A Case Study Comparing Student Satisfaction and Attainment of Course Outcomes When Passive and Active Pedagogical Approaches Were Used to Teach Global Logistics to Industrial Distribution and Logistics Students

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Abstract

This paper presents an exploratory study of the use of passive and active pedagogies to teach global logistics to industrial distribution and logistics students. The purpose of the study was to determine whether the type of teaching method (1) impacts student engagement and course interest, and (2) improves student understanding and application of logistics principles. Course evolution is described over an eleven-year period. Instructor and student roles and types of assignments are discussed. The paper summarizes student satisfaction and achievement of course outcomes based on administered surveys, course evaluations, examination and assignment performance, informal feedback, and course assessments. The results indicate that the majority of students preferred active learning, but desired that some passive teaching be retained. Compared to passive methods, active teaching helped students to improve their understanding of logistics. The study provides a model for academics interested in designing courses to teach logistics in an international context.

Keywords

Flipped Classroom; Active Learning Pedagogy; Global Logistics; Supply Chain Management

Introduction

This paper presents an exploratory study of the use of passive and active pedagogies to teach global logistics to industrial distribution and logistics students. The purpose of the study was twofold: to determine whether the type of teaching method (1) impacts student engagement and course interest, and (2) improves student understanding and application of logistics principles.

Global logistics is a required course for the Bachelor of Science degree in industrial distribution and logistics (IDIS) from the College of Engineering and Technology at East Carolina University. IDIS is an applied technology program that combines mathematics, industrial engineering technology, information systems, and business administration to solve problems related to the flow of products in the business-to-business supply chain. The paper identifies the challenges involved in designing a global logistics course and discusses course evolution over an eleven-year period, including nine years as a traditional class using two different teaching approaches and two years as a flipped class incorporating universal design for learning (UDL) principles. Instructor and student roles are discussed and types of assignments given are described. Student satisfaction and achievement of course outcomes are summarized based on administered surveys, course evaluations, performance on exams and assignments, informal feedback, and course assessments. The study provides a model for designing courses to teach logistics in an international context.

Challenges of Teaching Global Logistics

Technology advances have resulted in an increasingly connected world, posing a challenge to higher education institutions responsible for preparing future managers. Companies recruiting graduates from engineering and technology programs seek T-shaped individuals who have the skills to share knowledge across organization and country boundaries as well as deep technical expertise in a specific area. To achieve these results, curricula are being internationalized to prepare students to interact with constituents and solve problems in the global environment.

There are at least three challenges that an instructor faces when designing a course in global logistics. First, the teaching style must facilitate learning so that the desired course outcomes are achieved. Second, the international content must be presented in an interesting way, yet facilitate the development of the skills needed to succeed in technical management roles. Third, current technology applications must be used in a manner that stimulates the development of critical thinking skills to improve functioning in the global environment. All three issues must be considered in designing a course to stimulate interest and satisfy course learning outcomes.

Learning and Teaching Style Characteristics

Learning styles differ based on how information is received and processed. R.M. Felder and L.K. Silverman[1] identify eight different learning styles and note that how well a student performs depends on the extent to which the teaching method is aligned to the learning style. For each of the four stages of learning – perception, input, processing, and understanding – students are categorized into two distinct groups (sensing versus intuition; visual versus auditory; active versus reflective; and sequential versus global). Students who perceive information via sensory means require content to be presented in a concrete manner, while those who learn through intuition need a more abstract approach. Visual learners prefer material depicted in seeable form, while auditory learners require verbal methods. Active learners thrive in environments with high student engagement, while the opposite is true for reflective learners. Sequential learners require problems to be explained in logical steps, whereas global learners prefer a holistic approach followed only by some detail. Studies[2, 4] have shown that teaching methods that support higher level thinking produce more engaged students and higher test results, whereas lack of alignment between teaching and learning styles leads to passive behaviors toward learning. A.P. Gilakjani[3] notes that by understanding student learning styles, instructors can adapt their pedagogical methods to be more effective teachers.

Little information is available on the learning styles of IDIS students. Some insight is provided by R. Lipset[5], who notes personality differences between engineering, engineering technology, and industrial technology students and describes typical behaviors of the latter two groups. For example, engineering technology and industrial technology students prefer teamwork for major class projects, are less likely to seek help from instructors outside of class, like to understand how (not why) things work, and exhibit extroverted behavior by involvement in extracurricular activities. In another study, P. Katsioloudis and T. D. Fantz[6] found that industrial technology students in a materials process course preferred kinesthetic, followed by visual learning methods, while engineering technology students selected aural, followed by kinesthetic. From class observation, informal feedback, and course evaluations, the author has identified a preference for teaching that supports sensing, visual, active, and global learning methods among IDIS students.

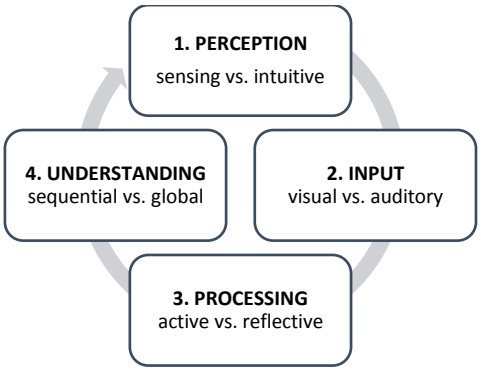

Figure 1: Steps in the Learning Process (based on the Felder and Silverman model)

Factors to Consider when Designing an Internationally-focused Course

International coursework can be an uncomfortable experience for many students with little or no global experience and who perceive the content to be complex, irrelevant, or limited to cultural norms. Various approaches have been used to teach global coursework. Immersion, which places students in a foreign environment through study-abroad programs or field trips, is a common method shown to be beneficial. Lee et al[7] indicate a positive correlation between the type of multicultural experience and the ability to think creatively. Other studies[8-10] note that the longer the immersion experience, the deeper and longer-lasting the impact in areas such as academic achievement, career decisions, personal development, social entrepreneurship, and knowledge production. Notwithstanding the benefits of immersion, this experience is not always possible. In such cases, engaging students in a simulated global environment is an option.

The Impact of Technology Advancements on Teaching Methods

Today, it is commonly acknowledged that technology not only influences the environment in which graduates are employed, but also the ways in which students communicate, collaborate and learn through interaction with, and assimilation of, information. Worley[11] describes millennials as quick thinkers who have learned to multi-task and react to information quickly – a consequence of playing video games – and notes that technology advances significantly impact how millennials learn, requiring teaching style to accommodate this new way of learning.

Innovative Pedagogical Approaches to Enhance Learning

Two teaching methods that provide a framework for adapting teaching method to learning styles, the environment, and personality types are the Flipped Classroom and Universal Design for Learning (UDL). Both are sufficiently flexible to facilitate the design of active learning courses.

The flipped classroom approach is an evolving pedagogical method that is gaining popularity in several disciplines, including science, technology, engineering, and mathematics (STEM)[12]. With this method, traditional lectures are moved outside of the classroom and completed asynchronously by the student, while active and problem-based learning is conducted during face to face sessions[13]. To be effective, student preparation prior to class sessions is essential. Additionally, work completed outside the classroom must support and integrate with class assignments[14]. Students are first introduced to the basic principles and terminology of the topic

through pre-class assignments. In the classroom, student comprehension is evaluated through formative assessments that require analysis and application. On completion of a topic, student learning is evaluated using summative assessments, e.g. exams or reflective papers. The goal is to link understanding of concepts with relevant application to reinforce learning, while ensuring course objectives, teaching and learning activities, and feedback / assessment methods align[15].

The flipped classroom has many benefits. It allows the design of assignments to match learning styles. Assignments can be developed to stimulate collaboration, as well as higher level thinking as defined by Bloom's taxonomy. B. Oakley and R. Brent[16] note that small group collaboration results in higher grades, deeper thinking, and longer retention compared to traditional classroom instruction. It also allows students to take greater responsibility for teaching themselves, while the instructor serves to provide guidance, clarification, and reinforcement.

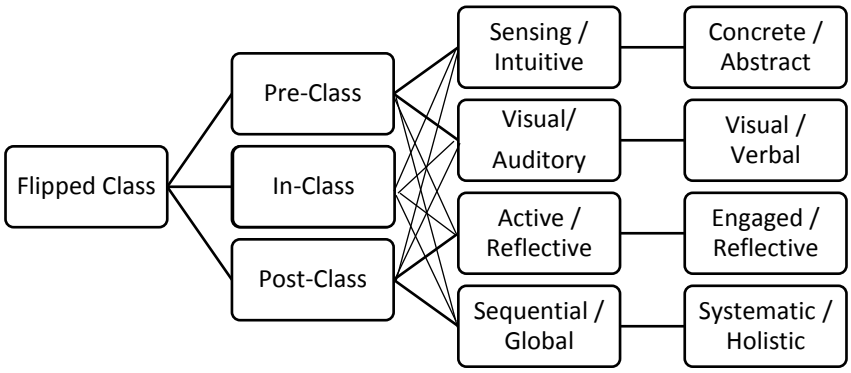

Figure 2: Flipped Classroom Model with Teaching Style Matched to Learning Style

UDL is another approach used to augment learning. S. Barteaux[17] notes that the goal of this technique is to support the learning of all students regardless of academic, social, emotional, or disability needs. UDL encourages content presentation in multiple formats and design of assignments to engage students in various ways.

Class Profile and Course Description

Global logistics is a senior level course that students take in their final or penultimate semester after completing 15 to 18 credit hours of focused coursework in supply chain and logistics. The class size averages 30 students, many of whom have little international experience. The course is interdisciplinary in nature, integrating three broad themes: supply chain and logistics principles, international trade operations, and global cultural awareness. The first two categories account for 90 – 95% of the content, while the latter makes up 5 – 10%. Topics covered are as follows:

- Global logistics and international trade operations
- Economic agreements and logistics networks
- Supplier, production, and distribution facility location
- Supply chain and logistics fundamentals (cost, inventory, reliability, responsiveness,)
- International logistics infrastructure (transport, information, other)
- International supply chain risk
- Methods of entry and global logistics intermediaries

- International transportation (air, ocean)
- Packaging (standards, cost, sustainability)
- International Commercial (INCO) Terms
- Cross-border compliance and regulatory issues

On completion, students are expected to demonstrate the following learning outcomes:

- Master global logistics and international trade operations knowledge
- Analyze, design, optimize and manage global logistics systems or processes
- Utilize contemporary tools to evaluate the impact of decisions on logistics performance
- Function effectively on a global logistics team
- Communicate effectively in written and verbal form
- Understand and respect professional, ethical, global and social issues that impact logistics

Evolution of the Course Structure

Over eleven years, the course structure was re-designed three times to continuously improve the content and quality of the course. The main goals were to strengthen students' ability to work in the international logistics environment and broaden understanding of global issues.

In the first three years, the course was administered through class lectures. Short videos (5 – 10 minutes) were occasionally incorporated to vary the content and stimulate discussion. Using this approach, the author provided most of the course content, while students listened and took notes. Evaluations consisted of quizzes (5%), short papers on assigned logistics readings (5%), tests (75%), and a paper on a country of choice (15%). All assignments were individual.

Based on student feedback and instructor observation, two problems were identified. This led to redesign of the course to increase student interaction and understanding of logistics applications. The main addition was a team-based semester project, with weekly assignments that provided hands-on experience simulating tasks in the global environment. Each team was assigned to two world regions which served as supply and distribution points. Students completed the planning, operations, and compliance requirements to move a product from origin to destination. Embedded in the project was a spreadsheet exercise to perform a quantitative analysis. The project was administered using course management software that provided a 24/7 online platform for team members to share their contributions and for the instructor to provide weekly progress comments. Class lectures were continued, but students were also allotted class time weekly to work on the project and interact with the instructor. With the addition of the project, the term paper, quizzes, and assigned readings were discontinued. To incentivize team work, the project grade was set at 35 – 40%, while tests accounted for 60%, and cultural quizzes, 5%.

Six years after implementing the project, the course was converted to a flipped class using the L. Dee Fink model and incorporating UDL principles. The main reasons were to continuously increase student engagement and interest and improve attainment of course outcomes. The revised structure included class preparation assignments (CPAs), class learning exercises (CLEs) and end of topic (key points of topic – KPT) assignments. The semester project was dropped and a simulation that provided an active learning environment was added to culminate the course.

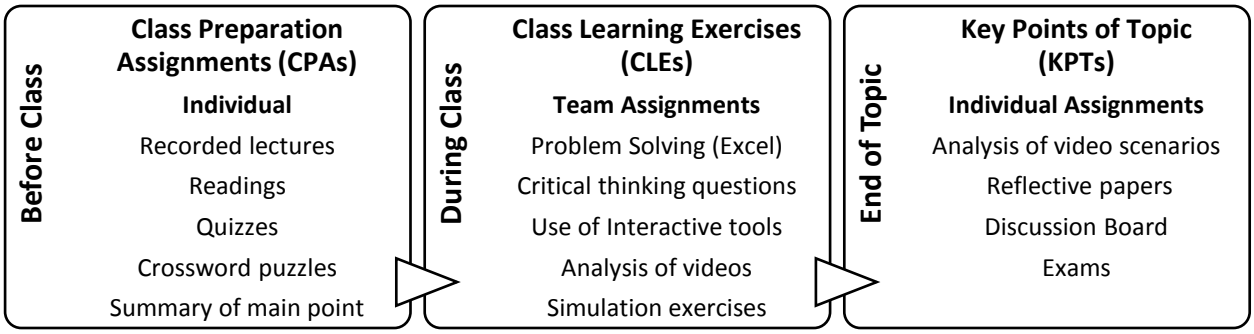

Figure 3: Illustration of the Flipped Classroom Approach applied to Global Logistics

CPAs typically consisted of assigned readings or pre-recorded lectures, followed by short assignments (e.g. quizzes, crossword puzzles on terminology) prior to class sessions. During face to face sessions, students worked on CLEs in teams and communicated with the instructor to seek direction, clarification, and explanation. In turn, the instructor was able to assess areas of weakness and provide immediate feedback on a one-on-one / team basis or through short presentations (10 – 15 minutes). On completion of each topic, students completed a short individual assignment (KPT) weekly during the first half of the semester. In the final six to seven weeks of the semester, the KPTs were discontinued and students worked in teams on a simulation to actively manage global logistics for a lean supply chain. The simulation allowed students to apply logistics knowledge to troubleshoot problems, select transportation modes, design routes, locate facilities, and manage inventory levels to minimize total logistics cost. The course grade was based on 65% individual work (CPAs, KPTs, exams) and 35% teamwork (CLEs, team simulation).

Table 1: Flipped Class Assignments with Examples of Assignments to Match Learning Style

Types of Global Logistics Assignments	Perception (S/I)	Input (V)	Processing (A/R)	Understanding (G)
CPAs				
Pre-recorded lectures	X			X
Crossword puzzles			X	
Quizzes				X
CLEs				
Video documentaries	X	X		
Short presentations	X	X		
Discussion questions			X**	
Critical thinking questions			X**	
Data gathering using interactive tools	X	X	X	
Brainstorming			X**	
Excel modeling	X*		X	
Logistics simulation (lean)	X			X
KPTs				
Reflective papers			X**	X
Creative problem solving		X		

S=Sensing; I= Intuitive; V=Visual; A= Active; R= Reflective; G=Global *I **R

Instructor-Student and Student-Student Interaction

Over the eleven-year period, both student-to-student and instructor-to-student interaction was gradually increased. In the first three years, instructor-student interaction accounted for less than 1% of class time, with virtually no class time allocated to teamwork. During the next six years, class time was provided weekly for students to work on the team project. During this time, the instructor met with each team individually to review progress, make suggestions, and clarify assignments. On average, 3% of class time was allocated to each team for instructor-student interaction, while team work accounted for about 25% of class time. In years 10 and 11, about 70% of class time was dedicated to teamwork. The instructor circulated among the teams at each class session to provide clarity and direction and to answer questions. Each team received about 10% of class time for instructor-student interaction over the course of the semester.

Forming Teams

To benefit from small group collaborative learning, it is critical that teams are high performing. Initially, teams were formed by the instructor using a random assignment process or by students themselves. Although students generally reported having a good experience with their assigned team members, complaints about maturity, work ethic, and availability were regularly discussed with the instructor. To minimize these complaints, software was used to form teams for the flipped classroom in an effort to improve harmony among team members. Students completed a questionnaire which profiled them in 27 areas and the instructor set priorities on how each category would be weighted for team assignment.

Criterion for Determining Student Success

To determine attainment of course learning outcomes, a quality assessment tool introduced by the department during the second phase of course redesign was used. The tool provides a means for assessing student work in various topical areas, diagnosing areas of weakness, and identifying potential solutions to improve results. Success in attaining course outcomes is defined in terms of a specific percentage of the class earning a designated minimum grade. The tool was used to evaluate the impact of the second and third stages of the course redesign efforts.

Results

Structured and unstructured data were collected from various sources such as student course evaluations, student informal feedback, student grades, instructor observation of the classroom, and course assessments over the eleven-year period. The results indicate that students preferred the flipped classroom with UDL principles incorporated to the traditional class but desired that short focused lectures on areas of weakness be maintained. The flipped classroom also produced the most favorable results in terms of attaining course outcomes.

Student Satisfaction

During the first three years, students indicated that the course content met expectations in terms of knowledge gained. The major issue expressed through written comments on student course evaluations, was that that the class presentation style utilized a large number of PowerPoints,

making it difficult to remain focused and absorb the information. Through informal feedback, students expressed interest in more hands-on assignments instead of a lecture-only approach.

In the ensuing six years, student feedback on course evaluations indicated that the term project supported the content taught in class, but was very time-consuming. Students indicated the need for more class time to work on the project and for greater interaction with the instructor to obtain guidance in interpreting instructions and completing assignments. Other comments suggested that the online platform used to administer the project was not always effective in sharing information among team members. While student interaction increased due to the teamwork component, continued instructor observation revealed low student engagement during lectures.

With respect to student satisfaction regarding the third phase of course redesign, a five-point survey administered to the flipped class indicated that the majority of students preferred active learning to traditional lectures. Students had very positive experiences collaborating, particularly with the simulation, which allowed them an opportunity to apply logistics principles and see immediate consequences of their decisions. The main criticisms of this approach were that the schedule was difficult to keep up with and a longer class period would be preferred to facilitate class discussions and teamwork. Some students also indicated that they did not like teaching themselves.

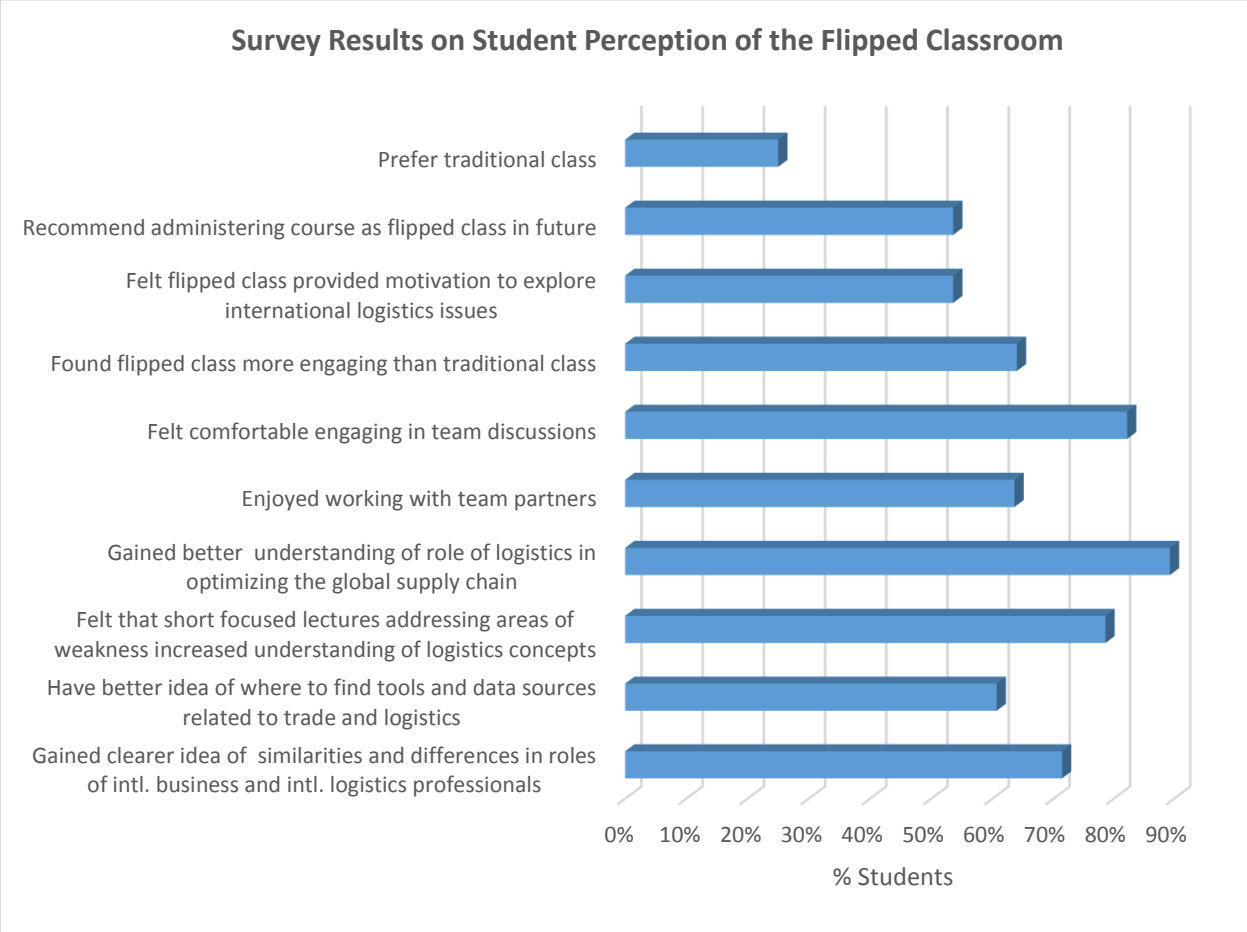

Figure 4: Results of the Flipped Classroom Survey based on a Sample Size of 28 Students

Attainment of Course Outcomes

To evaluate the effectiveness of the course redesign, the department's quality assessment tool was used. Results from phase two indicated that student performance met expectations in several areas. However, specific areas of weakness (e.g. fundamental applications, spreadsheet analysis) were also identified. During phase three of the course redesign, the flipped classroom sessions provided more class time for addressing weaknesses, which also became the focus for short class lectures. The results indicate that the course redesign efforts proved successful as student attainment of course outcomes increased from 56% in phase two to 80% in phase three.

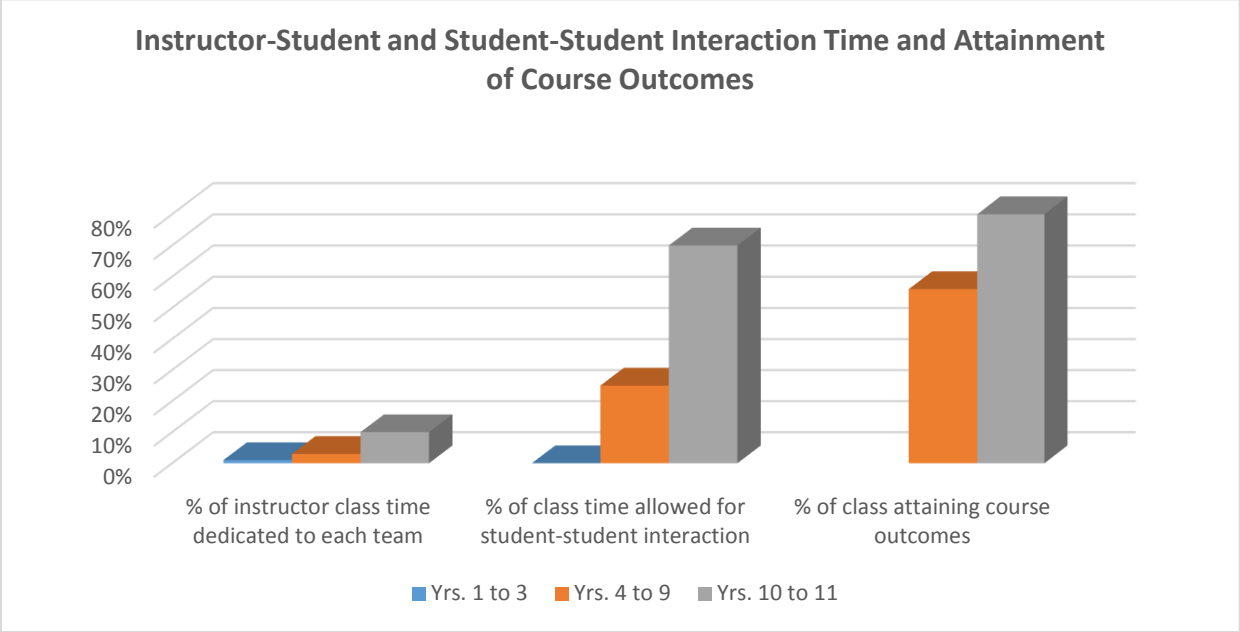

Figure 5: Interaction Time and Attainment of Course Outcomes

Conclusion

This case study compared student satisfaction and attainment of course outcomes when passive and active pedagogical approaches were applied to teaching a course in global logistics. Of the three approaches used, the results indicate that the flipped classroom method, in conjunction with UDL principles and short focused lectures on areas of weakness, holds the most promise for stimulating interest in the subject and improving student success. Given that the flipped classroom allows greater involvement in the international content of the course compared to a traditional class, designing a global logistics course in this way is likely to have a longer lasting and more profound impact on a student's thinking as it relates to the global environment.

In the quest to continuously improve teaching methods to ensure student satisfaction and success, opportunities exist to further enhance this model. The study provides a baseline for conducting further research on the use of active learning pedagogies and other technologies in teaching logistics. An opportunity also exists to gain a clearer idea of the relationship between different forms of interaction and collaboration on student satisfaction and attainment of course outcomes.

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