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Jigsaw Cooperative Learning Versus Traditional Lectures: Impact on Student Grades and Learning Experience

ABSTRACT

Despite significant research supporting active learning, many professors continue to use traditional lectures as their primary teaching method, particularly in introductory level courses. This article explores whether jigsaw cooperative learning had a positive impact on student grades and enhanced their learning experience, as compared to the traditional lecture method. The question was answered by collecting data from an insurance and risk management introductory course in the business school. To answer the question on learning experience, students completed a validated survey on each pedagogy, consisting of 15 statements that they rated on a Likert scale of 1 to 5, strongly disagreeing or agreeing with the statements. The course content was taught using lectures for four learning modules and the jigsaw learning method for four learning modules. After each module, a quiz was written by each student, and these grades were compared to establish the impact of each teaching method on student grades. Data was analyzed using descriptive statistics and two-way ANOVA testing to determine significant differences. Data was collected from two student groups. One group was a traditional university group of diverse students and the other group consisted of international students from India. I compared the results of the two student groups to identify any differences. This research adds to the studies on active learning in insurance education, specifically jigsaw cooperative learning. It also contributes to literature on effective teaching strategies for international student groups.

KEYWORDS

jigsaw cooperative learning, active learning, student grades, student experience, cooperative learning

INTRODUCTION

There is ample literature on active learning and flipped classrooms encouraging instructors or professors to incorporate more active learning into their classrooms (Armbruster, Patel, Johnson, & Weiss, 2009; LoPresto & Slater, 2016; Niemi, 2002; Wong, Ip, Lopes, & Rajagopalan, 2014). Part of this learning involves the acquisition of social skills; we need to have the skills necessary to interact with one another. Active learning theories foster social elements that promote interaction (Niemi, 2002). The focus on learning has changed, and continues to change, moving away from transmitting information to students to a student-centered approach involving students in activities (Gömleksiz, 2007). There is some research on jigsaw cooperative learning but considerably less than the broader topic of active learning. It is suggested that student learning will be enhanced by doing various activities rather than sitting and listening to a lecture (Russell et al., 2016).

Reflecting on my classroom experience, I confidently assert that some students do not enjoy learning in this way. Each year, I try to add more active learning activities to my courses because, based on ample research on this topic, I firmly believe that enhanced student performance is realized through these efforts. However, active learning activities are not always well received. For example, recently a student asked me why we do so many exercises in class. I briefly explained the active learning principles, and she said, "that may be true, but I hate doing so many activities. I learn a lot more from your PowerPoint lectures." Another student in my most recent class chose to get up and leave as soon as he heard that the lesson plan for the day involved group work of any type, specifically jigsaw cooperative learning. When I asked him why he chose not to engage in group work, he stated that he did not find learning from other students to be helpful in any way. He said that many of them did not do a good job on their assigned topic and he learned nothing. He felt his time would be better spent learning on his own.

I have always encouraged feedback from my students about my teaching methodology, both in person and in other ways. During the first few weeks of a new course, I distribute index cards to all students and ask them to anonymously share what they like about my teaching style; what should I do more of? I also ask them to identify strategies that they do not like. What would you prefer not to see more of, or possibly less of, if at all? Surprisingly, each year students continue to express their satisfaction with my PowerPoint lectures. This has piqued my curiosity. I am very interested in learning how students feel about jigsaw cooperative learning as compared to lecture-based learning. I want students to learn and to perform better, but I also want them to enjoy my classes!

My study was a quantitative project in the business field of study that focuses on jigsaw cooperative learning. The main purpose of my research is to inform my own teaching practices and acquire new knowledge about pedagogical strategies. This learning will ideally lead to decision making about the adoption of new teaching practices and ultimately improvement in my teaching. By disseminating my findings to other scholars, I hope to motivate and encourage them as well. I am also interested in contributing to the field of research on active learning and learning strategies that are effective in business, particularly insurance and risk management.

My objective was to determine whether the inclusion of jigsaw cooperative learning activities in an introductory insurance and risk management class is beneficial to students. Does it result in an increase in student grades? Does it have a positive impact on their learning experience? My research questions were as follows:

1. ***Will student grades be higher when jigsaw cooperative learning is used as compared to lectures? Will this be true for traditional and international student groups?***
2. ***Will students experience greater autonomy, competence, social relatedness, intrinsic motivation, and deeper-level processing when using jigsaw cooperative learning over lecture-style learning? Will this be true for traditional and international student groups?***

This article describes what jigsaw cooperative learning is and how it was used in this study. It will provide a comprehensive summary of the literature on the topic.

WHAT IS JIGSAW COOPERATIVE LEARNING?

Jigsaw learning was developed by Elliot Aronson and his colleagues in the 1970s (De Baz, 2001), and is one of the most common forms of cooperative learning. The structure used for jigsaw cooperative

learning may vary slightly from one instructor to another. However, it is believed that the jigsaw cooperative learning structure improves student learning by placing responsibility on each student to teach some of the material to other students in a group (Doymus, 2008). By making students responsible for teaching parts of the material to other students, a study by Aronson, Stephen, Sikes, Blaney, & Snapp (1978) found that student learning was enhanced.

The method begins with the professor introducing the topic and its subcomponents—the puzzle and its pieces. Following an explanation and instructions, each student is placed into two different groups of four to six students: a "home group" and an "expert group." Once students are placed into their home groups, each member of the group is assigned a component of a learning module. They are expected to thoroughly research their assigned component and become subject matter experts on their piece of the puzzle. They are given approximately 20 minutes to prepare summarized teaching notes on the key points relating to their topic. When this step is completed, students are placed into their expert groups. These groups are formed by putting all students who are assigned the same component of the learning module together. The expert groups then have about 15 minutes to further discuss the topic and refine their teaching notes. This is done by reaching agreement on what is most important. Then the students return to their home groups. Each member is now an expert on their assigned topic and is tasked with teaching their part to the other group members. Each person in the group will have an opportunity (three to five minutes) to peer tutor. It is believed that when one has an opportunity to teach others, a deeper level of learning takes place (Aronson et al., 1978). Once each member of the home group has taught their piece of the puzzle to the other members of the group, the whole puzzle is formed.

The learning experience may be concluded with some type of testing, either individually or as groups. In my class, I had each student first answer 10 multiple-choice questions individually. Then I formed small groups of three and asked each group to answer the same 10 questions collaborating with each other. Each group was given an instant feedback card, and once the collaborative answers were chosen, they could scratch their preferred answer. If it was correct, they scored three points. If it was not, they were allowed a second attempt, and if they selected the correct answer on the second try, they scored one point. After tallying the points, the group who had the highest score received a prize. I awarded each person in the winning group with a coffee card. This testing was not for evaluative purposes but was part of the learning activity.

LITERATURE REVIEW

The extant literature reviewed on jigsaw cooperative learning is consistent with the findings of active learning in general. Students performed better, and overall had a positive response to the teaching methodology. It appears that no research has been conducted on insurance and risk management courses. Most of the reviewed literature was based on science, technology, engineering, and mathematics (STEM) education. The findings from this study will therefore add not only to the body of literature on jigsaw cooperative learning and active learning, but also to business education and, specifically, insurance and risk management education. Further uniqueness is shown in the comparison of results for a group of traditional students and a group of international students from India. This additional finding complements the body of knowledge on teaching and learning strategies for international students.

Much research has been done on active learning in general, and it has been found that student performance improved (Russell et al., 2016) and that students enjoyed the varying activities. One study

in a physiology course (Montrezor, 2016) utilized various active learning activities such as a board game, a puzzle, a video, and a debate. The results were compared with those of classes where active methodologies were not used. From a comparison of grades on tests, it was concluded that the average grades for those students who participated in active methodologies were significantly higher than were those of the control groups. The researcher further concluded that students not only learned more, but also enjoyed the activities. Although Montrezor's (2016) learning strategies did not include jigsaw cooperative learning in the study, as an active learning strategy, it should yield similar results.

Numerous other studies have investigated the effect of jigsaw cooperative learning on student performance and have reported that grades were positively affected (Azmin, 2016; Doymus, 2008; Gömleksiz, 2007; Johnson, Johnson, & Stanne, 2000; Karacop & Doymus, 2013; Kiliç, 2008; Morgan, Rodriguez, & Rosenberg, 2008; Tran & Lewis, 2012). It was concluded in a study of 80 mathematics students in Vietnam that student-centered cooperative learning resulted in improved retention and achievement (Tran & Lewis, 2012). A study of Malaysian mathematics students found an improvement in students' achievements (Zakaria, Chin, & Daud, 2010). Gömleksiz (2007) concluded that jigsaw cooperative learning results in students' retaining information for a longer period of time than does teacher-centered instruction. Most of these studies have been conducted in fields other than business, except for one study of active learning with accounting students (Mohrweis & Shinham, 2015). The vast majority of studies have been done in STEM fields, such as mathematics (Tran & Lewis, 2012; Zakaria et al., 2010), chemistry (Karacop & Doymus, 2013), medicine (Montrezor, 2016), and biology (Slish, 2005), to name a few. No available research was found that focused on the general insurance or risk management fields of study—even though in today's business and professional settings, working in small teams is usual and cooperative learning strategies can benefit students by better preparing them for the workplace (Perkins & Saris, 2001).

Student grades are not always improved through jigsaw learning. Some studies found there to be no significant difference between passive learning, such as lecture style, and active learning (Bonwell, 1996; Hänze & Berger, 2007; Killian & Bastas, 2015; Mohrweis & Shinham, 2015; Slish, 2005). Slish (2005) noted only one component of learning where students experiencing active learning did slightly better on a post-test than did those experiencing passive learning. Killian & Bastas (2015) reported that the grades were slightly higher when team-based learning was used over lecture, but the difference was not statistically significant.

Not concentrating solely on the impact of jigsaw cooperative learning on student grades, my research also sought to determine the effect of both pedagogies on the overall student experience. Did each method result in positive experiences of autonomy, competence, social relatedness, intrinsic motivation, or deeper-level processing? Although some of the literature I reviewed delved into student experience with respect to jigsaw cooperative learning or other active learning strategies, the findings were inconsistent. One study found that the data from an attitude survey did not show that students had "a strong preference for either lectures or more active pedagogies, nor that they perceive themselves as learning much better from one or the other" (LoPresto & Slater, 2016, p. 74). Several studies concluded that for jigsaw cooperative learning to be an effective teaching strategy it must be structured correctly (Hänze & Berger, 2007; Morgan et al., 2008). In Morgan, Rodriguez, and Rosenberg's study (2008), it is suggested that students be grouped heterogeneously and that instructors carefully prepare and plan the lesson and articulate the guidelines clearly. Hänze and Berger (2007) suggest that the material needs to

be structured carefully by the teacher and adapted to the level of the ability of the students to teach it to others.

While the findings with respect to student experience were inconsistent, many articles I reviewed found the student perception to be positive (Russell et al., 2016) and an improvement in student attitudes toward the subject matter was evident (Killian & Bastas, 2015; Zakaria et al., 2010). One researcher stated, "students perceived the method positively because a majority reported that the method has increased their self-confidence, interest for learning and allowed them to be more active in the classroom" (Azmin, 2016, p. 92). Azmin elaborated on this statement by adding that although the low-medium achieving students preferred this method of instruction, high-achieving students preferred individual work (2016, p. 93). Another study concluded that a significant affirmative difference was found in high-achieving student grades when jigsaw cooperative learning was employed (De Baz, 2001). Another study posited that greater efforts to have positive relationships among students were evident and that the results of their work shows "a consistent positive relationship between cooperative learning method and attitudes towards learning" (Gömleksiz, 2007, p. 621). One of the participants in the work done by Morgan, Rodriguez, and Rosenberg (2008, p. 4) states that cooperative learning "is a good way to teach because it benefits all students, especially the low achievers." Another student in that study added that while learning the course material, the participants could develop communication skills (Morgan et al., 2008, p. 4). Tran and Lewis (2012) found student attitudes to be overwhelmingly positive toward jigsaw learning. When they asked their students in a survey to indicate their degree of enjoyment for this type of learning, 77.5 percent responded that liked it a lot; although a very small percentage (5 percent) indicated that they were not sure how they felt about the method, none claimed to dislike it. Yamarik (2007) suggests that students in cooperative learning environments were more likely to form study groups. One of the participants in his study stated that cooperative learning was "a great idea because it allowed me to learn the material from both the instructor and other students" (p. 275). Another said, "I learned the material much better by discussing it with my fellow group members" (p. 275). In Hänze and Berger's study (2007), there was no improvement in academic performance, but it was concluded that jigsaw cooperative learning has a positive impact on all categories of the student experience, especially the experience of competence.

Several studies reviewed found that students did not feel that jigsaw cooperative learning was an effective strategy because they were not able to learn through this method, found it challenging, and did not enjoy the experience (Missildine, Fountain, Summers, & Gosselin, 2013; Morgan et al., 2008; Slish, 2005). For example, in Morgan, Rodriguez, and Rosenberg's study (2008), although many participants found the methodology to be positive, some participants indicated that they did not trust the ability of their peers to teach them properly. Slish (2005) found in his work that students were resistant to jigsaw cooperative learning, mostly because they generally do not like working in groups. Students willing to do the work felt that they ended up doing most of the work while others did not engage. Absenteeism and a general lack of initiative had an impact on the effectiveness of jigsaw cooperative learning. When students in Slish's study were asked about the type of instruction they liked best, only 24 percent chose active learning, 16 percent chose a mixture of both pedagogies, and 60 percent chose passive learning (2005, p 9). Another study comparing active learning strategies with the traditional lecture model found that nursing students were less satisfied with the flipped classroom approaches than with lectures,

although their exam scores were higher (Missildine et al., 2013). This suggests that higher student satisfaction is not necessarily indicative of learning.

METHODOLOGY

My research was conducted in a theoretical introductory course in insurance principles and practices over one academic term. Some research has claimed that the jigsaw technique particularly benefits the learning process in theoretical courses (Kiliç, 2008). The data for my research was collected from two separate student groups. One student group consisted of traditional diploma students enrolled in the business management program, majoring in insurance and risk management. The second group of students was a separate class of international students, recently arrived from India, registered in the same diploma program, and taking the same program of study. Both groups of students were taught in the fall term (from September to the end of November). Their classes were two hours in length, twice weekly, on Mondays and Wednesdays. The traditional group took the class in early afternoon from noon to 2:00 pm, while the international group was scheduled for a morning class from 10:00 am to noon. For comparative purposes, neither class was exceptionally early or late in the day as to be an advantage or disadvantage over the other.

The course in insurance principles and practices is primarily lecture based in its current form. For the course sections included in my research, I taught four components of the course with the existing lecture format. Four components of the course were redesigned to incorporate jigsaw cooperative learning activities. It was my experience when using jigsaw teaching that I was able to cover the equivalent extent of material in the same amount of class time. Although significant time was required on the part of the professor to develop and prepare for the jigsaw modules, no additional class time was required to teach the material. My primary objective was to determine if jigsaw cooperative learning increased student performance and learning. At the end of each module, for both jigsaw cooperative learning and lecture-based instruction, students were required to complete a quiz that represented 5 percent of their overall course grade. The data to determine whether higher grades resulted when using jigsaw cooperative learning as compared with traditional lecture instruction was derived from the quiz results.

At the beginning of the course, I explained my research project to each student group and advised them that I would be requesting their consent to use their grades for this study. I informed them that regardless of their consent, all students would be expected to participate in the activities, but only those student grades whose permission was obtained would be used as part of the study. A colleague was asked to administer and collect the consent forms keeping them on my behalf until the course had concluded and the official marks were submitted. This complied with requirements of the institution's research ethics board.

To reduce the risk that the content being taught and tested was not comparable, I carefully planned and chose basic introductory concepts for each learning module. Because Insurance Principles and Practice is an introductory course and each chapter introduces some basic insurance and risk concepts, selecting comparable material was not difficult. For example, in one of the lecture modules, I taught students the five necessary components of a legally binding contract. In a comparable jigsaw cooperative learning session, the topic learned was comprised of five key ways insurance benefits society. In another lecture component, five different types of claims professionals were introduced. In the similar jigsaw cooperative learning lesson, students learned about different types of insurance organizations.

The quiz at the end of each lesson in both jigsaw cooperative learning and lecture modules included 10 multiple-choice questions selected from a databank of course questions.

When preparing my assessment quizzes, I chose each question using Bloom's taxonomy (see Centre for Teaching Excellence, n.d.) to ensure that the questions selected were the same level of difficulty. I focused on the cognitive domain of Bloom's taxonomy, which includes six hierarchical levels of learning: knowledge, comprehension, application, analysis, synthesis, and evaluation. Because the course is an introductory course and the assessment consisted of 10 multiple choice questions following each learning module, I chose questions from the lower levels of learning only: knowledge, comprehension, and application. The higher levels of learning were tested in the mid-term and final exams, where I used narrative questions, case scenario questions, and application questions. This type of examination is better suited to assess the students' ability to analyze, synthesize, and evaluate concepts than is multiple-choice testing. The marks from these examinations were not part of the research project. In each quiz for both jigsaw cooperative learning and lecture-based learning, I selected five knowledge-level questions, three comprehension-level questions, and two application-level questions. This allowed for reasonable confidence that the quizzes were comparable for each of the modules. All quizzes were written during the first 20 minutes of class.

To determine the student experience in relation to each pedagogy, they were asked to voluntarily participate in a survey to rate their student experience. The survey consisted of 15 questions about their experience with jigsaw cooperative learning and the same 15 questions regarding lecture-based lessons. The questions were designed to analyze student perceptions on their experiences of autonomy, competence, social relatedness, intrinsic motivation, and deeper-level processing. The survey was completed in the second last class of the course. I asked the same colleague to administer the survey and retain the collected forms until the course concluded and the official marks were submitted. Again, this was in compliance with the requirements of the institution's research ethics board.

The instrument used to collect the student experience data is a validated survey used by Prenzel and his colleagues (Prenzel, Eitel, Holzbach, Schoenheinz, & Schweiberer, 1993; Prenzel & Drechsel, 1996; Prenzel, Kristen, Dengler, Ettle, & Beer, 1996), and cited and adapted by Hänze and Berger (2007). The survey was revised by Hänze and Berger by adding some newly developed questions to make Prenzel's questionnaire more applicable to their comparative study between direct instruction and cooperative learning. After revising the survey, they tested the reliability of the instrument revisions and provided the Cronbach alpha coefficients as measurement of internal consistency of the subscales in their work. Their work was a study where the survey was used in a twelfth-grade physics class comparing jigsaw cooperative learning with traditional instruction. The survey included 15 questions about student experience. I used the same 15 questions and asked students to rate jigsaw cooperative learning and lecture-based instruction separately. (I have obtained permission to use this survey for publication purposes.) See Table 1 for survey questions.

Table 1. Student learning experience survey questions

1. I had the opportunity to learn about new things on my own
2. I had a feeling of freedom to make some of my own decisions
3. I noticed that I really understood things
4. I felt able to master the work
5. I was very comfortable with the atmosphere
6. I had a feeling of belonging to the others

7. My mind was elsewhere*
8. I was eager to learn about the material
9. The work was really fun
10. If I wasn't told to, I wouldn't have done anything*
11. I felt focused
12. I felt involved in learning the material
13. I took a critical look at the new material
14. I tried to distinguish between important and unimportant things
15. I tried to connect what I was learning with things I already knew

*reverse coding applied

Hänze and Berger (2007) grouped the student experience survey questions into five groups: autonomy, competence, social relatedness, intrinsic motivation, and activation of deeper-level processing. I used the same question groupings for my work. Table 2 shows how the questions were grouped.

Table 2. Survey question groupings

EXPERIENCE OF	QUESTION NUMBERS
Autonomy	1, 2
Competence	3, 4
Social relatedness	5, 6
Intrinsic motivation	7–10
Deeper-level processing	11–15

Students rated each question on a Likert scale from 1 to 5 with 1 being strongly disagree, 3 being neutral and 5 being strongly agree. Participants were given the choice to opt out of any question they were not comfortable answering. Other demographic data was also collected such as gender, age range, and the highest level of previous education completed. The participants consisted of 50 students (from a total of 56 students). This represents a participation rate of 89 percent. 19 students from the international cohort and 31 from the traditional group of students completed the survey, consisting of 27 males and 23 females. Fifty-four percent of the respondents were in the age range of 21 and under, while 34 percent were 22 to 30 years of age, and 12 percent were 31 and over. Fifteen students had some postsecondary education prior to enrolling in the program.

RESULTS

Using SPSS Statistics version 25 software, descriptive statistics were used to compute student grade means. Inferential statistics (paired t-tests and 2 x 2 ANOVA testing) were used to compare differences between jigsaw cooperative learning and lecture-style learning and to compare differences between the two student groups. Values of $p < 0.05$ were deemed statistically significant. Findings where $p < 0.10$, indicative of a small difference, are also discussed below.

To address my first research question (Will student grades be higher when jigsaw cooperative learning is used as compared to lectures? Will this be true for traditional and international student groups?), I analyzed the results of the quizzes students completed after each learning component. Using descriptive statistics, the mean and standard deviation was calculated for all quizzes testing both jigsaw cooperative learning and lecture material. The number of valid results for all students totaled 49.

Although 54 students in both classes were being studied, only 49 gave consent to use their grades for my study. Thirty of these students were from the traditional cohort and 19 were from the international cohort. Table 3 provides descriptive statistics for the student groups and the mean grades for each method of instruction.

Table 3. Descriptive statistics: student grades

	JIGSAW COOPERATIVE LEARNING	LECTURE
Group (*n*)	Mean (SD)	Mean (SD)
All students (49)	79.388 (12.253)	76.888 (14.987)
Traditional students (30)	82.083 (12.018)	77.833 (13.892)
International students (19)	75.132 (11.681)	75.395 (16.859)

A 2 x 2 analysis of variance (ANOVA) was performed to test for differences in student grades due to the two types of instruction—jigsaw cooperative learning and lecture-based learning—and differences in student grades between a traditional student group and an international student group, along with any possible interaction effects. Table 4 shows the results of the 2 x 2 ANOVA test results for student grades.

Table 4. 2 x 2 ANOVA results for student grades

DEPENDENT VARIABLE: MEAN GRADE			
Factors measured	df	F	*p* value
Method of instruction (JCL vs. LEC)	1	.50	.481
Groups (international vs. traditional)	1	2.78	.099
Interactions	1	.64	.425

The results of the ANOVA test show no statistically significant difference in student grades based on the pedagogical approach used. Overall, traditional student mean grades are higher than international student grades with a *p* value of .099, but there is no difference based on the type of instruction. The 2-way ANOVA shows no interaction effect with a high *p* value of .425. This indicates that a relationship between student group and teaching style likely does not exist.

To address my second research question (Will students experience greater autonomy, competence, social relatedness, intrinsic motivation, and deeper-level processing when using jigsaw cooperative learning over lecture-style learning? Will this be true for traditional and international student groups?), I asked students to voluntarily complete the student experience survey. The survey consisted of 15 questions designed to measure the experiences of autonomy, competence, social relatedness, intrinsic motivation, and the activation of deeper-level learning. The set of 15 questions was completed for each of the two different pedagogical approaches. A Likert scale was used to rate questions from 1 to 5, where 1 represented strong disagreement, 3 was neutral, and 5 signified strong agreement. Reverse coding was used for question numbers 7 and 10 so that positive attitudes would consistently be at the higher end of the scale. Table 5 illustrates the mean scores for each category of questions for all students who completed the questionnaire. The number of valid responses ranged from 46 to 50 participants. Some students chose not to answer all the questions, which explains the different number of observations in each category.

Table 5. Student experience questionnaire results for all students

QUESTIONS	JIGSAW COOPERATIVE LEARNING	LECTURE-BASED LEARNING
Experience of autonomy (n = 50)		
Mean	3.96	3.72
Standard deviation	.87388	.98021
Experience of competence (n = 47)		
Mean	3.66	3.95
Standard deviation	1.06376	.84849
Experience of social relatedness (n = 46)		
Mean	3.99	3.71
Standard deviation	.82657	.89179
Experience of intrinsic motivation (n = 46)		
Mean	3.59	3.62
Standard deviation	.82050	.78482
Activation of deeper-level processing (n = 47)		
Mean	3.91	4.02
Standard deviation	.64580	.82802

I also computed the mean scores for each of the question groupings by examining the scores separately for the traditional student group and the international student group. These results are shown in Tables 6 and 7.

Table 6. Student experience questionnaire results for traditional students

QUESTIONS	JIGSAW COOPERATIVE LEARNING	LECTURE-BASED LEARNING
Experience of autonomy (n = 31)		
Mean	3.73	3.58
Standard deviation	.94727	.99244
Experience of competence (n = 29)		
Mean	3.31	3.76
Standard deviation	1.03866	.95076
Experience of social relatedness (n = 30)		
Mean	3.78	3.60
Standard deviation	.83752	.82420
Experience of intrinsic motivation (n = 30)		
Mean	3.48	3.48
Standard deviation	.79424	.83653
Activation of deeper-level processing (n = 31)		
Mean	3.79	3.81
Standard deviation	.63137	.86176

Table 7. Student experience questionnaire results for international students

QUESTIONS	JIGSAW COOPERATIVE LEARNING	LECTURE-BASED LEARNING
Experience of autonomy (n = 19)		
Mean	4.34	3.95
Standard deviation	.57862	94126
Experience of competence (n = 18)		
Mean	4.22	4.25
Standard deviation	.86130	.54906
Experience of social relatedness (n = 16)		
Mean	4.38	3.91
Standard deviation	.67082	1.00364
Experience of intrinsic motivation (n = 16)		
Mean	3.81	3.89
Standard deviation	.84902	.61216
Activation of deeper-level processing (n = 16)		
Mean	4.14	4.44
Standard deviation	.63127	.58066

Paired t-tests were conducted to analyze the data to determine if there were any significant differences in the student experience ratings for jigsaw cooperative learning and lecture. Again, the total group results were scrutinized as was the breakdown of the two separate student groups, traditional and international cohorts. These results are reported in Table 8.

Table 8. Student experience questionnaire: Paired t-test results comparing jigsaw cooperative learning with lecture-based learning

	VALID RESULTS	MEAN	SD	P-VALUES
Autonomy				
All students	50	.24000	1.20475	.165
Traditional students	31	.14516	1.37352	.561
International students	19	.39474	.87526	.065
Competence				
All students	47	-.28723	1.22361	.114
Traditional students	29	-.44828	1.39735	.095
International students	18	-.02778	.84839	.891
Social relatedness				
All students	46	.28261	1.12868	.096
Traditional students	30	.18333	1.24902	.428
International students	16	.46875	.86542	.047
Intrinsic motivation				
All students	46	-.02717	.83038	.825
Traditional students	30	.00000	.72813	1.000
International students	16	-.07813	1.01947	.763
Deeper-level processing				
All students	47	-.11064	.80952	.354
Traditional students	31	-.01290	.90027	.937
International students	16	-.30000	.57504	.054

Mixed results are evident when the second research question is considered. Following are the findings for each experience group.

Experience of autonomy

A *p* value of .065 indicates there is some difference for international students. They experienced a greater sense of autonomy when learning with jigsaw pedagogy than they did when material was instructed through a lecture. No difference was evident for the traditional students or the total group of students.

Experience of competence

Traditional student results indicate a slightly higher experience of competence when being taught through lecture rather than jigsaw cooperative learning (p value = .095). There was no difference in the feeling of competence for international students or the entire group.

Experience of social relatedness

It is no surprise to see a difference in the student experience of social relatedness when jigsaw cooperative learning is used. Simply by the nature of cooperative learning, one would expect this to be true. For international students there is a significant difference indicated by a *p* value of .047. A slight difference was apparent for all students with a *p* value of .096, while no difference was evident for the traditional group.

Experience of intrinsic motivation

The results for the experience of intrinsic motivation showed that there were no differences between jigsaw cooperative learning and lecture-based learning. This was true for all student groups.

Activation of deeper-level processing

An assessment of the international student responses for deeper-level processing showed a *p* value of .054. This is indicative that deeper-level processing occurred when the learning was based on a lecture rather than jigsaw learning. This was not true for the traditional group or the whole group of students. No significant difference was manifested.

STUDENT EXPERIENCE SURVEY DISCUSSION

International students experienced a greater sense of autonomy when jigsaw learning was used. As detailed above, in jigsaw cooperative learning, students are tasked with teaching a component of the learning module to other students in their group. Students are responsible for how the learning process is structured. It is up to each student to decide how to teach the material to the other students in the group. The student is free to choose what needs to be taught within the confines of the topic, how to teach it, and how to structure questions or clarification of the subject matter. Students are afforded the opportunity to take ownership of their learning experience. It is expected that this should lead to a greater experience of autonomy—the freedom to self-direct actions and a feeling of empowerment. The pedagogical style contributes to meeting a learner's basic psychological need for autonomy. This in turn results in engaging students in their studies and creates a structure in which they are more likely to learn (Turner, 2019).

Deeper-level processing occurs when learners match the material being taught with abstract concepts stored in their memory from past learning. They do not focus just on the words of the material but attach greater meaning to them. It is indicative of a greater degree of semantic analysis—forming relationships between concepts previously learned. When words are recognized and there is familiarity from past experience with the words, the material is processed at a deeper level. The amount of attention given and processing time available will have an impact on the depth of processing. Deeper-level processing depends on the materials being learned and the task associated with the materials. Deeper-level processing results in information being stored in long-term memory, which has no known capacity and is forgotten very slowly or not forgotten at all (Craik & Lockhart, 1972). This learning outcome is sought after in a university classroom.

The results for international students show that deeper-level processing took place when lecture-based pedagogy was used. There was no significant difference for traditional students. I would have anticipated that jigsaw cooperative learning would result in deeper-level processing rather than lecture-based learning. I find the results somewhat mysterious. Previous research has shown that jigsaw cooperative learning results in deeper-level processing more than traditional lecture-based learning does (Aronson et al., 1978; Hänze & Berger, 2007). Other studies have shown that active learning strategies contribute to deeper-level processing (McKeachie, 1990; Niemi, 2002; Wong et al., 2014). One plausible explanation might be that the material taught in the lecture modules was developed by the professor. The PowerPoint lectures frequently presented relationships with past learning concepts, and this may have assisted students in making these connections more readily. Familiarity with the style and language used by the professor as opposed to the style used by peers might also have played a role. The processing time available also has a bearing on depth of processing. Jigsaw cooperative learning is structured with relatively short time frames allowed for each step of the process. This may have resulted in students' feeling that they did not experience deeper-level processing. Because deeper-level processing is dependent on the material and task, it is important that considerable effort be exerted in planning what pedagogy to use. Jigsaw cooperative learning should be carefully structured to ensure that deeper-level processing occurs.

Both student groups experienced greater social relatedness with jigsaw cooperative learning. The difference was significant for the international student group. With jigsaw learning, each student must work with others in a group with the objective of obtaining a common goal. Each student in the group is responsible for their part of the work, but the common goal is to teach each other. They do not work in isolation; they have accountability for the learning of the whole group as well as their own learning. This is important because experiencing a sense of belonging to the group enhances the desire to contribute to the well-being of the whole group, not just focusing on self. Peer connectedness and increased social interactions can result in other benefits. For example, because jigsaw cooperative learning fosters new relationships, students may be more willing to help each other in other course work and or subjects. Strong students may enter into tutoring relationships with weaker students. Study groups may be formed and sharing of resources may increase. Additionally, through the group interactions in the jigsaw cooperative learning classroom, students can improve their communication skills and learn to be more tolerant, understanding, and accepting of others and their differences.

Traditional students experienced a lower level of competence when jigsaw cooperative learning was used. In the jigsaw classroom, students are provided with opportunities to attain competence in their learning. They are assigned a topic in which they are expected to develop expertise so that they can

teach other group members the subject matter. Each student is expected to become competent in their portion of the work. This would lead one to expect students would experience an increased perception of competence as they strive to master the topic they are responsible for. The lower level of competence experienced by traditional students when jigsaw cooperative learning was used might have been the result of how well they perceived they were learning from others. It could also be that students do not enjoy working in groups.

I suggest that students may have recognized greater levels of competence with the piece of the puzzle they were responsible for mastering but did not feel competent in what they learned from others. The jigsaw cooperative learning literature has not delved into differences that students experience in their perceived competency when they are in the role of peer teacher versus learner. In their study assessing the advantages and disadvantages of reciprocal peer teaching, Bentley and Hill (2009) state that 75 percent of students in their study strongly agreed that their sense of obligation to master the material they were assigned to teach to their peers was increased. Sixty-seven percent reported an increase in their level of confidence with respect to the material they taught to their peers. Bentley and Hill's study identified the most frequent disadvantage of reciprocal peer teaching was the dissatisfaction expressed by students in the learner role. As learners, 39 percent pinpointed the greatest drawback of reciprocal peer teaching to be that they did not receive adequate teaching from their peers. One student in their study expressed frustration because the peer teacher was not prepared, did not do a good job, and did not finish on time.

Hänze and Berger's (2007) establish that jigsaw cooperative learning had a positive impact on the experience of competence, but their study did not consider if this experience differed when students were teachers or learners. Hänze and Berger report that when comparing grades of participants in jigsaw pedagogy and traditional lecture-based learning, jigsaw learning participants achieved higher grades on the subject matter they taught but lower grades on the material taught by others.

In my study, it is interesting to note, traditional students perceived a lower level of competence when jigsaw cooperative learning was used. Although the 2 x 2 ANOVA test showed that no significant difference was found in student grades for the two different pedagogies, Table 3 shows that their mean grades were slightly higher when using jigsaw cooperative learning than they were with lecture-based learning. Might this be because when students feel less competent they will work harder to gain competence they feel is lacking in order to achieve better grades? Another thought to consider is whether, if a student is feeling incompetent, a weaker performance is manifested due to lack of confidence. A future study designed to examine whether or not there are differences in student experience—especially their perceptions of competence when they teach material to their peers as opposed to being in a learner role—would be constructive. Such a study could ask students to rate their jigsaw cooperative learning experience from the perspective of teaching, followed by a separate rating from the point of view of a learner.

The results and discussion below about the student experience survey constructs indicate that there is a place in the classroom for jigsaw cooperative learning, lecture-based learning, and other pedagogical approaches. It is beneficial to use different teaching techniques to better meet the needs of the disparate learning styles within student groups. It is also useful to vary activities and teaching styles to keep the class interesting and increase student engagement opportunities. At the crux of this discussion is the need to thoughtfully choose the teaching method that best aligns with the material

being taught and is most likely to contribute to a successful learning experience and better student grades.

LIMITATIONS AND FURTHER STUDIES

One limitation of this study is the sample size. This course is only offered once annually with small class sizes. A larger sample would be constructive.

Another possible limitation is the comparability of materials taught using the two pedagogies. The content chosen for each module of study was introductory, and, using subject-matter expertise, the material for each module was carefully selected to overcome this limitation. This, however, did not take into account any impact on grades that may have occurred due to practice or fatigue effects.

The practice effect suggests that student learning increases as they progress through a course. The more opportunities students have to practice the material they are being taught, the greater the mastery of the subject matter. In a research study conducted on reading achievement and the practice effect, a small to moderate increase in achievement was found when students were provided with practice opportunities (Coker, Jennings, Farley-Ripple, & MacArthur, 2018).

The fatigue effect purports that student learning is negatively affected by fatigue. As students progress through a course chock-full of examinations, assignments, and other academic activities, it is reasonable to expect that fatigue will be experienced as demands increase. The cumulative consequence of increased hours of reading, studying, and doing homework might result in higher levels of fatigue and stress. This in turn might be manifested in deteriorating grades. In a study of college students, where researchers investigated the relationship between fatigue and cognitive functioning, it was concluded that fatigue impairs the ability to learn and compromises neurocognitive functions (Palmer et al., 2014). A limitation of my research is that the fatigue effect and its impact on grades were not taken into account. Nor was the practice effect considered. Future research would be useful to determine any impact that practice or fatigue effects might have on student grades when comparing the jigsaw cooperative learning pedagogical approach with traditional lecture-based learning. For example, it would be interesting to ascertain if any difference in results would be realized if such a study were to reverse the order of the jigsaw cooperative learning modules with the traditional learning modules.

A further limitation of my study is that grades used to measure student learning were based on multiple-choice quizzes following each module. Each quiz was worth 5 percent of the final course grade. Student motivation increases when work is evaluated. Unfortunately, stress and exam anxiety can also increase. This can be problematic when using grades to measure learning. In my study, these factors were not controlled for. Students are motivated to study more when they know a test is forthcoming. Emphasis will be given to material they struggle with or do not know. Does additional study result in higher grades, or are higher grades the result of the pedagogical approach used to teach the material? In my study, both pedagogies were tested with similar, scheduled exams, but it would be interesting to conduct a similar study where grades are based on unscheduled or surprise assessments carried out at the end of each class in which a learning module is being measured as part of the research.

The Dunning-Kruger effect—when humans self-assess their learning or performance, low performers tend to overestimate their abilities and high performers tend to under-estimate their abilities (Luce & Kirnan, 2016)—might have an impact on study habits and resulting grades, as well as the results of the self-assessed learning experience survey. If low performing students over-estimate their

abilities they may study less which could affect their grades. A similar future study could investigate any influence caused by the Dunning-Kruger effect.

Students might not recognize good learning experiences. If a learning experience is difficult, it might be rated negatively even though it promotes better long-term retention of material—a "desirable difficulty" (Yue, Bjork, & Bjork, 2013).

Another limitation of the student experience is hindsight bias. This occurs when individuals consider something that has already happened or been learned and overestimate their likelihood of predicting it in advance (Arkes, Guilmette, Faust, & Hart, 1988). Students may think things they already know are easier—a result of hindsight bias. My study did not attempt to eliminate any hindsight bias that might have occurred. A future study could consider the effect of hindsight bias.

As described above, each module included a multiple-choice quiz. Although Bloom's taxonomy was used to ensure the level of difficulty was similar for all quizzes, it would be impossible to state that the level of difficulty was identical. Perhaps a 10-question multiple-choice test was not broad enough to determine differences in grades and thus resulted in no significant differences. It is possible that a significant difference could have been realized if the study had not been limited to the lower levels of Bloom's taxonomy but also tested the higher levels.

With jigsaw cooperative learning, because it is dependent on students being responsible for their own learning and teaching one another, it is imperative that students attend regularly. If several students did not attend, group sizes were affected. This was not within the control of the researcher.

As discussed above, a future study to explore any differences in student experience, particularly student perceptions of competence as a teacher versus perceived competency levels as a learner would be informative. Although some of the jigsaw cooperative learning literature reviewed discussed this idea on a surface level, to the best of my knowledge this concept has not been thoroughly examined. A study of this nature could also test for any impact that the teacher-versus-learner role might have on student grades.

A final limitation may be found in the immediacy of testing. Once the module was completed for both jigsaw cooperative learning and lecture-style instruction, a quiz was given at the beginning of the following class. Long-term retention was not tested, and it is possible that this might have yielded different results.

CONCLUSION

In summary, the results of this study reveal that a statistically significant difference does not exist when comparing student grades using jigsaw cooperative learning versus traditional lecture-based instruction. Jigsaw cooperative learning does not negatively affect student grades, so it is still a good instruction method in that it engages students in the learning process and can be used to change the classroom practices. My study revealed that there are some benefits of using jigsaw cooperative learning in enhancing the student experience.

The analysis of student experience for the two different pedagogical approaches revealed mixed results. The most significant difference was evidenced in the experience of social relatedness for the international students. A higher degree of social relatedness occurred when jigsaw cooperative learning was used. The international cohort of students also reported a slightly increased experience of autonomy when learning through jigsaw, but a deeper-level processing of material took place when lectures were given. For traditional students, there was not much difference in the results between the two pedagogies.

A small increase in the experience of competence was apparent for lecture style learning over jigsaw. A larger sample size would have been particularly beneficial when breaking the total number of students into two separate groups.

Future similar studies would be recommended using a larger sample size. This would be useful to confirm the results of this study or to determine additional outcomes. Consideration of the implications of hindsight bias, the Dunning-Kruger effect, concept of desirable difficulties, fatigue effects, and practice effects could be included in future studies. Considering student experience ratings of jigsaw cooperative learning from the point of view of their roles as teacher and learner would be of interest. I would also suggest additional research on jigsaw cooperative learning in the field of business or insurance and risk management, as well as studies on jigsaw cooperative learning and its impact on international students. Finally, a study to investigate whether it was predominantly "A" students who experienced higher satisfaction with jigsaw cooperative learning over lecture-style learning or were students with lower academic results more satisfied?

Having acknowledged the limitations of this study, and the need for further research, the results of this study add to the body of literature on jigsaw cooperative learning and active learning strategies. It also adds to business education research. No previous studies have been completed on active learning or jigsaw cooperative learning in the insurance and risk management field, so these findings provide value in an area lacking research-based knowledge. A further uniqueness of this paper is that it adds to the body of knowledge on teaching and learning strategies for international students.

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