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Evaluating the Use of an Interdependent Group Contingency in Online Graduate Courses to Increase Engagement

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Evaluating the Use of an Interdependent Group Contingency in Online Graduate Courses to
Increase Engagement

by

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A thesis submitted in partial fulfillment of the
requirements for the degree of
Master of Science
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ABSTRACT

Enrollment in online academic programs has increased substantially in recent years (Allen & Seaman, 2011) and is especially relevant due to the COVID-19 pandemic (Khalil et al., 2020). Peer interaction and engagement opportunities are strategies associated with course satisfaction, test performance, and grades and should be incorporated into online courses (Conaway et al. 2005). Group contingencies have been commonly studied in face-to-face classrooms and have been found to be effective intervention in changing target behavior in elementary and secondary education settings (Barrish et al., 1969; Deshais et al., 2019; Harris & Sherman, 1973; Mitchell et al. 2015; Wiskow et al., 2019), but has received limited attention in higher education, particularly interdependent group contingencies (Carroll & Williams, 2007; Cheatham et al., 2017; Speltz et al., 1979). The purpose of this study was to evaluate the effectiveness of an interdependent group contingency on academic engagement among three online graduate cohorts. The results indicated an interdependent group contingency was not effective in increasing engagement and future research should be conducted to further evaluate the use of group contingencies in an online academic setting.

INTRODUCTION

Author Note

Due to the COVID-19 pandemic the thesis requirements for students graduating from the USF ABA program in 2021 has been modified and may include fewer participants, case studies or literature review.

Internet access has increased substantially over the past 30 years with over 55% of the global population having at least some access to the internet (Roser et al., 2015). Students have benefited from increased internet access as demonstrated by increased enrollment in online academic programs in recent years (Allen & Seaman, 2011). As of 2017, there were more than 3.1 million students enrolled in online academic programs (Gallagher, 2019). The Covid-19 pandemic has expedited the rate at which students are enrolling in online courses (Khalil et al., 2020). As of June 2020, 97% of college students in the United States have switched to online instruction at least temporarily (Bustamante, 2021). Prior to the Covid-19 pandemic, two main factors drove the growth of online education, including ease of accessibility (Ryan, 2018) and flexibility of scheduling (Gaytan & McEwen, 2007). For example, students who enroll in online programs do not need to relocate to be close to campus nor alter their employment schedule to accommodate class times.

Although online education may be easier to access and maintain enrollment, many students have reported online instruction is typically of lower quality than face-to-face instruction (Bustamante, 2011). Indeed, online programs may have inherent challenges alongside the many benefits. Kentor (2015) noted students in online programs exhibit lower levels of engagement with course content, peers, and instructors. Universities first began to experiment with online instruction in the mid-1990s with most

early programs closing shortly after opening (Kentnor, 2015). The primary reason for early program failures was related to the modality of content delivery with a stark contrast between online and face-to-face instruction. Based on the dissolution of early programs, online education garnered a reputation as an ineffective method of teaching by both instructors and universities (Kentnor, 2015). For example, many instructors provided online students with course materials, such as lectures and reading, while failing to program for student engagement (Kentnor, 2015). Active student engagement is an important element for effective teaching, in face-to-face and online teaching (Dykman & Davis, 2008; Gaytan & McEwen, 2007; Kentor, 2015). Previous research suggests promoting regular communication, providing feedback, and assigning group work can lead to increased engagement in online courses (Dykman & Davis, 2008; Gaytan & McEwen, 2007). Martin and Bolliger (2018) developed an extensive survey to evaluate student engagement in online courses. Students indicated how important online education engagement strategies were to them on a scale of very unimportant to very important. Researchers found students did not just want to be told what assignments to complete and when they were due, but also valued communication, discussions, and feedback with instructors and peers (Martin & Bolliger, 2018). Given the importance of instructor and peer interaction in the online environment, researchers have examined the ways in which these connections are fostered. Gaytan and McEwen (2007) distributed a questionnaire to two online course instructors and the students enrolled in their courses. The questionnaire asked students to rate commonly used instructional and assessment strategies in an online learning environment on a Likert scale. One question asked students specifically about dynamic interactions which referred to the frequency and quality of interactions between students, peers, and instructors. Researchers found only 52% of students reported the online learning environment was filled with dynamic interaction. Joksimović et al. (2015) analyzed peer interactions in relation to academic performance in an online master's course. The researchers found that specific components of communication demonstrated in online discussion posts, such as continuing a thread, complimenting other students, and expressing appreciation were predictors of academic performance. They also found active participation in discussion postings were

correlated with higher final grades. These studies suggest participation in peer interactions can be beneficial but may be limited in online learning environments.

Limited interaction may lead to fewer learning opportunities for students in online courses as compared to peers in face-to-face courses. Gaytan and McEwen (2007) administered a survey to students enrolled in an online course at a public university. The survey listed statements regarding online instruction and their experiences. Participants indicated their agreement with given statements on the survey. When students were given the statement, “All members of a group must participate in chat room discussions” only 36% of students indicated they agreed with the statement. This means more than half of the surveyed students did not agree possibly indicating most students did not participate.

In a similar study, Da Silva et al. (2019) analyzed student participation by reviewing discussion board posts in a colligate online course. The researchers reviewed variables such as the time discussion posts were submitted by students and whether the posts were graded. The researchers identified two notable trends in student responding. First, students showed a higher tendency to post discussions during the beginning of the semester, which then decreased over time. Second, only about half of students regularly participated in discussion boards when there was no incentive in place. These patterns of responding indicated a discussion board alone may not be the most effective way to measure student participation given the inconsistency in posting. However, modern online classrooms offer tools to allow instructors more precise measures of student behavior. Many learning management platforms collect data on student participation and engagement. For example, Canvas provides instructors with accurate measures of student page views and duration of engagement with course material.

Peer interaction is an important component in online learning environments and group work is associated with higher course satisfaction, test performance, and grades. Conaway et al. (2005) analyzed peer interactions through student discussion posts in an online business research methods course. Students were divided into small groups of five for a group project. Groups used discussion boards to communicate with each other and data on frequency of discussions posted per group were collected. Student responses were then evaluated on effectiveness, cohesiveness, and interactiveness. The researchers noted increased

student interaction on the discussion board was correlated with student learning and satisfaction with the course. This suggests students who interact with peers more frequently tend to perform better academically and report higher satisfaction with the course.

Employing group contingencies may be a viable approach to designing interventions to increase engagement and peer interactions. Group contingencies are peer-oriented programs where access to reinforcers are provided to individuals contingent on behavior of all members in the group (Chow & Gilmour, 2015). Group contingencies have been commonly studied in face-to-face classrooms and have been found to be an effective intervention for increasing behavior in elementary and secondary education settings (Barrish et al., 1969; Deshais et al., 2019; Harris & Sherman, 1973; Mitchell et al. 2015; Wiskow et al., 2019).

Dependent, independent, and interdependent are three variations of group contingency systems (Cooper et al., 2020). Dependent group contingency systems consist of identical contingencies in place for all members of a group. The reinforcement requirement is contingent upon the performance of one or multiple members of the group (Cooper et al., 2020). For example, Heering and Wilde (2006) implemented a dependent group contingency to increase on-task behavior for students enrolled in two elementary general education classrooms. Reinforcers were offered to the class contingent on all members of the class engaging in on-task behavior for at least 75% of observation periods. Results of the study demonstrated the dependent group contingency increased on-task behavior from a mean level of 50% during baseline to 85% across both classrooms during intervention.

An independent group contingency system consists of an identical contingency applied to all members of a group. However, the reinforcement requirement is contingent upon the behavior of a single individual within the group (Cooper et al., 2020). For example, Sloman et al. (2014) used independent group contingencies to decrease inappropriate behavior in a residential setting with individuals with developmental disabilities. During intervention, access to reinforcers were offered to all individuals in the group who met criterion. Specifically, researchers gave access to special activities for individuals who

had no more than one instance of inappropriate behavior or no instances of inappropriate behavior. The independent contingency system was effective and substantially decreased inappropriate behavior.

An interdependent group contingency consists of applying the same contingencies for each individual while the reinforcement requirement is contingent on the overall performance of the group or smaller groups (Cooper et al., 2020). Joslyn et al. (2019) demonstrated using an interdependent contingency to decrease disruptive behavior in an alternative high-school classroom. Reinforcement was contingent on the class as a whole decreasing disruptive behavior by 80%. Each member of the class received reinforcers when the class met the 80% criterion. The use of an interdependent group contingency system proved to be an effective intervention in decreasing disruptive behavior.

Further research has been conducted comparing different group contingencies in academic settings. Deshais et al. (2019) compared the effects of an independent group contingency system and a randomized dependent group contingency to increase academic compliance in a first-grade classroom. Results indicated both contingencies increased academic compliance equally. The authors also noted participant preference toward the randomized-dependent condition but indicated this preference could be due to a difference in academic performance. The researchers then divided the students into two groups. Target students who had a record of lower academic performance and non-target students with records of adequate academic performance. Researchers noted the low performance of target students could explain a preference towards the randomized-dependent condition as the reinforcer would be delivered on the performance of a higher academically performing student's performance. Thus, lower performing students would benefit from higher performing student's behavior. Alric et al. (2007) compared independent, interdependent, and dependent group contingencies and their effectiveness with fourth-grade students across eight elementary schools to increase reading fluency. Similar to that of Deshais et al. (2019), Alric et al. (2007) found independent, interdependent, and dependent group contingencies to be equally effective to increase reading fluency.

The effects of group contingency systems have also been compared to individual contingency systems. For example, Axelrod (1973) conducted an evaluation comparing an interdependent group

contingency with an individualized contingency system. Two special education classes were assigned either a group or individualized contingency. Numbers 1-25 were then written on a board in decreasing order and one number was crossed off each time a challenging behavior occurred beginning with 25. The remaining number on the board corresponded with how many tokens the student(s) received. Students could exchange tokens for reinforcers at a later time. Results of the study demonstrated the group and individualized contingency led to similar decreases in disruptive behavior. Despite similar results across group and individualized contingencies, Axelrod (1973) suggested group contingencies may be more convenient for teachers due to management of reinforcer distribution and easier data collection.

The literature on group contingencies consists mostly of studies with young children and adolescents. There are few studies that have used group contingencies in higher education. A study conducted by Cheatham et al. (2017) demonstrated the utility of a dependent group contingency system as an effective intervention to increase participation in a college course. The interdependent contingency consisted of dividing the class into two teams. Each team received points contingent upon individual team member participation. At the end of the class, the team with the most points received access to the choice of candy or one activity point. Speltz et al. (1979) compared the use of an interdependent group contingency to independent contingency systems in a college course to increase the number of students submitting assignments. In the interdependent group, researchers delivered extra credit points contingent on the submission of assignments with two variations, an interdependent responders group and an interdependent all member group. In the interdependent responders group, whenever eight or more students submitted an assignment, all students who submitted the assignment received extra credit. In the interdependent all member group, whenever eight or more students submitted the assignment, all students received extra credit. In comparison to the use of independent contingencies, the implementation of interdependent contingencies resulted in higher rates of assignment submissions. The researchers hypothesized that extra credit points were an effective reinforcer contingent on the submission of assignments due to many students indicating in a follow-up questionnaire that they were willing to complete and submit assignments to receive extra credit. However, some students reported that although

they wanted to receive extra credit and were willing to complete the assignment, sometimes students would forget to complete the assignment before class. This was reported to be less of a problem in the interdependent contingency as students had peers to remind them to complete the assignment. These results suggest that an interdependent contingency may be more beneficial in an academic setting as there is more opportunity for students to prompt each other in comparison to an independent contingency.

Carroll and Williams (2007) also compared the effects of interdependent group and individual contingencies on academic performance with college students. Researchers divided a class into different sections and prescribed one of the contingencies. Students were divided into groups based on their baseline exam scores. All contingencies had an individual component and a group component. In the individual contingency, students had to first maintain or improve their exam grades for five extra credit points. An additional five points were then offered contingent on meeting the group requirement as well. In the interdependent section, within groups extra credit was contingent on improving the group mean exam score by at least one point first. Additional extra credit was offered if the individual alone also maintained or improved their exam grade. Performance levels increased across all contingencies and were similar, however, performance levels were highest in the section implementing interdependent contingencies. Higher performance levels were hypothesized to be a result of more students meeting the criterion and earning extra credit in the group contingency condition.

There are few studies in online education and interventions to address limitations associated with online learning. Peer interaction and academic engagement are essential to face-to-face instruction and should be programmed when designing online learning environments.

Instructors should embed peer interaction and engagement opportunities into online courses given the large number of students transitioning to or initially electing online education programs (Allen & Seaman, 2011). Group contingencies have been shown to be an effective intervention for increasing peer interactions and academic engagement in classrooms (Cheatham et al., 2017; Harris & Sherman, 1973; Medland & Stachnik, 1972; Reinhardt et al., 2009; Wiskow, 2018). Thus, examining the efficacy of group contingencies in online learning arrangements was warranted. The purpose of this study was to

evaluate the effectiveness of an interdependent group contingency on academic engagement among online graduate students.

METHOD

Participants

This study included three cohorts of students enrolled in a public university's online graduate program in Applied Behavior Analysis (ABA). Each cohort consisted of 18 to 30 students for a total of 67 students. Each cohort's experience in the graduate program varied. Cohort 1 was enrolled in their first semester during the time of the study. Cohort 2 consisted of students who had completed at least one semester in the program but less than one year of graduate study. Cohort 3 consisted of students enrolled in their final semester of the program. Participants were excluded from the study if they withdrew from the course or were inactive for more than seven consecutive days. Inactive was defined as failing to log into the online learning platform within a 24-hour period. Two students were excluded from this study because of inactivity. Instructors and teaching assistants of the courses were also included in the study to post announcements, export data, and refer students to researchers as needed.

Recruitment Procedures

The primary investigator contacted instructors of three graduate courses in ABA via email. The email included a brief description of the study and its procedures. These courses were offered concurrently in the first 8-weeks of the semester. The instructor and their students were enrolled in the study if the instructor agreed to the procedures described in the email. The study was exempt from Institutional Review Board requirements given the procedures involved typical and ongoing classroom instruction and any consent given would be the only identifying information stored about individual students.

Target Behavior and Measurement

The primary dependent variable in this study was days logged into Canvas. Secondary dependent variables included Slack usage, page views, and quiz scores. Days logged into Canvas was defined as the total number of days a student accessed their course through their Canvas account. Days logged into Canvas was measured using frequency. For further data evaluation, Slack usage was included and measured in comparison with days logged into Canvas. Slack usage was defined as the percentage of students who sent at least one message in their group Slack channel for the designated week. Frequency of students engaging in Slack usage was then calculated as a percentage. Page views were defined as any time a student clicked on a link (i.e., web browser loaded a page) to a page within Canvas. Page views were also recorded using frequency. Quiz scores were defined as the grade earned on a quiz calculated as a percentage. Days logged into Canvas and page views were recorded automatically within Canvas. All quiz score data was recorded within the Canvas Gradebook.

Canvas

Canvas is an interactive online platform used to host online classes and provide access to course material, assignments, and grades. Canvas offers analytics to administrators to track student activity, including data on page views and participation. Data provided on page views are the frequency of successive requests to access the server. Canvas defines participation as the completion of specific actions online. These include posting a new comment to the announcement board, submitting an assignment, loading a collaboration, joining a web conference, posting a new comment to the discussion board, starting a quiz, and submitting a quiz. Participations are tracked for both instructors and students enrolled in a course. These data can be accessed by instructors or administrators of the course on the Canvas Course Analytics page and can be exported as Microsoft Excel files.

Courses

Students in the study were enrolled in only one of the following courses: ABA Basic Principles, Single Subject Design, or ABA in Developmental Disabilities. All courses were offered within the same period. Students were only enrolled in a single course so there was no overlap of participants across

courses. Each course was set up similarly with modules containing the following pages: About the Module, Reading, Lectures, Discussion, and Quiz. In about half of the modules, an additional assignment related to course content was required. For each page (i.e., About the Module, Reading, and Lectures), a student had to manually select “Mark as Done” to progress to the next item in the module. All modules were open for nine days from 12:00 AM Saturday until 11:59 PM on Sunday. All courses total 1,000 possible points with every discussion and quiz each worth 20 points except for one course where quizzes were worth 30 points.

Interrater Agreement

Data on days logged in, page views, and quiz scores were de-identified and exported by the course teaching assistant to an Excel file. The teaching assistant removed all names and identifiable information from the Excel sheet leaving only the data on days logged in, page views, or quiz score. The teaching assistant then sent the Excel file to the primary and secondary raters via email. Both raters then independently recorded the data exported from the Excel file. A record was considered in agreement if both the primary and secondary rater recorded the same frequency. A record was considered a disagreement if the primary and secondary rater recorded different frequencies. Score-by-score agreement was used to report a percentage of agreement with the number of scores that had agreements divided by the total number of scores and multiplied by 100 (Cooper, Heron, & Heward, 2020). A score was defined as the number reported in a cell. Since data collected were a permanent product exported from Canvas, in the case of a disagreement, researchers went back and corrected the disagreement to reflect the true values. Interrater agreement was collected for at least 33% of the data collected across baseline and intervention with 100% interrater agreement across all three cohorts. Interrater agreement data sheets can be found in Appendices A, B, and C.

Procedural Integrity

A task analysis (TA) was used across course modules which described baseline and intervention procedures. An observer recorded if all steps in the TA occurred as described based on permanent product measures provided within Canvas. A “Y” indicated the step in the procedure was executed correctly, and

a “N” indicated the procedure was not executed correctly. This TA is available in Appendices D and E. Procedural integrity was calculated by dividing the number of steps executed correctly by the total number of steps, multiplied by 100 to report a percentage (Cooper, Heron, & Heward, 2020). Procedural integrity was 100% across baseline and intervention for all three cohorts.

Experimental Design

A multiple baseline across cohorts was used in this study. The introduction of the intervention was staggered for each cohort contingent on the stability of baseline data.

Procedure

Pre-experimental

Students were divided equally into groups of three to five students depending on the number of students enrolled in the cohort. Students were assigned to groups based on their frequency of page views during baseline. Students were organized in order from highest page views to lowest page views. High, moderate, and low page views were determined within each cohort by counting the page views for each student during baseline and creating high, moderate, and low groups based on the upper, middle, and lower tertile of students ranked by their page views. Students were then redistributed to create equal groups based on total page views. An announcement from the teaching assistant to all students via Canvas listed group assignments and was embedded into the week 1 assignment.

After being assigned to a group, students were given instructions to download a work orientated communication application (i.e., Slack). These groups were set up by the researcher within the application. Students then received instruction on how to create an account and join their assigned group. Students joined their previously assigned group set up in Slack by the researcher. Groups were required to create a group name and submit a screenshot of their group name along with evidence of all members having joined the group on Slack. This assignment was scored as either complete or incomplete with students who submitted the screenshot by the deadline receiving 10 points and students who do not submit the screenshot by the deadline receiving zero points. Additionally, instructors were asked to withhold

offering any extra credit opportunities throughout the duration of the course and all complied with this request.

Baseline

During baseline, the class was facilitated by the instructor as usual. Researchers collected data on page views and frequency of days logged in. The number of modules during which baseline procedures were implemented was staggered across cohorts.

Intervention

During intervention, the instructor continued to facilitate the class as usual with the addition of a group contingency. Students received information on the group contingency and a schedule in Week 0, outlining which weeks the contingency was in place. Additionally, an announcement was posted at the beginning of the module with the group contingency and embedded within the About Module page as a reminder to students to communicate with their group members about their activity during the week. Students who met the requirements of the group contingency for the week earned a five percent increase on their previous quiz score. The group contingency initially required students to log in four days a week. However, students in all three cohorts were meeting this requirement during baseline. As a result, the criterion was changed to require students to log in to Canvas across six days within a module. If all students within a group logged into Canvas six or more days within a week and viewed at least one page within the current module, each member of the group received extra credit applied to the quiz grade from the previous week. Extra credit was not given to any member of the group if a single member did not meet the criterion. Teaching assistants notified groups that met criteria individually via email.

Social Validity

Students and instructors were given a social validity questionnaire to assess the feasibility and acceptability of the intervention at the end of the semester. The questionnaires can be viewed in Appendices F and G. Social validity questions and formatting were constructed with reference to Wolf (1978) and Grooves and Austin (2019). The questionnaires included statements rated on a 5-point Likert scale and open-ended questions. The student questionnaire was administrated within the final module of

the course via Qualtrics. The instructor questionnaire was sent by email, linking instructors to the Qualtrics survey. Results were aggregated, anonymous, and could not be linked to an individual student or instructor.

Results from both student and instructor questionnaires are presented in the tables below.

Table 1 represents student responses on the questionnaire distributed after the intervention. Students reported agreeing most with the statement “the expectation of logging in four days was achievable” with 76% of students either agreeing or strongly agreeing. This was followed by 46% of students strongly agreeing or agreeing the group assignments were fair, and 30% of students strongly agreeing or agreeing the expectation of logging in six days a week was achievable. Statements with the highest percentage of disagreement among students included “I participated more in the course with the group support.”, “I performed better academically with the support of the group.”, and “Participating in the group helped me learn how to work as a team.” with 22% of students strongly disagreeing with these statements.

Instructor results from the social validity questionnaire are represented in Table 2. Instructors reported strongly agreeing most with the statements, “Increasing student participation is an appropriate goal in an online course.” and “The group contingency was easy to implement.” with two out of three instructors selecting they strongly agreed with these statements. While none of the instructors reported strongly disagreeing with any of the statements, two instructors did report disagreeing with the statement “Using a group contingency was an appropriate intervention to increase student participation” while one instructor agreed.

Student questionnaires also included two opened ended questions at the end of questionnaire that allowed students to anonymously describe the benefits they found while participating in the group contingency as well as give suggestions as to what could be improved in the study. Student responses were divided into themes of commonly discussed topics among students. For benefits, 24 students did not list any benefits, five students indicated they valued the ability to ask questions to their peers efficiently, three students indicated they valued peer interactions, two students indicated they valued checking in with peers, another two students described Slack as an outlet for casual conversation, one student described the

benefits of Slack for discussing assignments, and one student agreed there were benefits but did not describe them specifically. For suggestions, 33 students did not list any suggestions or stated no suggestions were needed, five students described the need for an increase in peers using Slack, another five students suggested a lower criterion for days logged in, four students suggested providing individualized feedback, four students suggested incorporating group assignments, four students suggested increasing the reinforcer magnitude, four students suggested using a dependent contingency, three students suggested increasing the group/group chat sizes, two students suggested using an unmonitored chat, two students suggested removing the requirement of Slack, two students suggested increasing the clarification around the usage of Slack, one student suggested using a different platform, and one student described the study as time consuming. Results from the open-ended segment of the questionnaire can be found in Table 3.

Table 1*Percentage of students' responses on the social validity questionnaire*

Statement	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
The expectation of logging in four days a week was achievable.	43	33	10	10	3
The group assignments were fair.	17	29	36	10	7
The expectation of logging in six days a week was achievable.	16	14	10	39	20
I enjoyed participating and communicating with my peers via Slack.	13	17	36	23	10
I participated more in the course with the group support.	10	4	32	32	22
I performed better academically with the support of the group.	9	7	33	29	22
Participating in the group helped me learn how to work as a team.	7	9	19	43	22
My relationships with peers improved through communicating and participating via Slack.	7	16	30	29	17

Note. Percentage of students' responses on the social validity questionnaire distributed at the conclusion of intervention. Statements were rated on a Likert scale ranging from strongly agree to strongly disagree.

Table 2*Percentage of instructor responses on the social validity questionnaire*

Statement	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Increasing student participation is an appropriate goal in an online course.	66.67	33.33	N/A	N/A	N/A
The group contingency was easy to implement.	66.67	33.33	N/A	N/A	N/A
Using a group contingency was an appropriate intervention to increase student participation.	33.33	N/A	N/A	66.67	N/A
I enjoyed implementing the contingency in my course.	N/A	33.33	66.67	N/A	N/A
I am satisfied with the results of using a group contingency	N/A	33.33	66.67	N/A	N/A
I would recommend the use of group contingencies to other online instructors.	N/A	33.33	66.67	N/A	N/A
I am satisfied with the results of using a group contingency.	N/A	33.33	66.67	N/A	N/A
I would recommend the use of group contingencies to other online instructors.	N/A	33.33	66.67	N/A	N/A
Students appeared to enjoy the group interaction.	N/A	N/A	100	N/A	N/A
The relationships of students in my course improved with the group contingency.	N/A	N/A	100	N/A	N/A

Note. Percentage of instructor' responses on the social validity questionnaire distributed at the conclusion of intervention. Statements were rated on a Likert scale ranging from strongly agree to strongly disagree.

Table 3*Themes described in the student social validity questionnaire*

Themes Described under Benefits	Frequency
Student did not list any benefits/stated they did not use Slack	56
Valued ability to ask questions to their peers efficiently	5
Valued peer interaction	3
Valued checking in with peers	2
Described Slack as an outlet for casual conversation	2
Described Slack as an outlet for discussing assignments	1
Agreed there was benefits but did not describe specific benefits	1
Themes Described under Suggestions	
Student did not list any suggestions/stated no suggestions were needed	33
Discussed a need for increase in peer Slack usage	5
Suggested a lower criteria	5
Suggested incorporating individualized feedback	4
Suggested incorporating group assignments	4
Suggested increase value of reinforcer	4
Described preference for dependent contingency	4
Suggested increasing size of groups/group chat	3
Described preference of an unmonitored chat (increase privacy)	2
Suggested lifting requirement of using Slack	2
Suggested clarifying the purpose of Slack	2
Suggested using a different platform	1
Discussed the study as time consuming	1

Note. Frequency of students who discussed the listed theme in the open-ended portion of the student social validity questionnaire.

RESULTS

Frequency of Days Logged In

Figure 1 displays results for all three cohorts across baseline and intervention for average frequency of days logged into Canvas and percentage of Slack usage demonstrated by students weekly. During baseline, students in cohort 1 logged into Canvas an average of 4.4 days per week (range = 4.15-5.04), students in cohort 2 logged into Canvas an average of 4.14 days per week (range = 3.95-4.42), and students in cohort 3 logged in an average of 3.61 days per week (range = 3.21-4.13). The percentage of students using Slack was 0% during baseline as Slack had not yet been introduced to the cohorts. During intervention, days logged in averaged of 5.21 days per week (range = 5.2-5.4) for cohort 1. The percentage of students actively using Slack for the first week of intervention was initially high at 88%. Percentage of students using Slack decreased in proceeding intervention weeks with an overall total average of 50% (range = 36%-88%) of students using Slack during the intervention condition in cohort 1. In cohort 2, days logged in averaged 4.25 days per week (range = 3.26-5.05) during intervention with a total average of 19.75% Slack usage (range = 0%-53%) of students using Slack. In cohort 3, days logged in averaged 3.85 days per week (range = 3.63-4.33) during intervention. The average Slack usage in this cohort was much lower than the other two cohorts at 5.25% (range = 0%-8%) during intervention.

Average Page Views

Figure 2 represents data for average page views across all three cohorts during baseline and intervention. Average page views were a secondary measure in this study and no experimental decisions were based off this data. In the first panel, average student page views for cohort 1 remained stable throughout baseline and intervention with an average of 283.88 page views during baseline and an average of 283.1 page views during intervention. Data for cohort 2, can be seen in the second panel of

Figure 2. Page views appeared to be on an increasing trend during baseline with the first three data points but was then followed by a significant decrease on the last baseline data point placing the average page views during baseline at 208.11. Upon the introduction of intervention, average page views initially increased, but began to decrease over time with the intervention average page views being 205.1. Data for cohort 3 is represented in the third panel. A similar variable trend is seen in baseline and intervention for cohort 3. A decrease in average page views is apparent in cohort 3 with average page views in baseline being 168.06 and 121.15 during intervention.

Quiz Scores

Quiz scores were another secondary measure in this study and no experimental decisions were based off this data. Average quiz scores across all three cohorts are represented in Figure 3. Quiz scores excluded extra credit applied for students who met criteria to receive extra credit. For cohort 1, the average quiz score during baseline was 79.66% (range = 79%-81%). During the intervention phase the average quiz score increased to 84% (range = 81%-90%). Cohort 2 also experienced an increase in quiz scores with an average quiz score of 86% (range = 78%-90%) during baseline and 88.5% (range = 86%-90%) during intervention. Cohort 3 demonstrated an increase in average quiz score from baseline to intervention with an average quiz score of 92.4% (range = 89%-98%) during baseline and an average quiz score of 95.25% (range = 92%-98%) during intervention.

Figure 1

Results for the Average Frequency of Days Logged into Canvas

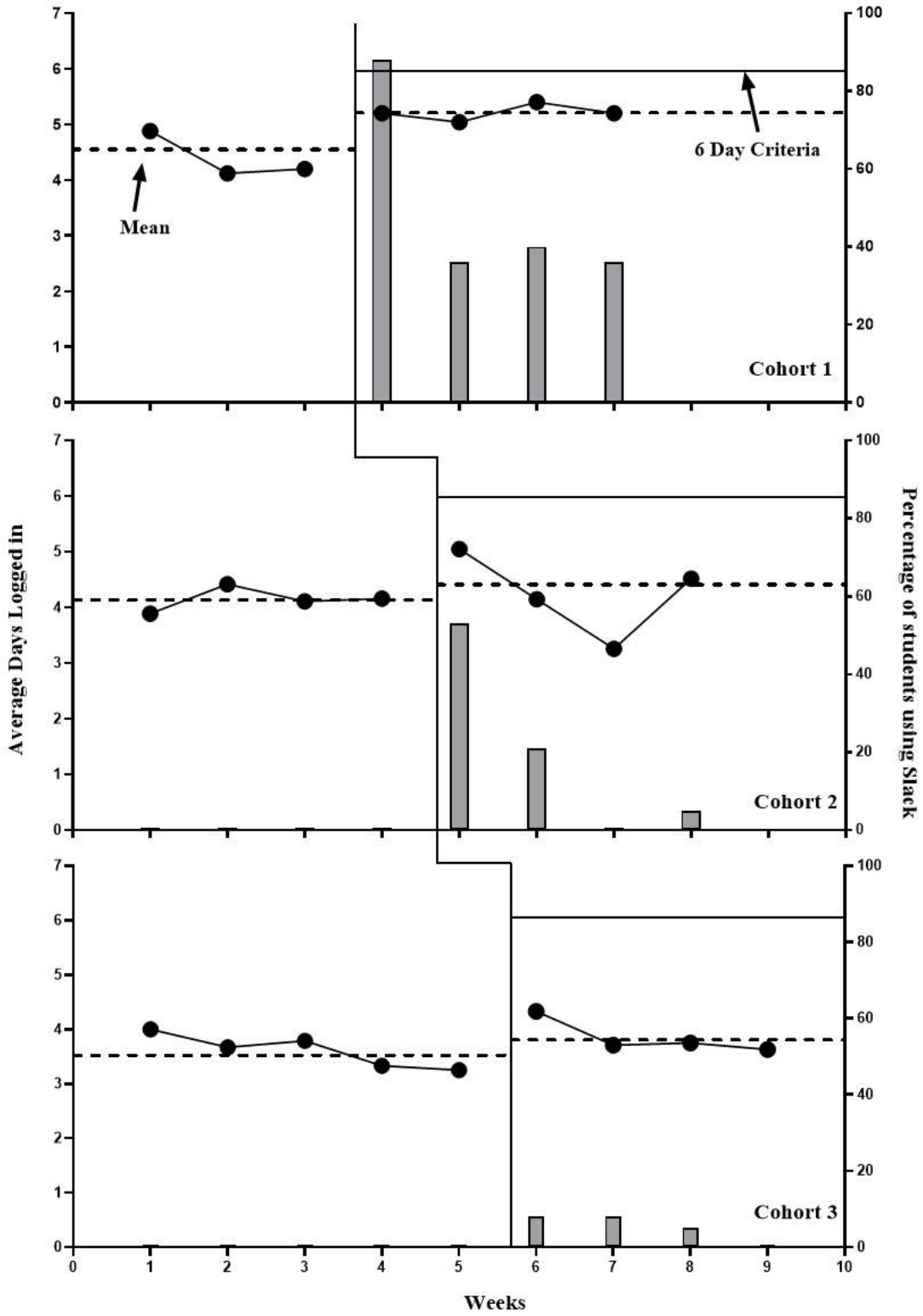


Figure 2

Results for the Average Page Views on Canvas

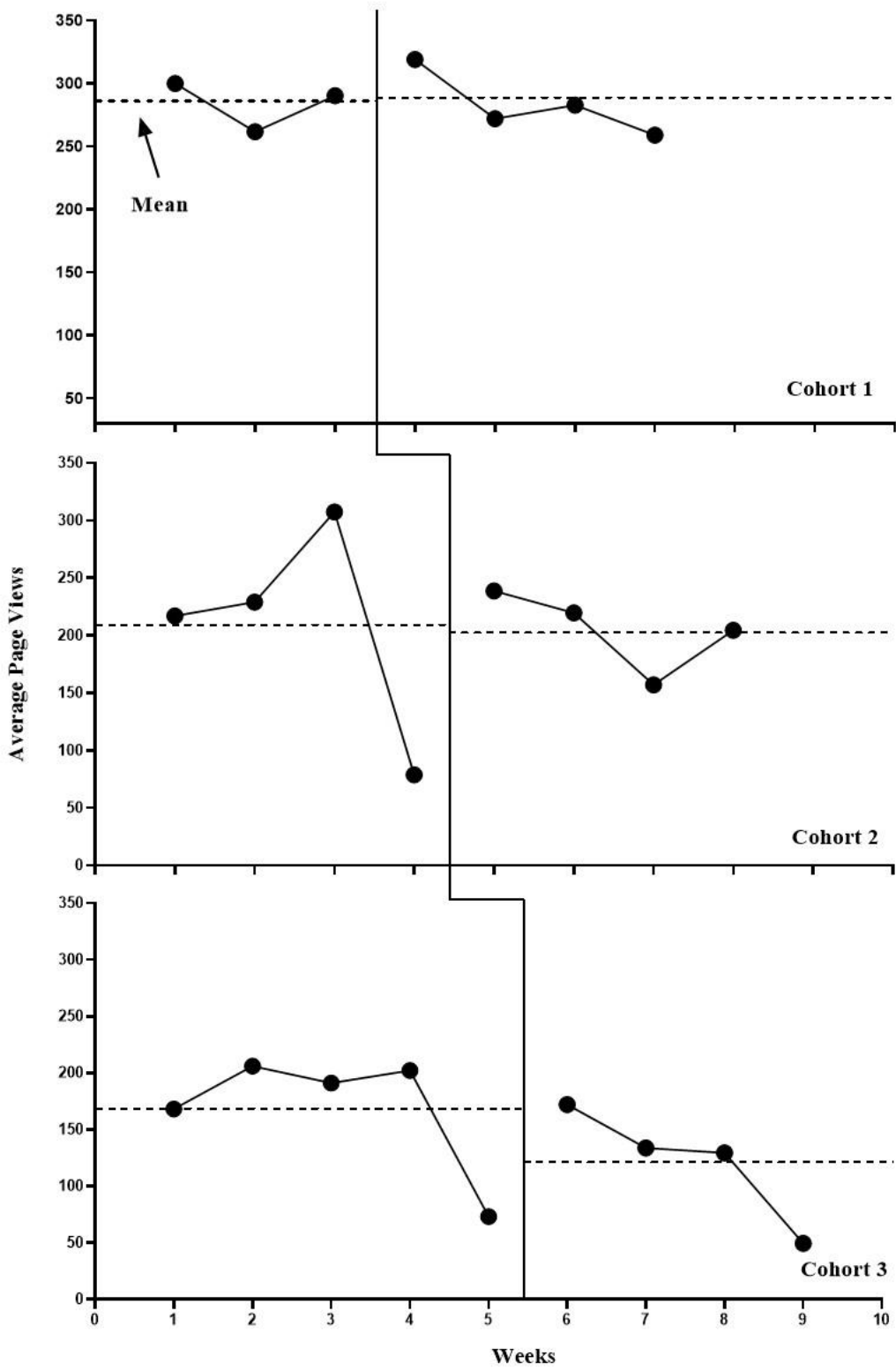
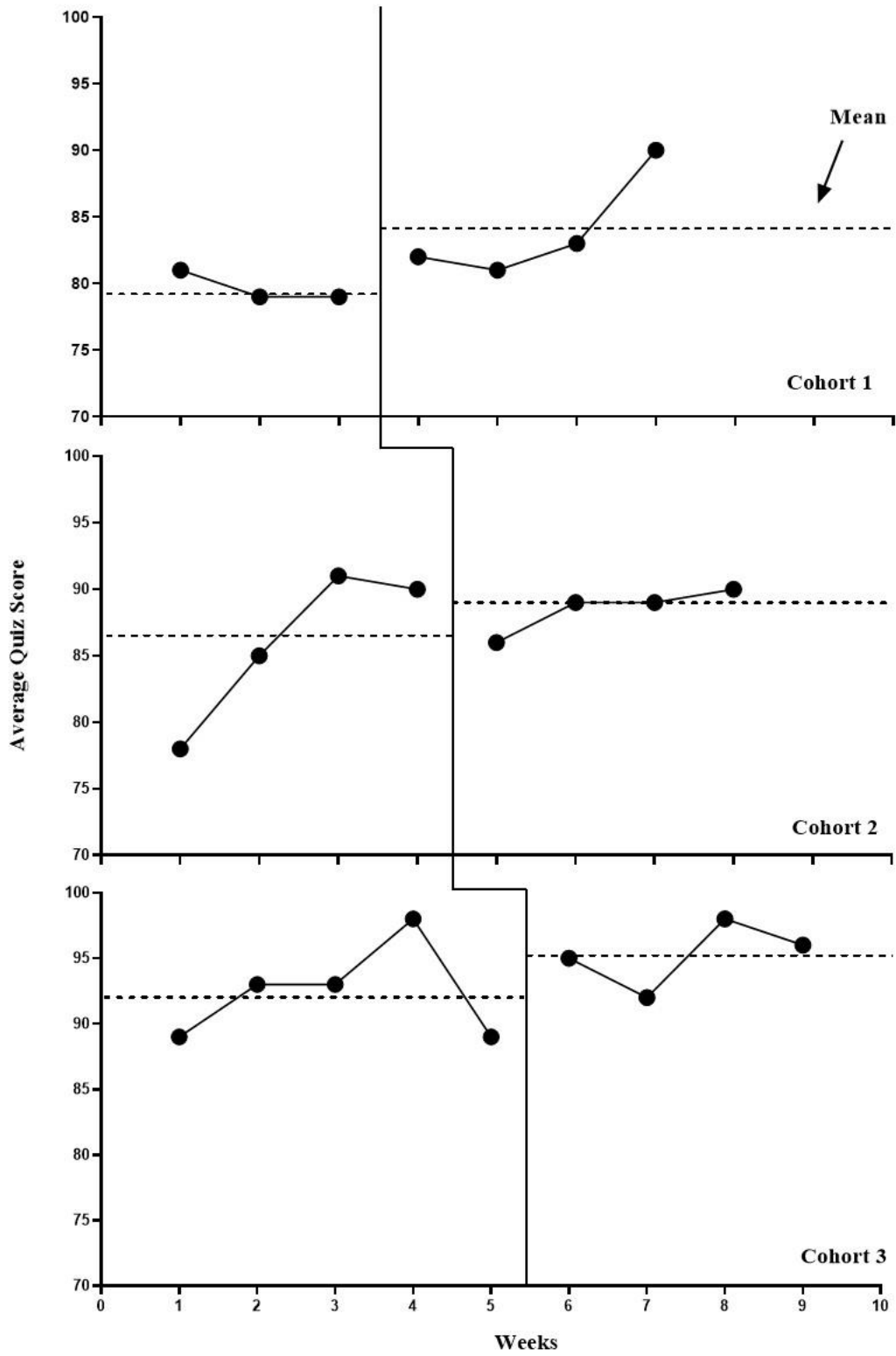


Figure 3

Results for the Average Score Received on Weekly Quizzes



DISCUSSION

This study evaluated the effectiveness of an interdependent group contingency on academic engagement among online graduate students. Students in three online graduate courses received extra credit contingent on all students in their assigned small group logging in six times to the assigned module. Results of the study indicated that an interdependent group contingency was not effective in increasing days logged in across the three cohorts. There was a slight increase in average days logged in during the intervention phase, but no clear demonstration of control and none of the cohorts met the six-day criteria. Although, the interdependent group contingency did not increase the average days logged in across the three cohorts, during intervention the average days logged in increased across all three cohorts. The consistent increase in average days logged in upon the implementation of intervention suggests interdependent group contingencies effectiveness in online academic programs warrants further research.

Much of the previous literature shows group contingencies to be an effective intervention in increasing student engagement (Cheatham et al., 2017, Speltz et al., 1979). In contrast, the present study did not show similar outcomes. In the present study, students displayed a pattern of responding similar to students observed in Da Silva et al. (2019). Da Silva (2019) noted students discussion post responses decreased as the semester progressed. Similarly, students in the present study initially engaged in high levels of communication within Slack, which decreased over the course of the semester. This suggests student responding decreases as the semester progresses.

Instructors should be aware of this pattern of responding and incorporate strategies to attempt to stabilize student responding throughout the semester. Future research could manipulate motivating operations throughout the semester to better evaluate this pattern.

There are many potential variables that could explain the results from the study. First, it appears Slack usage may be correlated with the average days logged in per week. For all three cohorts, Slack usage was at its highest upon the initial introduction of the intervention. Average days logged in was also highest upon introduction of the intervention. For cohort 1, Slack usage slightly decreased, followed by a slight increase, and a final decrease. Average days logged in follows this same pattern of responding. Similarly, in cohort 2 a decreasing trend is apparent in Slack usage from weeks five to seven followed by an increase on the final data point. Average days logged in also has a decreasing trend from weeks five to seven followed by an increase on the final data point. For cohort 3, data were consistently low across intervention for Slack usage. Once again, a similar trend is seen for days logged in. This suggests cohorts that had a higher percentage of students using Slack, had a higher number of days logged in.

One explanation for the association between Slack usage and average days logged in is that students using Slack were prompting their peers to log into Slack. Students often used the application to check in with their peers to see how many days they had already logged in that week and to remind them of the criterion. Students using Slack also often used the application to discuss assignments and ask questions regarding the course. Previous literature suggests students who engage in peer interactions more frequently perform better academically (Conaway et al., 2005). It is possible discussing course material and asking questions may have prompted students to interact with course material resulting in logging in more often during weeks Slack usage was higher.

The purpose of Slack was to provide students with an outlet for communication. Notably, each cohort displayed a distinct pattern of using Slack. One consideration for the difference in Slack usage was the experience difference between cohorts. Cohorts 2 and 3 had more experience in their academic program and with peers. Thus, cohorts 2 and 3 may have already established other means for communicating with peers. Cohort 1 had just started in the program with this being the first course taken. It is possible communication outlets had not been yet established for cohort 1, which may be one explanation for their higher usage of Slack.

Average page views during baseline and intervention were variable across cohorts. Cohort 1 remained stable across baseline and intervention while cohorts 2 and 3 displayed a decrease in page views from baseline to intervention. It is possible at the beginning of a course a student views more pages to familiarize themselves with the expectations, material, and navigation of Canvas. Since cohort 2 and 3 have had more experience in the program, they may have been more familiar with navigation through Canvas. Cohort 1 may have had more page views as they may have not been as familiar with the structure of the course and Canvas. Another potential explanation for the variability in page views is that the content and pages available in each module varied from week to week. It is possible that some modules contained more information and pages to view than other modules. This information would suggest that during some weeks there was more opportunity for page views as there were more available pages to view.

Quiz scores increased from baseline to intervention across all three cohorts. Experimental decisions were not based off a quiz scores. It is possible that intervention influenced quiz scores, however other potential factors that could have effected performance should be considered.

When exposed to the first quiz, a student may not have known what to expect or how questions would be presented. However, upon completing more quizzes students may have become more familiar with the quiz format and recognized how to better study for quizzes. The content of the quiz may have also influenced quiz scores. The content on each quiz varied every week across each cohort. The variability in content could explain the increase in quiz scores as well. The pattern in quiz score data suggests that the intervention did not hinder student's performance on quizzes. Future research should consider this data and evaluate whether the intervention could improve quiz performance.

There are some limitations to consider as an interdependent group contingency did not show an effect on academic engagement. One limitation was the inability to control for extraneous communication outlets. Multiple students reported having another application or outlet for communication for their cohort in the open-ended segment on the social validity questionnaire. If cohorts already had an application in use to communicate with each other, additional communication outlets such as Slack may be redundant.

There was also a limitation in the student social validity questionnaire. Seventy student responses were recorded on the social validity questionnaire even though there was only 67 students in the study. The extra surveys submitted suggests that some students may have taken the social validity questionnaire more than once. Since results were anonymous, the researcher could not identify which students took the survey more than once. As a result, all student responses submitted are represented in the social validity data.

Another limitation to this study was the change in criteria that occurred. As stated in the procedures, students were meeting the original stated intervention criteria of logging in four days per week during the baseline phase. As a result, the criteria had to be increased from four days to six days. Although an announcement was made informing students of this criteria change, it is possible not all students immediately saw the announcement of a criterion change and therefore effected the number of days logged in for that week. Students also reported in the open-ended segment of the social validity questionnaire that they believed the criterion of logging in six days per week was too high. Although baseline levels suggested six days would be an appropriate level for criteria, some students disagreed and did not believe the criteria was feasible. It may be possible that students included in this study too highly in baseline to capture the effects of the intervention. Future research should consider the population and current engagement level of students upon further evaluation of this intervention.

Additionally, it is possible that 5% extra credit did not function as a potent reinforcer. The average quiz score across all three cohorts during the baseline phase was 86.02%. This score is considered above a passing based on the university's academic scoring system. Cohort 1 was the most sensitive to the intervention with the lowest average quiz scores during baseline (79.66%). During intervention, the average quiz score for cohort 1 increased from baseline levels (84%). In contrast, cohort 3 was the least sensitive to the invention with the highest average quiz scores during baseline (92.4%) which remained stable during intervention (95.25%). It is possible the value of the reinforcer was not the same across all three cohorts. Lower quiz scores may have been an establishing operation for extra credit for students in cohort 1. As a result, the students may have been more likely to

communicate using Slack and log into Canvas more often. Students in cohort 3 already had high quiz scores which may have been an abolishing operation for extra credit. Further implementations of this study should consider the population of students and possibly conduct a preference and/or reinforcer assessments to identify possible reinforcers as well as the magnitude of reinforcement.

There is not enough evidence in the present study to support the use of group contingencies in higher education. It is unclear whether the lack of effect is due to the type of group contingency selected for this study or the differences in the implementation of the interdependent group contingency in the online environment versus face-to-face classrooms. However, based on repeated demonstrations of successful group-based interventions in previous studies, and the challenges and limitations in the present study, additional research is warranted. Further implementations of this study should consider the population of students and possibly conduct a preference and/or reinforcer assessment to identify possible reinforcers as well as the magnitude of reinforcement. Future studies should also examine independent and dependent group contingencies to determine if these impact engagement in online classes.

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APPENDICES

Appendix A: Page Views Data Sheet

Observer:

Date:

Course:

	Frequency of Page Views within a Module								
Students	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Participant 1									
Participant 2									
Participant 3									
Participant 4									
Participant 5									
Participant 6									
Participant 7									
Participant 8									
Participant 9									
Participant 10									
Participant 11									
Participant 12									
Participant 13									
Participant 14									
Participant 15									
Participant 16									
Participant 17									

Participant 18									
Participant 19									
Participant 20									
Participant 21									
Participant 22									
Participant 24									
Participant 25									
Participant 26									
Participant 27									
Participant 28									
Participant 29									
Participant 30									

Appendix B: Days Logged into Canvas Data Sheet

Observer:

Date:

Course:

	Frequency of Days Logged into Canvas									
Students	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Participant 1										
Participant 2										
Participant 3										
Participant 4										
Participant 5										
Participant 6										
Participant 7										
Participant 8										
Participant 9										
Participant 10										
Participant 11										
Participant 12										
Participant 13										
Participant 14										
Participant 15										
Participant 16										
Participant 17										

Participant 18									
Participant 19									
Participant 20									
Participant 21									
Participant 22									
Participant 24									
Participant 25									
Participant 26									
Participant 27									
Participant 28									
Participant 29									
Participant 30									

Appendix C: Quiz Score Data Sheet

Observer:

Date:

Course:

	Quiz Score by Module							
Students	1	2	3	4	5	6	7	8
Participant 1								
Participant 2								
Participant 3								
Participant 4								
Participant 5								
Participant 6								
Participant 7								
Participant 8								
Participant 9								
Participant 10								
Participant 11								
Participant 12								
Participant 13								
Participant 14								
Participant 15								
Participant 16								
Participant 17								

Participant 18								
Participant 19								
Participant 20								
Participant 21								
Participant 22								
Participant 24								
Participant 25								
Participant 26								
Participant 27								
Participant 28								
Participant 29								
Participant 30								
Average Quiz Score								

Appendix D: Procedural Integrity Checklist-Baseline

Researcher:

Course:

Date of Assessment:

Statement	Y/N
Researcher created a page in the Getting Started module for the introduction of the intervention.	
Researcher included instructions to using Slack in Introduction module.	
Researcher included contact information in Introduction module.	
Researcher posted instructions outlining procedures of intervention prior to the start of intervention.	
Researcher assigned students to groups.	
Instructor or researcher posted the group members as an announcement via Canvas.	
Researcher created Slack channel for each group.	
Researcher posted assignment for students to submit screenshot of Slack group name.	
Researcher transferred data from Student Analytics in Canvas to Excel datasheet for each cohort on page views during the baseline condition.	
Researcher transferred data from Student Analytics in Canvas to Excel datasheet for each cohort on days logged into Canvas during the baseline condition.	
Researcher transferred data from Student Analytics in Canvas to Excel datasheet for each cohort on quiz scores during the baseline condition.	

Appendix E: Procedural Integrity Checklist-Intervention

Researcher:

Course:

Date of Assessment:

Statement	Y/N
Researcher transferred data from Student Analytics in Canvas to Excel datasheet for each cohort on page views during the intervention condition.	
Researcher transferred data from Student Analytics in Canvas to Excel datasheet for each cohort on days logged into Canvas during the intervention condition.	
Researcher transferred data from Student Analytics in Canvas to Excel datasheet for each cohort on quiz scores during the intervention condition.	
Researcher notifies all members of the group who met the criteria to receive extra credit.	
Researcher reminds group members of criteria while notifying groups if they met criteria.	
Researcher added extra credit on module quiz under the Fudge Point section.	
Researcher added comment to quizzes stating how much extra credit was received and noting extra credit was received for group logins.	

Appendix F: Social Validity Questionnaire-Student

Instructions: Below are statements and open ended questions regarding your participation using Slack. Please respond to the following statements. A 5 indicates you strongly agree with the statement while a 1 indicates you strongly disagree. When finished, please click submit. All responses are recorded anonymously.

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I enjoyed participating and communicating with my peers via Slack.	5	4	3	2	1
2. The expectation of logging in four days a week was achievable	5	4	3	2	1
3. The expectation of logging in six days a week was achievable	5	4	3	2	1
4. The group assignments were fair.	5	4	3	2	1
5. I performed better academically with the support of the group.	5	4	3	2	1
6. I participated more in the course with the group support.	5	4	3	2	1
7. Participating in the group helped me learn how to work as a team.	5	4	3	2	1
8. My relationships with peers improved through communicating and participating via Slack.	5	4	3	2	1

1. Did you find any benefits to using Slack to communicate with your peers? If so, please describe those benefits.
2. What improvements would you suggest for using and participating with your peers in Slack?

Appendix G : Social Validity Questionnaire-Instructor

Instructions: Below are statements regarding your participation in implementing a group contingency. Please respond to the following statements. A 5 indicates you strongly agree with the statement while a 1 indicates you strongly disagree.

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Increasing student participation is an appropriate goal in an online course.	5	4	3	2	1
2. Using a group contingency was an appropriate intervention to increase student participation.	5	4	3	2	1
3. The group contingency was easy to implement.	5	4	3	2	1
4. Student participation increased while the contingency was in place.	5	4	3	2	1
5. Academic performance increased when the group contingency was in place.	5	4	3	2	1
6. I enjoyed implementing the contingency in my course.	5	4	3	2	1
7. Students appeared to enjoy the group interaction.	5	4	3	2	1
8. The relationships of students in my course improved with the group contingency.	5	4	3	2	1
9. I am satisfied with the results of using a group contingency.	5	4	3	2	1