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Utilizing Peer Instruction to Enhance Academic Achievement and Active Learning in Business Education

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ABSTRACT

Researchers are increasingly interested in evaluating and reshaping traditional teaching practices to implement more student-centered and active learning approaches in higher education. Peer Instruction (PI) has been recognized as an interactive teaching method that significantly impacts student learning by encouraging active participation in an engaging learning environment. This study examines the impact of Peer Instruction (PI) on improving academic performance and active learning in business education beyond its usual limits of application in scientific and numerical fields. This study compared the outcomes of students who engaged in PI with students who took traditional lecture-based classes in business courses. This research uses a quasi-experimental research design because it is not feasible to use a full experimental design because it is impossible to randomly select subjects. Empirical data, collected through pre-and post-tests, discussion prompts, and PI activities, demonstrated significant improvements in student engagement, cognitive processing, and performance in the PI group compared to the control group. Students who participate in PI report higher test scores and levels of engagement, underscoring PI's potential to foster deeper understanding, critical thinking, and active engagement. Despite the positive results, the study noted limitations such as a narrow focus on the class by one instructor and the absence of marked differences in conceptual understanding between the PI and individual study groups, then only tested academic achievement without engaging students' levels of critical thinking. Highlighting the effectiveness of PI in business education, this research calls for broader application and further investigation into the role of PI in enhancing active learning, suggesting future exploration into diverse academic areas, methodologies, and technological tools, as well as applying it to examine critical thinking and interaction students to deeper learning content.

Keywords : Peer Instruction, Active learning, academic performance, business education,higher education

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1. INTRODUCTION

Peer Instruction has gained significant attention in college classrooms as an effective method for improving student achievement and engagement (Knight & Brame, 2018; Tullis & Goldstone, 2020; Fakoya et al., 2023). Developed by Eric Mazur, a physicist at Harvard University in 1991, Peer Instruction (PI) is an instructional strategy designed to actively involve students in the learning process by encouraging peer interaction and discussion. During a standard PI session, students are generally presented with conceptual questions connected to the course content. In a classroom setting, students regularly provide individual responses to a given question, often by utilizing a polling system or clickers. Subsequently, they engage in group discussions with their peers, allowing them to explain their reasoning, debate different viewpoints, and collaborate to reach a consensus. Following this discussion, students reconsidered their initial responses and voted again. Ultimately, the teacher promotes a class-wide discussion to assess the issue, explore various problem-solving techniques, and clarify any misunderstandings (Tullis & Goldstone, 2020). This method not only enhances academic performance but also offers students opportunities to develop and hone their social skills, which are often considered obstacles to implementing active learning strategies (Zaid et al., 2018; Borte, et al., 2023). In a setting that emphasizes active learning, social skills play a vital role in fostering effective communication, collaboration, and cooperation among students. However, not all students may possess these qualities initially, which can present challenges in implementing a student-centered learning approach (Zaid et al., 2018). Despite extensive research on PI in physics, science, and mathematics, its application in the social sciences, particularly in business education, remains relatively unexplored (Olpak & Yilmaz, 2021; Woo, et al., 2022). This study examines the use of PI in business education, specifically in Business Ethics and Corporate Social Responsibility (CSR) courses, to determine its impact on students' active learning and comprehension of business ethics and CSR concepts. This study primarily focuses on assessing the improvement in students' academic achievement and active learning through the utilization of PI teaching method compared to traditional lecture-based approaches. A conceptual assessment in the area of business ethics and CSR was administered as a pretest/posttest. The research questions addressed in the study include: (i) Does Peer Instruction enhance students' academic performance in business ethics and CSR courses? (ii) How does the pairing of students in Peer Instruction (PI) groups affect active learning? (iii) How do students perceive the use of PI in their active learning experience?

2. LITERATURE REVIEW

2.1. Peer Instruction in Education

Peer Instruction is an instructional method that was initially developed by Eric Mazur, a physicist at Harvard University in 1991. It is an evidence-based teaching and learning approach that involves asking students conceptual questions during class time. Following a mini-lecture, students answer a conceptual question individually, then vote and record their answers individually using an Audience Response System. Afterward, students engage in discussions with their peers, explaining their reasoning for their answers. If a majority of students respond incorrectly, they are asked to convince their peers of their answer. After peer discussion, students vote again, and the instructor explains the correct and incorrect answers while also seeking input from the class (Knight & Brame, 2018; Vickrey et al., 2015).

Peer Instruction (PI) has been found to offer several advantages in the realm of education. It is widely recognized as an interactive teaching method that significantly influences students' learning through active participation in an engaging learning environment (Aina & Azeez, 2018). PI has been shown to improve cognitive domains such as achievement, problem-solving, conceptual understanding, critical and creative thinking skills (Woo, et al., 2022; Straw et al., 2023). Additionally, PI leads to increased student satisfaction and a positive shift in their attitudes and beliefs (Woo, et al., 2022; Scheider & Asprion, 2023). Tullis and Goldstone (2020) further emphasized the benefits of PI, highlighting the importance of social interactions and peer explanations in facilitating active learning.

Recent literature has demonstrated that PI is beneficial across various academic disciplines. However, there is a noticeable geographical bias in existing research, with a majority of studies focusing on North America, particularly the United States. Olpak and Yilmaz (2021) analyzed 58 papers from SSCI-indexed journals to evaluate the development of research on PI, finding that most studies focused on North America, particularly the United States. Similarly, Woo et al. (2022) analyzed 26 studies on the impact of PI on students' learning, finding that 17 out of 26 studies were conducted mainly in Western contexts. This geographical bias underscores the need for more diverse global perspectives in research on PI. Furthermore, research on PI has primarily focused on numerical courses such as physics, chemistry, and computer science, highlighting a need to explore its application in a wider range of academic disciplines. Clickers were the most commonly used response technology in the reviewed papers, but researchers and educators need to examine the effectiveness of various response technologies in diverse educational contexts (Olpak & Yilmaz, 2021).

2.2. Active Learning

Active learning has developed in response to the limitations of passive teaching methods in higher education. According to Sekwena (2023), there are times when lecturers find it challenging to involve students effectively in a learning process that does not stimulate student interest or enthusiasm. This issue becomes particularly concerning when students struggle with the depth and duration of passive teaching, leading to disengagement and a decrease in critical thinking (Sekwena, 2023). The traditional method of "chalk and talk," where the lecturer communicates one-way to students, typically leads to low levels of student engagement and understanding.

Despite frequent calls for more active student learning, there are few signs of continuous, large-scale improvement in active learning in higher education, especially in social science, economics, and business education (Børte et al., 2023; Sekwena, 2023; Kozanitis & Nenciovici, 2022; Ismail et al., 2020). This indicates a critical gap between the theoretical framework that supports active learning and its practical implementation on a large scale.

Shroff et al. (2019) stated that active learning being an umbrella term, encompasses different pedagogical models of instruction that align with learners' active learning strategies. Shroff et al., (2019) provide the classification of the different pedagogical learning models or instructional approaches, which can be represented as subsets of the broader concept of active learning. Shroff et al., (2019) list that authentic learning, case base learning, collaborative learning, cooperative learning, discovery learning, experiential learning, inquire-based learning, peer-assisted learning, problem-based learning, self-directed learning, self-regulated learning, situated learning, task-based/task-oriented learning and team base learning are pedagogical learning model. Borte et al. (2023) highlighted that group discussions, hands-on activities, case studies, simulations, and project-based learning are various active learning methods that can be used by educators. According to Handy and Polimeni (2015), educators employing these pedagogical models can design and implement active learning activities that foster student engagement and enhance learning outcomes. Active learning can improve critical thinking, problem-solving, and collaboration skills (Borte et al., 2023), increase tolerance for ambiguity, and result in better retention of subject matter (Handy & Polimeni, 2015). Additionally, it can improve memory retention, enhance social skills, and increase student satisfaction. Such skills prepare students for an innovative and global workforce in the future (Handy & Polimeni, 2015).

Ismail et al. (2020) posit that implementing active learning can significantly enhance student engagement, which has become a primary goal for educators. Active learning requires students to participate in meaningful learning activities and reflect on their actions, which promotes practice and fosters student engagement. With an increasing focus on student engagement, active learning has been identified as a promising approach to achieving this objective (Ismail et al., 2020). Various techniques including communication, co-construction, experimentation, interaction, and problem-based learning have been employed to encourage student participation (Borte et al., 2023).

Active learning involves students engaging in discussions that require the analysis, evaluation, synthesis, and development of higher-order thinking skills (Zaid et al., 2018). According to Zaid et al. (2018), social skills are an important attribute among students in fulfilling the objectives of bringing discussion into an active learning environment. Social skills are defined as the ability to communicate effectively, work well within a team, and influence or inspire others. However, not all students possessed these attributes. Without the necessary social skills, students may struggle to actively participate in discussions and engage in collaborative learning activities. This can hinder the effectiveness of discussions as a means of promoting active learning and student-centered approaches. To address this challenge, initiatives must be undertaken to support students in developing and enhancing their social skills. For example, in online social networks, peer instruction is an effective way to encourage active online discussion and student involvement (Zaid et al., 2018).

The incorporation of technology in education, motivated by globalization and competition among higher learning institutions, aims to revolutionize teaching methodologies. However, the introduction of technology alone does not guarantee active learning. Borte et al. (2023) emphasize the importance of combining technological resources with effective pedagogical strategies to engage students in a meaningful way. Educators must develop digital proficiency and employ a variety of teaching techniques to encourage collaboration and critical thinking. Despite advancements in technology, students may still experience one-way interactions, underscoring the need for mediated discussion and collaborative learning. Therefore, successful implementation of technology requires harmony between instructional objectives, technological capabilities, and pedagogical approaches to promote active learning environments. This idea is supported by Borte et al. (2023), who stressed the significance of not only focusing on technological advancements but also on the pedagogical strategies that facilitate meaningful student engagement.

2.3. Active Learning in Education

Traditional teaching methods, such as direct instruction and lectures, have long been the main focus of calls to adopt active learning approaches. The traditional lecture method, often referred to as chalk-and-talk, is the primary instructional strategy utilized by the lecturer. However, this method does not involve students or elicit interest in the subject matter because it positions students in a passive role in the learning process. In recent years, there has been an increasing interest among higher education researchers in reevaluating and transforming traditional teaching practices to implement more student-centered and active learning strategies. This shift intends to improve student learning outcomes, engagement, and overall educational experiences. A noteworthy study that has significantly contributed to this shift is the meta-analysis by Freeman et al. (2014). This study investigated the impact of active learning on student performance in science, engineering, and mathematics (STEM) subjects and found that active learning resulted in significant enhancements in student scores within the STEM fields (Freeman et al., 2014). Furthermore, Ting et al. (2023) conducted a meta-analysis focusing on the effects of active learning, particularly in the context of Asian students' performance in STEM subjects.

Furthermore, Kozanitis and Nenciovici (2022) conducted a meta-analysis focusing on the impact of active learning versus traditional lecturing on college students' learning achievement within humanities and social sciences. Their study revealed that active learning yielded higher learning achievement than traditional lecturing, suggesting that active learning approaches can benefit STEM disciplines and fields within the humanities and social sciences (Kozanitis & Nenciovici, 2022). These studies challenge the conventional lecturing approach, advocating for a transition to evidence-based teaching practices prioritizing student engagement and comprehension through active learning (Freeman et al., 2014; Kozanitis & Nenciovici, 2022). In line with this perspective, Woo, Rameli, and Kosnin (2022) propose that educators apply interactive teaching methods drawn from various pedagogical, learning models that align with their students' active learning strategies. Moreover, Shroff et al. (2021) have systematically categorized a diverse array of pedagogical learning models within active learning, providing educators with valuable insights into the breadth of available approaches to interactive teaching methods.

2.4. Applying Peer Instruction in Business Education

While the utilization of PI is well-established in STEM education, its adoption in social sciences and business education is not as extensive. According to Olpak & Yilmaz (2021) and Woo, Rameli, & Kosnin (2022), there is a need for further exploration of PI in business course to determine its efficacy in these contexts. Studies indicate a geographical bias, with a majority of research conducted in North America, particularly in the United States (Olpak & Yilmaz, 2021; Woo, Rameli, & Kosnin, 2022). Furthermore, research on PI has primarily focused on numerical courses, neglecting its potential application in a wider range of academic disciplines (Olpak & Yilmaz, 2021). Although STEM fields have widely embraced PI, its integration into business education is less prevalent. However, existing literature suggests that where PI has been implemented in business courses, the results have been positive (Olpak & Yilmaz, 2021).

The results of Ding and Xu's (2014) research offer a persuasive argument for expanding the use of Peer Instruction (PI) across a variety of business education disciplines. Their investigation, which was conducted in the context of introductory business statistics, revealed that implementing PI, particularly when supported by hints, led to improved exam performance and increased conceptual comprehension among students. This suggests that PI has potential applications beyond courses that are primarily focused on numerical analysis and can be utilized in other areas of business education. In conclusion, while PI has been widely adopted in STEM education, there is still unrealized potential for its use in business education. The positive outcomes reported in existing studies establish a strong foundation for its increased application. Future research and practice should aim to explore the benefits of PI in various aspects of business education, including non-quantitative courses. Doing so will enable educators to foster more active student learning, improve engagement and understanding, and better prepare students for the complex challenges they will encounter in the business world.

2.5. Applying Mentimeter in Peer Instruction

The educational technology landscape is continuously changing, presenting new tools to improve learning experiences. One such innovative tool, Mentimeter, has emerged as a powerful platform that can be effortlessly integrated with the Peer Instruction (PI) method to create active learning environments. While traditional clickers have long been the dominant response technology in classrooms, there is a growing need for educators and researchers to explore the efficacy of alternative response technologies, like Mentimeter, in diverse educational contexts (Olpak & Yilmaz, 2021). Mentimeter is a freemium, user-friendly, and cloud-based Student Response System (SRS) that allows students to participate in class using their own digital devices. It is simple to use, making lectures more interactive and engaging. Students access the Mentimeter webpage and input a unique six-digit code to submit their answers. The group's responses are displayed on the teaching screen and stored for later access by the instructor. In summary, Mentimeter is a useful tool for enhancing learning experiences and fostering active learning environments in various educational contexts (Rudolph, 2018). In a study conducted by Webb (2023), the impact of Mentimeter on university student participation in taught sessions was investigated. This study utilized qualitative methods to evaluate the influence of Mentimeter, a classroom response system, on student engagement and learning. Results indicated that Mentimeter significantly improves student participation, resulting in a more engaging teaching session and positive effects on students' learning (Webb, 2023). The implementation of interactive technologies such as Mentimeter in Peer Instruction has demonstrated promising results in enhancing student involvement in university settings (Webb, 2023). Furthermore, research on its use in large classes has highlighted its potential to enrich learning and teaching by facilitating real-time engagement and feedback, even in situations where one-on-one interaction is limited due to class size. The integration of Mentimeter in business education to incorporate Peer Instruction can be particularly beneficial in this regard.

3. METHODOLOGY

This study utilizes a quasi-experimental research design because it is not feasible to employ a full experimental design due to the impossibility of random subject selection. An equivalent control group pre-test post-test design was chosen for this study, as it approximates the internal validity of a true experimental design while optimizing external validity and other means of comparing groups. Quasi-experimental designs can be used when it is not possible to randomly assign subjects and allocate them into treatment and control groups (Rogers & Revesz, 2019). Additionally, due to school regulations, it is not feasible to randomly assign students to different treatment groups for the experiment. Instead, we randomly assigned the treatment methods to the classes. One class was designated as the control group (traditional classroom), and another class was designated as experimental group 1 (with PI). In this case, we used Mentimeter for students to select the correct answers during classroom discussions.

3.1. Participants

Two regular business classes taking the Business Ethics and CSR course at President University, Indonesia, participated in this study. The total number of students from these two business classes was 72. Among them, 68 students provided valid data, including answers to all questions during classroom discussions and attendance at the final exam. There were 44 female students (64.70 percent) and 24 male students (35.30 percent). Hence, using the adopted technique, the classes were divided into the experimental and control groups: E (Experimental group, using PI) and C (Control group, traditional class). A total of 34 students were assigned to the experimental group, and 34 students were assigned to the control group. The participants' breakdown for the study is presented in Table 1.

Table 1. Participants of the Study

No	Group Method	Male	Female	Total
1	Control Group	8	24	32
2	Experiment Group	12	20	32
Total		20	44	64

3.2. Instrument

The question instruments for classroom discussions and exams were selected from the test bank for the Business Ethics course provided in the book "Business Ethics: Ethical Decision Making and Cases" by Ferrell et al. (2021), published by Cengage Learning. These questions were chosen by the Business Ethics and CSR course instructors at the school. Examples of questions and their answer choices are shown in Figure 1. In this study, both the experimental group and the control group were given Pre-Test and Post-Test questions. In the experimental class, additional questions were provided, aside from the Pre-Test and Post-Test, to serve as discussion prompts and for use with PI. The questions used for in-class polling differed from those used in the exams. Although all these questions measure the same Business Ethics and CSR theories and concepts, the problem context and data are significantly different. The Pre-Test and Post-Test required students to answer questions individually through a Google Form, which was the same procedure for both groups in this study. Meanwhile, the questions for the experimental class were answered through the Mentimeter application, where students answered several questions before any discussion, and their responses were displayed. Afterward, they were given time to discuss the issues with their classmates. Subsequently, they were allowed to answer the same questions again via Mentimeter. In both the initial and final exams, students were required to complete six questions with a total of 40 items. Each correct item was worth 1 point.

Furthermore, to assess the success of implementing PI in active learning, we used an instrument to measure learners' perceptions of active learning activities developed by Shroff et al., 2021. This instrument consists of 20 items covering five constructed scales: engagement, cognitive processing, orientation to learning, readiness to learn, and motivational orientation. The scale has provided a valid and reliable method for researchers to measure learners' perceptions of the active learning activities they engage in. The items can be seen in the following Table 2.

Table 2. Quistioner instrument to measure learners' perceptions of active learning activities

Using the following scale, (7 = Strongly Agree, 6 = Simply Agree, 5 = Slightly Agree, 4 = Disagree and Strongly Disagree, 3 = Slightly Disagree, 2 = Simply Disagree, 1 = Strongly Disagree), circle the number that indicates your level of agreement with the following statement

		Strongly Agree	Agree,	Slightly Agree	Simply Agree or Disagree	Slightly Disagree	Simply Disagree	Strongly Disagree
1.	I feel that the activities in class allow me to engage effectively in an open exchange of ideas	7	6	5	4	3	2	1
2.	I feel that in-class activities allow me to examine issues from a deeper perspective.	7	6	5	4	3	2	1
3.	I am able to realize the value of the learning situation by making meaning of the learning process.	7	6	5	4	3	2	1
4.	I feel like the activities in class allow me to explore a variety of different issues that I may not have considered before.	7	6	5	4	3	2	1
5.	I feel that the activities in class encourage me to engage in discussions around real-life contexts.	7	6	5	4	3	2	1
6.	I feel that the activities in class allow me to define problems systematically by looking at them from different angles in an effort to find possible solutions.	7	6	5	4	3	2	1
7.	I feel a tendency to take responsibility for my learning adopting a "learning by doing" approach.	7	6	5	4	3	2	1
8.	I feel that the activities in class arouse my curiosity about the topics discussed.	7	6	5	4	3	2	1
9.	I felt the in-class activities allowed me to interact effectively with the content to broaden my understanding of the discussion topics.	7	6	5	4	3	2	1
10.	I feel that activities in class shape my confidence in learning by reinforcing my learning goals.	7	6	5	4	3	2	1
11.	I feel able to improve my own learning abilities by utilizing my own experiences.	7	6	5	4	3	2	1

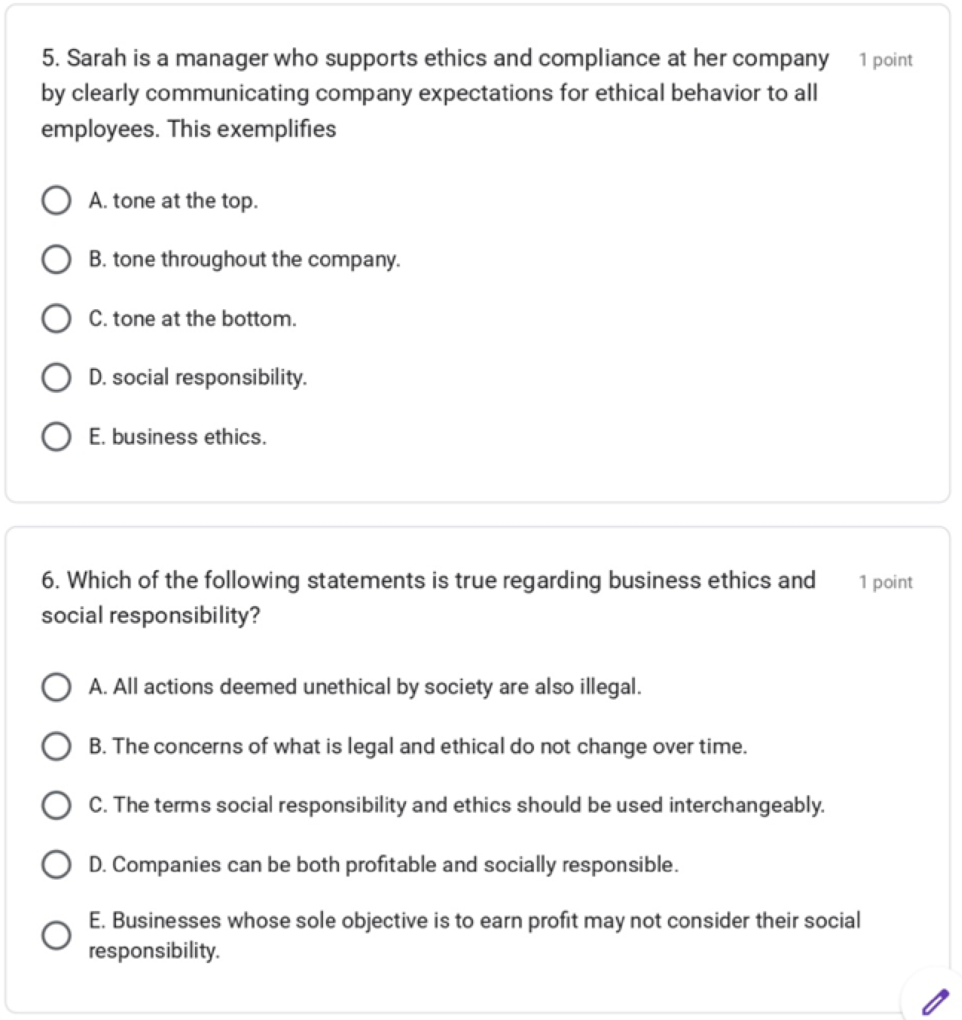
12.	I feel like I have control over how much I can participate in class activities.	7	6	5	4	3	2	1
13.	I feel the in-class activities allow me to interact effectively in thought-provoking dialogue through collaborative discourse.	7	6	5	4	3	2	1
14.	I felt the activities in class allowed me to analyze my own views and their wider context to draw firm conclusions.	7	6	5	4	3	2	1
15.	I feel the in-class activities allow me to integrate my values into real-world practice.	7	6	5	4	3	2	1
16.	I felt the desire to get out of my comfort zone by trying new approaches to learning.	7	6	5	4	3	2	1
17.	I feel that in-class activities allow me to formulate judgments by considering different points of view.	7	6	5	4	3	2	1
18.	I feel that the activities in class encourage me to be open to new learning experiences.	7	6	5	4	3	2	1
19.	I feel a willingness to adapt to different learning needs.	7	6	5	4	3	2	1
20.	I feel that the activities in class interest me.	7	6	5	4	3	2	1

Source: Shroff, R. H., Ting, F. S., Lam, W. H., Cecot, T., Yang, J., & Chan, L. K. (2021). Conceptualization, development and validation of an instrument to measure learners' perceptions of their active learning strategies within a Shrof context. (translate to Indonesian)

9/10/23, 5:34 PM Pre Test Business Ethics And Social Responsibility

4. The principles and standards that determine acceptable conduct in business organizations are referred to as 1 point

- A. social responsibility.
- B. business strategies.
- C. business ethics.
- D. business stances.
- E. corporate citizenship.


5. Sarah is a manager who supports ethics and compliance at her company by clearly communicating company expectations for ethical behavior to all employees. This exemplifies 1 point

- A. tone at the top.
- B. tone throughout the company.
- C. tone at the bottom.
- D. social responsibility.
- E. business ethics.

6. Which of the following statements is true regarding business ethics and social responsibility? 1 point

- A. All actions deemed unethical by society are also illegal.
- B. The concerns of what is legal and ethical do not change over time.
- C. The terms social responsibility and ethics should be used interchangeably.
- D. Companies can be both profitable and socially responsible.
- E. Businesses whose sole objective is to earn profit may not consider their social responsibility.

Figure 1. Examples of Pre and Test Questions

3.3. Data Collection

This experimental study was conducted during the regular teaching period at the school. Researchers guided the teachers who conducted the classes. The entire study spanned six weeks and consisted of six teaching sessions. The first session was used for the pre-test and an explanation of the teaching method. Sessions two through five involved the presentation of additional questions. In the experimental class, students were given time to discuss their answers and the learning topics as part of the PI process. The final session was used for the post-test and the completion of the active learning

perspective items for the experimental class. In each teaching session, the teacher delivered a lecture on business ethics for approximately 20 minutes and used the remaining 45 minutes for classroom discussions.

During the second through fifth teaching sessions, five questions were prepared based on the content of the learning materials, resulting in a total of 30 questions. For each question, students were asked to use their Mentimeter devices to select their answers one by one. Within 5-20 minutes, the results were displayed on the screen, allowing students to get an overview of the voting proportions. For example, they could see how many classmates chose option A and how many chose option B, and so on.

In PI group, students are instructed to give each other explanations and instructions to solve problems. They were asked to take on the role of instructor as an alternative. They were given about ten minutes to discuss with their peers and choose their own answers. Although they were not required to reach the same answer, they needed to try their best to convince their partner of their choice.

In contrast, in the control group, after the voting results were automatically displayed on the screen, students immediately proceeded into a traditional classroom setting. There was no opportunity to discuss with classmates or receive further explanation from the teacher. About ten minutes later, students were asked to re-select their answers to the same questions. Different treatments were applied to the two groups, and these differences can be seen in Figure 2 below.

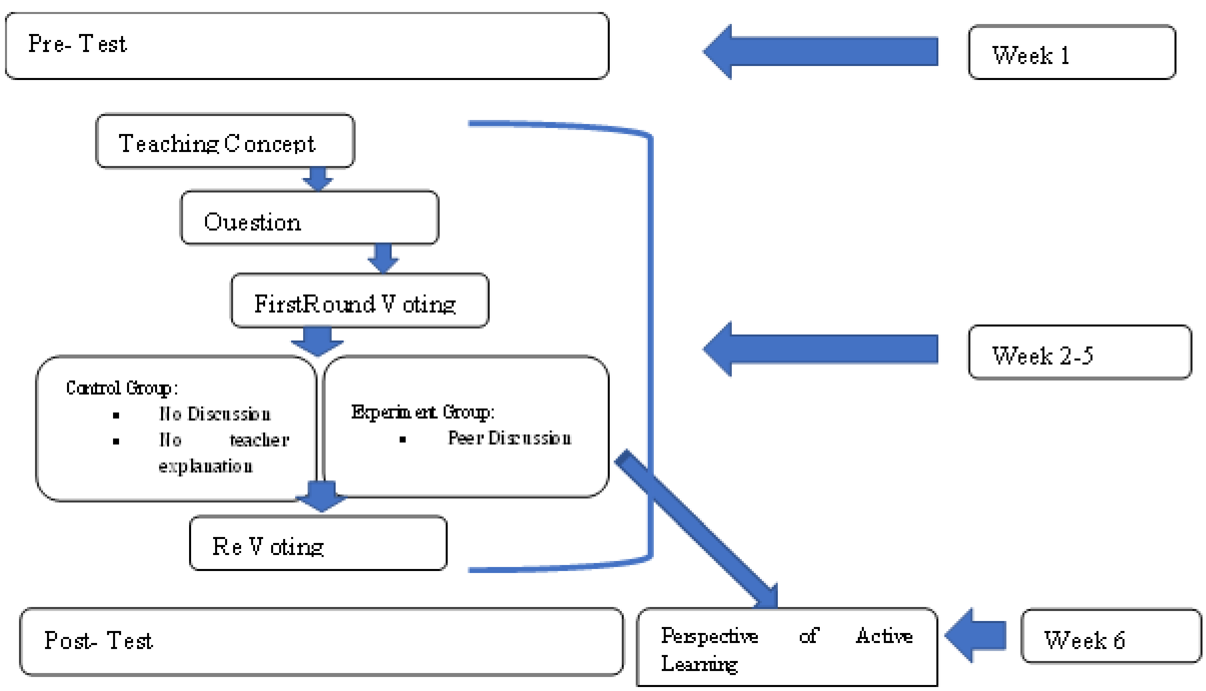


Figure 2. Differences Control and Experiment Group Treatment

4. RESULTS

Sixty-eight students from President University who were enrolled in the Business Ethics and CSR courses participated in this study. These students were divided into experimental and control groups, each consisting of 34 students. Overall, tests were conducted to answer the three research questions posed in this study. The results are explained as follows:

RQ 1. What influence does PI have on academic achievement in business education?

The study participants' academic achievement results were conducted through a pre-test in the first week before the classes began and a post-test at the end of the class, conducted in the eighth week. This study found the academic test results for each student in both the control and experimental groups. In Table 3, the descriptive statistics show that the average of the experimental group (M = 92.38, SD = 2.80) is higher than that of the control group (M = 62.17, SD = 9.28).

Table 3. Descriptive Statistics

Group	Mean	Std. Deviation	N
Control	62.1768	9.28037	34
Experiment	92.3885	2.80934	34
Total	77.2826	16.67035	68

Source : Author Computation

ANCOVA was conducted with the pre-test score as a covariate to explore whether the final scores (post-test) of both groups differ significantly. It can be observed that there is a significant difference in academic achievement between the two groups in the study, with F = 327.921, p =.000, and a partial η^2 =.835. RQ1 investigates whether there is a difference in academic achievement between the two groups being tested: the control group using traditional classes and the experimental group using PI.

Table 4. Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15735.945[a]	2	7867.972	177.366	.000	.845
Intercept	25414.306	1	25414.306	572.911	.000	.898
Pretest	219.182	1	219.182	4.941	.030	.071
Group	14546.570	1	14546.570	327.921	.000	.835
Error	2883.398	65	44.360			
Total	424756.655	68				
Corrected Total	18619.343	67				

a. R Squared = .845 (Adjusted R Squared = .840)

Source : Author Computation

Based on these results, it is revealed that there is a significant difference in learning achievement between students who used PI (experimental group) and those in traditional classes (control group), where the mean difference is 29.631. This difference is obtained by subtracting the mean of the experimental group, 92.098, from the control group's mean, which is 62.467, with a standard error (*SE*) of 1.150 (*see* Table 5).

Table 5. Estimated Marginal Test

Group	Mean	Std.Error
Control	62.467[a]	1.150
Experiment	92.098[a]	1.150

[a] Covariate appearing in the model are evaluated at the values Pretest = 37.5257

Source : Author Computation

RQ2. How does PI influence the change in answer?

The effectiveness of PI likely depends on whether students are paired with a peer who was initially correct. Students' initial correct answers tended to remain correct more often when paired with an incorrect peer (94.23%) in the experimental group. Meanwhile, in the control group, the results showed that the probability of maintaining the correct answer was still higher, although not significantly when compared to the experimental group. A student who initially gave an incorrect answer often switched to the correct answer when paired with a correct partner (91.18%). The results of the research during the six weeks of lectures can be seen in Table 6 and Figure 3 below.

Table 6. The number of correct and incorrect answer

No	Control						Experiment					
	Pretest		Posttest				Pretest		Posttest			
	C	I	C-C	C-I	I-C	I-I	C	I	C-C	C-I	I-C	I-I
1	11	23	8	3	11	12	14	20	13	1	15	5
2	10	24	9	1	14	10	15	19	15	0	16	3
3	12	22	10	2	17	5	16	18	15	1	17	1
4	13	21	11	2	16	5	19	16	16	0	18	1
5	14	20	11	3	14	6	21	13	20	1	12	1
6	15	19	14	1	15	4	19	16	19	0	15	1
Total	75	129	63	12	87	42	104	102	98	3	93	12
Mean	21,4	36,9	18,0	3,4	24,9	12,0	29,7	29,1	28,0	0,9	26,6	3,4

Note : C = correct; I = Incorrect ; C-C = Both correct; C-I = Correct to Incorrect : I-C= Incorrect be Correct; I-I = Both incorrect

Source : Author Computation

RQ3. How do students perceive the use of PI in their active learning experience?

A survey was conducted with 20 questions answered by 35 students, using a rating scale from 1 (strongly disagree) to 7 (strongly agree), as seen in Table 5. The mean scores were consistently higher, supporting the use of PI as an instructional strategy in active learning.

Table 7. Survey results of students'perception about Peer Instruction

Main Themes	Survey Questions	Mean Value (n=35)	Standard Deviation
Engagement (E)	1. I felt the activity (peer instruction) allowed me to engage in an open exchange of ideas effectively	6.60	.695
	2. I felt the activity (peer instruction) encouraged me to engage in discussions revolving around real-life contexts	6.40	.736
	3. I felt the activity (peer instruction) allowed me to effectively interact with the content to broaden my understanding of the topic of discussion	6.54	.611
	4. I felt the activity (peer instruction) allowed me to effectively interact in thought-provoking dialogue through collaborative discourse	6.46	.701
Cognitive Processing (C)	1. I felt the activity (peer instruction) allowed me to examine problems from a deeper perspective	6.57	.608
	2. I felt the activity (peer instruction) allowed me to define the problem systematically by viewing it from different angles in an effort to find possible solutions	6.46	.657
	3. I felt the activity (peer instruction) allowed me to analyze my own views and their wider contexts in order to draw firm conclusions	6.54	.657
	4. I felt the activity (peer instruction) allowed me to formulate judgments by taking into account different points of view	6.51	.612
Orientation to Learning (O)	1. I was able to realize the value of the learning situation (in peer instruction) by making meaning out of the learning process	6.49	.702
	2. I felt the activity (peer instruction) shaped my beliefs towards learning by reinforcing my learning goals	6.51	.658
	3. I felt the activity (peer instruction) allowed me to integrate my values into real- world practice	6.51	.658
	4. I felt the activity (peer instruction) encouraged me to be open to new learning experiences	6.51	.658
Readiness to Learn (R)	1. I felt the inclination to take responsibility for my learning by adopting a "learning-by-doing" approach	6.63	.547

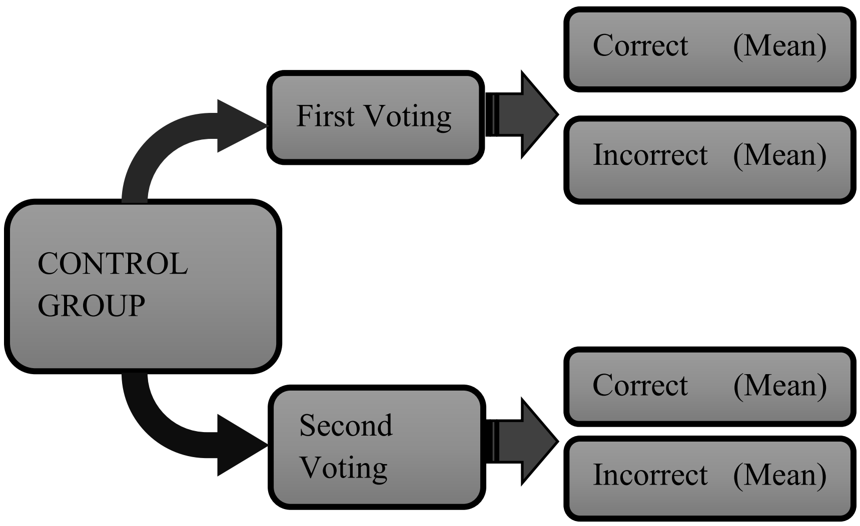
	(peer instruction)	6.54	.505
	2. I felt I was able to advance my own learning capabilities by drawing on my own experiences (in peer instruction)	6.57	.608
	3. I felt a willingness to step out of my comfort zone by trying new approaches to learning (in peer instruction)	6.49	.612
	4. I felt a willingness to adapt to different learning needs (in peer instruction)		
Motivational Orientation (M)	1. I felt the activity (peer instruction) allowed me to explore a variety of different issues that I may not have otherwise considered	6.57	.502
		6.49	.658
	2. I felt I had a sense of control as to how much I could participate in the activity (peer instruction)	6.49	.658
	3. I felt the activity (peer instruction) aroused my curiosity about the topics being addressed.	6.46	.611
	4. I felt the activity (peer instruction) held my interest		

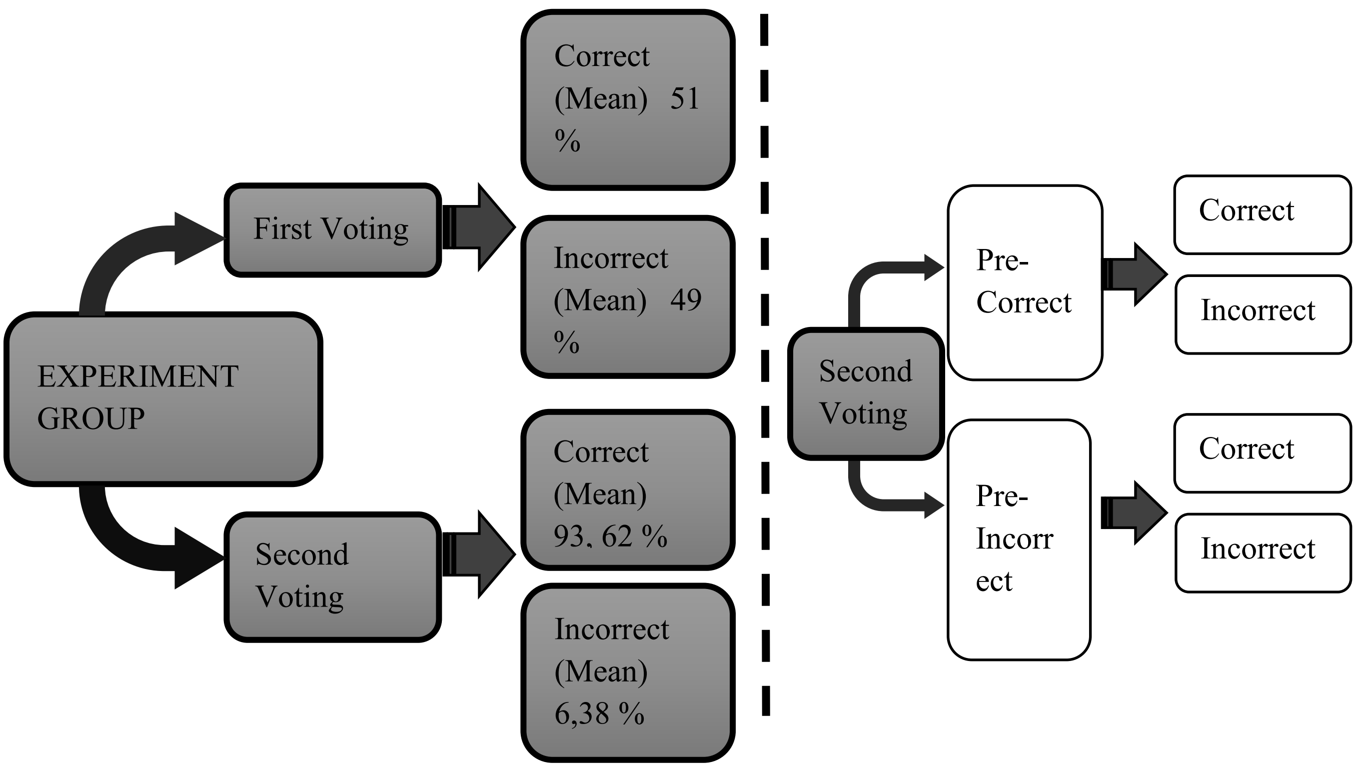
Strongly Disagree = 1; Moderately Disagree=2; Slightly Disagree=3; Neither Agree nor Disagree= 4; Slightly Agree = 5; Moderately Agree = 6; Strongly Agree

Source : Author Computation

From the results listed in Table 7 above, it is clear that students' views on the use of PI are very positive. The average score for each question in each active learning theme, as mentioned earlier, exceeded 6, indicating students' approval of their experience with PI as it provided opportunities to engage in active learning. Students found the formative assessment with PI and the use of Mentimeter very engaging.

Figure 3. Participants' responses on the first voting and second voting and the answer changes





5. DISCUSSION

5.1. Influence of Peer Instruction (PI) on Academic Achievement

The study examined the impact of Peer Instruction (PI) on academic achievement in higher education, particularly in business education. The results demonstrate a significant difference in academic achievement between the experimental group that used PI and the control group that followed traditional instruction methods. This substantial difference is evident from the mean academic test scores, where the experimental group (M = 92.3885) outperformed the control group (M = 62.1768), with a large effect size (partial $\eta^2 = .835$). Further support for these findings is provided by the ANCOVA analysis, which showed a significant difference in final scores between the two groups even after controlling for pre-test scores ($F = 327.921$, $p = .000$). These results clearly indicate that PI has a positive impact on academic achievement in business education. This conclusion aligns with previous literature, which highlights the effectiveness of active learning strategies such as PI in improving student learning outcomes (Freeman et al., 2014; Knight & Brame, 2018; Tullis & Goldstone, 2020; Kozanitis & Nenciovici, 2022; Fakoya, Ndrio, & McCarthy, 2023). These studies, much like the current one, reveal that PI fosters student engagement, interaction, and a deeper understanding of course material, thereby contributing to enhanced academic performance. The higher mean scores in the experimental group reflected the benefits of collaborative learning and peer interaction facilitated by PI, which encouraged active participation and positively impacted academic achievement (Freeman et al., 2014).

Although PI has demonstrated a positive influence on academic achievement and student engagement, implementing it in business education may present several challenges and barriers. One such challenge is instructor readiness and training. Many instructors may be unfamiliar with active learning techniques like PI, and transitioning from traditional lectures to an interactive, PI-based model requires significant adjustments to teaching practices. Faculty need sufficient training to effectively design and facilitate PI sessions, manage discussions, and monitor student progress. Without appropriate training and support, instructors may resist or find it difficult to implement PI. Another challenge is the logistics of classroom size, particularly in larger business education settings, where facilitating peer discussions and monitoring individual student progress becomes more difficult. Ensuring that every student actively participates and benefits from PI in larger settings requires innovative solutions, such as using teaching assistants or incorporating technology. Additionally, student resistance to active learning may be another barrier. Students who are accustomed to passive learning in traditional lecture formats may initially resist the shift to PI, perceiving it as more work or feeling uncomfortable engaging in peer discussions, especially if they lack confidence in their knowledge or social skills. Addressing this resistance requires clear communication about the benefits of PI and creating a supportive environment that encourages participation. Lastly, time constraints can pose a challenge, as implementing PI may require more class time compared to traditional lecturing, particularly when allowing students to discuss concepts with peers. In a packed curriculum, finding the time to integrate PI without compromising content coverage can be difficult.

To overcome these challenges, several strategies can be employed. Providing comprehensive professional development for instructors is essential. Workshops on active learning methods, classroom management, and the use of PI can help educators feel more comfortable and confident in using these strategies. Mentorship programs, where experienced PI users guide newcomers, can also smooth the transition. In large classroom settings, technology such as clicker systems or learning management systems (LMS) can facilitate real-time feedback and structured peer discussions, allowing for effective collaboration even in large classes. Introducing PI gradually rather than implementing it all at once can help students adjust to the method. Beginning with low-stakes activities and slowly building toward more complex peer discussions can reduce resistance, and instructors should clearly explain the purpose and benefits of PI to gain student buy-in. Careful curriculum integration and time management are also crucial, with one possible approach being to use PI in place of traditional assessments or reduce the number of lecture topics to allow for more in-depth peer discussion. This approach focuses on deeper understanding rather than superficial content coverage.

5.2. Impact of PI on Answer Change

Furthermore, there is another aspect examined in this study, namely how PI influences changes in students' answers. The findings of this research indicate that students who initially answered incorrectly when paired with peers who initially gave the correct answer will change their answer to the correct answer. The correct answer value was (94.23%) in the experimental group. Then, students also tended to maintain the correct answer, although not significantly higher, when paired with a friend who initially answered correctly (91.18%). These findings reveal that the use of PI by collaborating with colleagues' discussions and reflections contributes to better retention and understanding, resulting in a greater number of correct answers thereby improving learning outcomes.

The observation of paired patterns in the use of PI is in line with previous findings which emphasize that interaction with peers provides increased conceptual understanding and has an impact on knowledge retention (McMaster et al., 2006; Schell & Butler, 2018; Tullis & Goldstone, 2020). Through collaboration and peer discussion methods, problem-solving will be provided where students are involved in an active sense-making process to increase students' conceptual understanding and also strengthen their learning. (Lasry et al., 2008; Shin et al., 2020).

This higher retention of correct answers in the experimental group underscores that the use of PI in facilitating the learning process with peers will increase conceptual mastery and retention

5.3. Student Perception of PI in Active Learning

This research also investigates students' perceptions of PI as an instructional strategy in active learning. The results of this study revealed very positive responses, with students demonstrating high levels of engagement, cognitive processing, learning orientation, learning readiness, and motivational orientation. This finding is in line with the results of other studies which also reveal that students stated that PI encourages active involvement, critical thinking, and meaningful learning experiences, in line with the principles of constructivist pedagogy (Chiu & Cheng, 2017; Baepler et al., 2020; Deslauriers et al., 2019; Yannier et al., 2021).

In addition, the positive perception of PI in this study supports previous research that highlights the benefits of PI in promoting a student-centered learning environment, encouraging collaboration, and increasing motivation (Halverson & Graham, 2019; Wong & Liem, 2022; Li & Lajoie, 2022). These findings also underscore the importance of student acceptance and satisfaction in instructional design, as positive learning experiences are critical to increasing intrinsic motivation and academic success (Aina & Langenhoven, 2015; Tullis & Goldstone, 2020).

Ultimately, the results of this study provide empirical evidence supporting the highly efficacious use of PI as an effective teaching strategy in business education. By encouraging active engagement, peer interaction, and deeper learning experiences, PI improves academic achievement and fosters students' positive perceptions of the learning process.

5.4. Limitations

This study has several notable limitations that provide opportunities for further research. First, instructor biases may have played a role in influencing the outcomes, as the same teacher was responsible for both classes. The teacher's personal teaching style, expectations, and interaction with students could have inadvertently affected the students' performance in both the individual study group and the Peer Instruction (PI) group. To address this in future research, it would be beneficial to involve multiple instructors or implement controls to minimize potential biases. This would allow for a more objective assessment of the effectiveness of the instructional methods employed.

Second, the quasi-experimental design of this study limits the internal validity of the findings due to the lack of random assignment of students to groups. While this design allowed for real-world classroom observation, it introduced the possibility of selection bias, as the groups were not randomly formed. As a result, the comparability between groups may have been affected, and the findings may not fully reflect the effects of PI on learning outcomes. To strengthen future research, a randomized controlled trial should be considered, where students are randomly assigned to groups, improving the robustness and reliability of the findings. Moreover, this design also restricts the generalizability of the results. The study was conducted within a specific educational context and with a relatively small sample size. Future research should explore the application of PI in diverse educational contexts and disciplines. Expanding the study to different subjects, levels of education, and cultural settings would help validate the effectiveness of PI across various fields.

Additionally, the study did not include any qualitative data, which limits the depth of understanding regarding students' experiences and perceptions of PI. To improve the reliability and validity of future research, it is essential to incorporate qualitative methods such as interviews or focus groups with participants. This would allow for triangulation of the data, providing a more comprehensive view of the impact of PI by gathering students' insights and experiences. Qualitative data could offer valuable perspectives on how students interact with their peers, how they process the learning content, and what challenges they face in group discussions, all of which are crucial for understanding the full impact of PI on learning outcomes.

Finally, while this study provides important insights, the limitations related to instructor biases, the quasi-experimental design, the narrow educational context, and the absence of qualitative data suggest that further research is needed. Addressing these limitations will lead to more comprehensive and reliable conclusions about the effectiveness of PI, particularly across different educational settings and disciplines, and will offer a more nuanced understanding of students' learning experiences.

6. CONCLUSION

This study contributes valuable insights into the efficacy of Peer Instruction (PI) in enhancing academic achievement, student engagement, and conceptual understanding in higher education, particularly within business education. The findings confirm that PI significantly improves academic performance compared to traditional instruction methods, with students in the PI group demonstrating higher mean test scores and retention of correct answers. Moreover, the positive student perception of PI further underscores its potential as a student-centered learning strategy, fostering motivation, critical thinking, and collaborative learning.

These results align with existing research supporting active learning models and provide empirical evidence of the substantial impact of PI on students' academic outcomes and their positive learning experiences. By engaging in peer discussions, students not only correct their misconceptions but also enhance their conceptual mastery and retention, key factors in long-term academic success.

Despite the robust findings, this study acknowledges certain limitations. The quasi-experimental design, potential instructor biases, and lack of randomization in group assignment suggest the need for future research that incorporates more controlled methodologies, including randomized controlled trials. Additionally, the absence of qualitative data limits the depth of understanding regarding student experiences with PI. Future studies should consider incorporating interviews or focus groups to capture more nuanced perspectives on the learning process.

In conclusion, this research reaffirms PI as an effective pedagogical tool in business education and beyond, promoting not only academic success but also a more dynamic and interactive classroom environment. Further exploration of PI's applicability across different educational contexts and subjects will help to establish its broad utility in fostering deeper learning and engagement.

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