 (70-100)	13.04
Student 15	82.5 (75-87.5)	5	87 (75-100)	12.04
Student 16	81.5 (65-90)	11.12	79 (60-90)	12.45
Student 17	86.5 (75-92.5)	6.98	92 (80-100)	7.58
Student 18	76.5 (67.5-85)	7.42	85.5 (80-95)	6.71
Student 19	77 (65-90)	9.08	77 (65-90)	10.37
Overall	81.21 (75.5-86.5)	3.71	83.09 (74.5-92)	5.10

Note. Each student completed five quizzes under the control condition and five quizzes under the ATS condition.

significant correlation between student perceptions on how the course material helped their learning and their quiz scores under the control condition ( $r_s = .07, p = .78$ ) or the ATS condition ( $r_s = .26, p = .15$ ). However, there was a significant correlation between student enjoyment of ATS materials and performance on quiz scores for the ATS condition ( $r_s = .49, p = .03$ ). A similar correlation was not observed under the control condition ( $r_s = .05, p = .75$ ). Thus, students who enjoyed ATS tended to score higher on quizzes with material taught under the ATS condition. Finally, the students reported a significantly higher level of enjoyment with ATS materials ( $M = 3.42$ ) over the textbook ( $M = 2.26$ ) ( $z = -3.09, p = .002$ ), suggesting that students enjoyed ATS significantly more than the textbook.

## DISCUSSION

The current study was conducted to examine the effects of using ATS as a supplement to a textbook with self-guided notes in an online graduate-level ABA course on student quiz performance. We also analyzed the correlations between student quiz performance with their perceptions of materials, as well as student satisfaction with course materials. Overall, we found that student quiz performance was significantly enhanced during the weeks ATS materials were added. Additionally, we found that students did not perceive either tool (i.e., the textbook versus ATS) as being more valuable to their



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**Table 2. Satisfaction survey questions and ratings**

<b>N = 19 (N = 18 Items 5 and 9)</b>	<b>Category</b>	<b>Distribution 0-1-2-3-4</b>	<b>Mean/Mode</b>	<b>SD</b>
1. The textbook/readings helped me learn the information. I feel that I know more about the topics after going through the readings.	textbook	2-1-1-6-9	3/4	1.33
2. The textbook/readings helped me to prepare for the quizzes.	textbook	1-1-1-7-9	3.16/4	1.12
3. The ATS modules helped me to learn the information. I feel that I know more about the topics after going through the modules.	ATS	0-0-1-4-14	3.68/4	0.58
4. The ATS modules helped me to prepare for the quizzes.	ATS	0-1-1-5-12	3.47/4	0.84
5. What I learned from the textbook/readings helped me to do the project/assignment.	textbook	1-1-2-10-4	2.83/3	1.04
6. What I learned from the ATS modules helped me to do the project/assignment.	ATS	0-1-2-7-9	3.26/4	0.87
7. I would have done just as well on the quizzes if I had not studied the textbook/readings.	textbook	12-6-0-0-1	0.53/0	0.96
8. I would have done just as well on the quizzes if I had not studied the ATS modules.	ATS	7-10-1-1-0	0.79/1	0.79
9. I would have done just as well on the project/assignment if I had not studied the textbook/readings.	textbook	8-9-1-0-0	0.61/1	0.61
10. I would have done just as well on the project/assignment if I had not studied the ATS modules.	ATS	7-7-2-3-0	1.05/0.5	1.08
11. I enjoyed textbook readings.	textbook	3-1-3-12-0	2.26/3	1.15
12. I enjoyed the ATS modules.	ATS	0-2-0-5-12	3.42/4	0.96
13. I would recommend ATS to students taking CEP 844.	ATS	1-1-0-5-12	3.37/4	1.12

Note. This table displays the category of survey questions (textbook/ATS), the frequency of scores, mean/mode, and standard deviation for each question. Ratings: 0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree, and 4 = strongly agree. Items 7-10 were reverse coded for data analyses.

learning or quiz performance than the other. Finally, we found that students rated their enjoyment with the ATS materials as greater than that of the textbook, and their enjoyment of the ATS materials was significantly related to performance on quiz scores under the ATS condition.

### Weekly Quizzes

Student performance on weekly quizzes was significantly enhanced through the use of a supplemental online video training program. Specifically, compared to the control condition, students performed significantly better on weekly quizzes when ATS was added to supplement the textbook with self-guided notes. It is possible that ATS included video presentations on the applications of ABA principles specifically to children with ASD that added clarity and thus enhanced student learning of the content presented in the textbook. As described, the majority of the students enrolled in this online ABA course had limited exposure to ABA-related practices in the applied settings. Therefore, video-based presentations may be a superior instructional method in order to facilitate the acquisition, compared to only textual presentations in the textbook with guided notes without video demonstrations.

The ATS modules were used as the primary instructional method to teach ABA skills in previous studies (Fielding, 2012; McCulloch & Noonan, 2013; Young-Pelton & Doty, 2013). However, this study used the textbook with accompanied self-guided notes as the primary instructional method, and ATS was only a supplement. It is also important to note that we did not compare two distinct instructional methods (e.g., the textbook versus video formats) under two conditions. Rather, both conditions required textbook chapter readings and their accompanied self-guided notes as primary instructional components, with the ATS modules assigned as additional supplementary materials under the ATS condition. Thus, this study was not designed to examine the isolated effect but rather the additive effect of ATS on student quiz performance. It is common that instructors design and implement effective strategies with the addition of a video-based instruction component to supplement student learning (Sherer & Shea, 2011).

Self-guided notes used in both conditions also played an important role in student quiz performance as guided notes are an effective strategy used in higher education classrooms to enhance learning for college students (Larwin & Larwin, 2013). The purpose of self-guided notes in this study was to increase active student responding to ensure high quality of the online instruction in both conditions. Students were required to go through the required readings via the completion of self-guided notes prior to taking the weekly quizzes.

In their review of evidence-based online instructional strategies, Means et al. (2010) reported that no significant difference on student knowledge acquisition was found in seven of eight studies of university online courses with a control group involving the traditional textbook format of instruction and another experimental group involving video-based format of instruction with the same content as the control. It is likely that non-significant effect was due to the comparison involved two instructional formats matched with equal academic engaged time but both had limited active student responding in those studies. As active student responding is key to effective instruction (Whitney, Cooper, & Lingo, 2017), the ABA course in our study used self-guided notes to ensure active student responding in both conditions, and the ATS as a supplementary material also incorporated active student responding by requiring mastery on the post-instruction competency checks. Although our study did not compare the textbook and video formats of instruction separately, our preliminary finding supported that video or multi-media format of instruction with active student participation had a significant additive effect on knowledge acquisition for graduate students. It is possible that any format of instruction would likely be equally effective, as long as such a format of instruction provides the same opportunities for students to engage in active learning, as opposed to simply engaging in passive learning (e.g., listening to lectures, watching videos).

Consistent with previous findings, (Fielding, 2012; Granpeesheh et al., 2010; Hamad et al., 2010; McCulloch & Noonan, 2013; Young-Pelton & Doty, 2013), results of our study also indicated that ATS was effective to enhance ABA knowledge acquisition when used as a supplement to the textbook with self-guided notes. This has important practical implications for the decision to continue including ATS as a supplemental assignment in an online instructional program.

### **Course Materials Evaluation Survey**

The results of the survey indicated that the students enjoyed ATS significantly more than just the textbook and their enjoyment of ATS was related to their quiz performance. Specifically, higher ratings of student enjoyment of the ATS material were related to greater performance on quiz scores. This finding is partially consistent with the cognitive research literature that indicates a relationship between student performance and students' situational interest in instructional materials (e.g., Fryer, & Ainley, in press; Rotgans & Schmidt, 2011). That is, when students are interested in certain instructional materials due to temporary contextual factors (e.g., an interesting experiment in a science class), students are more likely to learn the material. Thus, it seems as though the use of video presentations in this online course may lead to an increase in students' situational interest and enhanced learning outcomes (Sherer & Shea, 2011).

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As described above, the videos contained live teaching demonstration so the learners could visualize the applications of ABA principles in action, as opposed to textual descriptions in the textbook and guided notes. It is possible that most students enjoyed the live demonstrations in the videos. Further investigations are needed to examine the potential differential effects of the video format of instruction on student performance for certain groups of students who may respond better under such an instructional format. It is possible that other motivational variables relevant to course contingencies (e.g., mastery requirements, points awarded to quizzes) play important roles in motivating student learning, rather than situational interest alone. Thus, whether interest in materials can be considered as a motivational variable remains theoretically questionable. Future research should also include investigating the effects of different types of motivational variables (e.g., intrinsic interest versus contingency) on student study behavior and their test performance in online learning.

**Limitations**

Limitations of this study included a relatively small sample size and the lack of a control group for experimental comparison. The lack of baseline condition also made it difficult to determine student initial performance level. It is important for future investigations to include a control group to allow experimental comparison. Future researchers may also consider administering a pretest as a measure of student initial performance.

**CONCLUSION**

Overall, the findings of our study supported the use of ATS as a supplement to enhance student ABA knowledge acquisition in the online course for graduate students. Survey results also indicated that students perceived ATS as helpful and enjoyable in their learning and such enjoyment was related to their performance under the ATS condition. Therefore, our preliminary data suggest that using ATS in an online ABA course had additive benefits of increasing student quiz performance as well as student enjoyment in learning for graduate students.

**DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST**

The authors declare no conflict of interest.

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