

### The effect of co-teaching on academic engagement and test anxiety of nursing students of Lorestan University of Medical Sciences

تأثير التدریس المشترك على المشاركة الأكاديمية وقلق الاختبار لدى طلاب التمريض في جامعة لورستان للعلوم الطبية



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**Background:** There is valid evidence that supports the impact of active teaching methods on student-related outcomes. One of these active teaching-learning approaches is co-teaching. This study aimed to determine the effect of co-teaching on nursing students' academic engagement and exam anxiety.

**Method:** This study was conducted with a two-group semi-experimental design. In total, 35 undergraduate nursing students in the second semester of 2021-2022 at Lorestan University of Medical Sciences, who had chosen the Fundamental of Nursing course, was selected by whole enumeration based on the inclusion criteria. Teaching was provided conventionally for the control group (n = 18) while co-teaching was done for the intervention group (n = 17). The participants completed the academic engagement scale and the exam anxiety scale at two parts: the end of the 10th session and the end of the 20th week. Data were analyzed using t-test, paired t-test, and chi-square in Stata 17 software.

**Results:** The results showed that the collaborative teaching approach, compared to conventional teaching, had no significant difference in the students' average score of academic involvement and test anxiety.

**Conclusion:** The co-teaching method did not show any difference in the variables of academic involvement and test anxiety compared to conventional teaching. More studies are suggested to plan co-teaching methods.

**Keywords:** Co-teaching, Engagement, Test anxiety, Nursing, Students

### تأثير تدریس مشترك بر درگیری تحصیلی و اضطراب امتحان دانشجویان پرستاری دانشگاه علوم پزشکی لورستان

**زمینه و هدف:** شواهد معتبری وجود دارد که از تأثیر روش‌های تدریس فعال بر نتایج مرتبط با دانشجو حمایت می‌کند. یکی از این رویکردهای فعال یاددهی-یادگیری، تدریس مشارکتی است. این مطالعه با هدف تعیین تأثیر تدریس مشارکتی بر درگیری تحصیلی و اضطراب امتحان دانشجویان پرستاری انجام شد.

**روش:** این پژوهش با طرح نیمه تجربی دو گروهی انجام شد. در مجموع 35 دانشجوی ترم اول کارشناسی پرستاری نیمسال دوم 1400-1401 در دانشگاه علوم پزشکی لورستان که درس اصول و مهارتهای پرستاری را انتخاب کرده بودند به صورت تمام انتخاب شدند. برای گروه کنترل (n = 18) تدریس به روش مرسوم ارائه شد، در حالی که تدریس مشارکتی برای گروه مداخله (n = 17) انجام شد. مقیاس درگیری تحصیلی و مقیاس اضطراب امتحان در دو مقطع زمانی، پایان جلسه دهم و پایان هفته بیستم توسط مشارکت کنندگان تکمیل شد. داده ها با استفاده از آزمون t مستقل، تی زوجی و کای اسکوار با نرم افزار Stata 17 تجزیه و تحلیل شدند.

**یافته‌ها:** مطابق نتایج، تفاوت معنی داری در میانگین نمره درگیری تحصیلی و اضطراب آزمون، بین رویکرد تدریس مشارکتی در مقایسه با تدریس مرسوم وجود نداشت.

**نتیجه گیری:** روش تدریس مشارکتی در مقایسه با تدریس به روش مرسوم، تفاوتی در متغیرهای درگیری تحصیلی و اضطراب آزمون نشان نداد. مطالعات بیشتری برای برنامه‌ریزی روش تدریس مشارکتی پیشنهاد می‌شود.

**واژه های کلیدی:** تدریس مشارکتی، درگیری، اضطراب آزمون، دانشجویان، پرستاری

**الخلفية:** هناك دليل صالح يدعم تأثير طرق التدريس النشطة على النتائج المتعلقة بالطلاب. يعد التدريس المشترك أحد مناهج التدريس والتعلم النشط. هدفت هذه الدراسة إلى تحديد أثر التدريس المشترك على انخراط طلاب التمريض الأكاديمي وقلقهم من الامتحان.

**الطريقة:** أجريت هذه الدراسة بتصميم شبه تجريبي من مجموعتين. في المجموع، تم اختيار 35 من طلاب التمريض الجامعيين في الفصل الدراسي الثاني من 2021-2022 في جامعة لورستان للعلوم الطبية، الذين اختاروا دورة أساسيات التمريض، من خلال التعداد الكامل بناء على معايير التضمين. تم توفير التدريس بشكل تقليدي لمجموعة التحكم (n = 18) بينما تم إجراء التدريس المشترك لمجموعة التدخل (n = 17). أكمل المشاركون مقياس المشاركة الأكاديمية ومقياس القلق من الامتحان على نقطتين: نهاية الجلسة العاشرة ونهاية الأسبوع العشرين. تم تحليل البيانات باستخدام اختبار t، واختبار t المقترون، و chi-square في برنامج Stata 17.

**النتائج:** أوضحت النتائج أن أسلوب التدريس التعاوني، مقارنة بالتدريس التقليدي، لم يكن له فروق ذات دلالة إحصائية في متوسط درجات الطلاب للمشاركة الأكاديمية وقلق الامتحان.

**الخلاصة:** لم تظهر طريقة التدريس المشترك أي فرق في متغيري المشاركة الأكاديمية وقلق الامتحان مقارنة بالتدريس التقليدي. تم اقتراح المزيد من الدراسات لتخطيط طرق التدريس المشترك.

**الكلمات المفتاحية:** التدريس المشترك، المشاركة، القلق من الامتحان، التمريض، الطلاب

### لورستان یونیورسٹی آف میڈیکل سائنسز کے نرسنگ طلباء کی تعلیمی مصروفیت اور امتحانی پریشانی پر شریک تدریس کا اثر

**پس منظر:** ایسے درست ثبوت موجود ہیں جو طلباء سے متعلقہ نتائج پر فعال تدریس طریقوں کے اثرات کی حمایت کرتے ہیں۔ تدریسی سیکھنے کے ان فعال طریقوں میں سے ایک شریک تدریس ہے۔ اس مطالعہ کا مقصد نرسنگ طلباء کی تعلیمی مصروفیت اور امتحان کی بے چینی پر شریک تدریس کے اثر کا تعین کرنا تھا۔

**طریقہ:** یہ مطالعہ دو گروہوں کے نیم تجرباتی ڈیزائن کے ساتھ کیا گیا تھا۔ مجموعی طور پر، لورستان یونیورسٹی آف میڈیکل سائنسز میں 2021-2022 کے دوسرے سمسٹر میں 35 انڈرگریجویٹ نرسنگ طلباء، جنہوں نے نرسنگ کے بنیادی کورس کا انتخاب کیا تھا، ان کا انتخاب شمولیت کے معیار کی بنیاد پر پوری گنتی کے ذریعے کیا گیا۔ کنٹرول گروپ (n = 18) کے لئے روایتی طور پر تدریس فراہم کی گئی تھی جبکہ شریک تدریس مداخلت گروپ (n = 17) کے لئے کی گئی تھی۔ شرکاء نے تعلیمی مصروفیت کے پیمانے اور امتحان کے اضطراب کے پیمانے کو دو نکات پر مکمل کیا: 10 ویں سیشن کا اختتام اور 20 ویں ہفتے کا اختتام۔ Stata 17 سافٹ ویئر میں t-test، paired t-test اور chi-square کا استعمال کرتے ہوئے ڈیٹا کا تجزیہ کیا گیا۔

**نتائج:** نتائج نے ظاہر کیا کہ مشترکہ تدریسی طریقہ کار، روایتی تدریس کے مقابلے میں، طلباء کی تعلیمی شمولیت اور امتحانی اضطراب کے اوسط اسکور میں کوئی خاص فرق نہیں تھا۔

**نتیجہ:** مشترکہ تدریس کے طریقہ کار نے روایتی تدریس کے مقابلے میں تعلیمی شمولیت اور امتحانی اضطراب کے متغیرات میں کوئی فرق نہیں دکھایا۔ شریک تدریسی طریقوں کی منصوبہ بندی کے لیے مزید مطالعات تجویز کی جاتی ہیں۔

**مطلوبہ الفاظ:** شریک تدریس، مشغولیت، امتحان کی پریشانی، نرسنگ، طلباء

## INTRODUCTION

Evidence supports the impact of active teaching methods on student outcomes (1). One of these active teaching-learning approaches is co-teaching (2). Traditionally, co-teaching has been a tool for changing pedagogical practices (3). William Anderson first presented the idea of co-teaching. It has been used in all education levels, including higher education (4, 5).

In higher education, teachers can be research collaborators, but teaching collaborators and co-teachers are rare (6). Today, co-teaching is considered a model of planning and instruction to reach all learners, not merely students with specific needs (4). Team teaching, also known as collaborative teaching and co-teaching (3, 7), involves the participation of all team members in planning, designing, teaching, and assessing student and course assignments (8). Co-teaching is collaborative professional communication (9). An effective co-teaching model requires all dimensions of the learning process (10). Critical elements of co-teaching include co-planning, co-teaching, and co-assessment (11). In this approach, instructors share responsibilities, thus support their health and ability to cope with high workloads (12).

Co-teaching supports the potential of creating a solid learning community for students and teachers. One of the main advantages of collaborative teaching is the reflection of the nature of the professional community in which students begin to participate during their undergraduate course. Team teaching best serves motivated teachers who embrace a diversity of thought and innovative approaches (6, 8) and provide them with professional growth, classroom management support, and collaborative opportunities (13). Co-teacher instruction can be organized around four co-teaching models: supportive, parallel, complementary, and team co-teaching. In team teaching, two or more people do what one teacher has traditionally done alone and assume responsibility for all learners. Both teachers are equally active in sharing the lead instructional roles with whole group instruction of students with and without disabilities (14).

An effective team teaching consisting of two teachers working together can make active participation of all students. Evidence shows that students in collaborative classrooms experience more cognitive engagement and progress than in classrooms with only one teacher (15, 16). Students' participation and engagement in class are one of the main concerns of teachers, which can be increased through collaborative teaching (17).

Academic engagement is the learner's constructive, enthusiastic, and knowledge-based participation in learning activities that lead to positive academic outcomes (18). The study by Carter et al. (2012) defined the domains of engagement as follows: behavioural engagement refers to participation in academic and extracurricular activities. Cognitive engagement is defined as the amount of student investment in learning. Emotional engagement includes interest, a feeling of belonging, and a positive attitude about learning and communication with other peers and teachers. Active engagement is the constructive participation of the

student in the educational process that one receives (17).

A collaborative teaching style, by providing more opportunities for teachers to respond and increasing student feedback, creates academic conflict and reduces test anxiety (19). Another factor that affects teaching style is test anxiety. Test anxiety is students' emotional reaction to an assessment (20). The main factors causing test anxiety are extreme course load, fear of failure during a test, and studying the entire night before exams (21). In the study, test anxiety was reported to be high (21). An average level of anxiety is helpful as a motivational factor that can increase one's efficiency more effort. However, extreme anxiety causes disturbance of mental processes (22). Collaborative teaching, by providing more opportunities for teachers to respond and also increasing feedback to students, creates academic engagement and reduces test anxiety (19).

Regarding co-teaching in nursing during the last 40 years, it has been investigated in some studies. However, the literature needs to be more comprehensive regarding the details of using this approach in nursing (8). In several studies, the advantages and disadvantages perceived by students have been investigated (6). Previous studies have reported that the most common barrier to implementing co-teaching is a need for more time for co-planning. Other barriers include difficulty finding suitable partners, differences in teachers' personalities, and unclear roles in teaching situations. Also, the faculty management's lack of support hinders the collaboration implementation (12).

The benefits and challenges of collaborative teaching are well documented, but there needs to be more substantive evidence to demonstrate the effectiveness of collaborative teaching among undergraduate students. Especially in practice-based professions such as nursing, active collaboration in collaborative teams is more the rule than the exception. Undergraduate students should have opportunities to learn how to collaborate and observe the modelling of collaborative teaching practice. Although articles and books have been written to describe team teaching in other fields, there are few texts about team teaching in nursing and the details of its application in the nursing profession or its professional development (8). Nurses must work as a team and be educators with patients and their colleagues. To prepare them for this dynamic role in their career programs, they need genuine learning opportunities to see collaborative practice and co-teaching and have first-hand experience with it (6).

On the other hand, collaboration at the classroom level, especially co-teaching, currently needs a solid empirical basis for effectiveness. Studies are often limited to small case studies, survey reports on perceptions, or observations of teachers' experiences with this model (23). Therefore, this research was conducted to determine the effect of co-teaching on nursing students' academic engagement and test anxiety.

## METHODS

The current study is a semi-experimental with two groups and was conducted in the second semester of 2022-2023 at Lorestan University of Medical Sciences (two schools of Nursing).

**Participants**

Nursing students of the Khorramabad Nursing School (number = 17) were selected as the intervention group, and the students of Aligudarz School of Nursing (number = 18) were selected as the control group, non-randomly. Students were selected by the whole enumeration and entered based on the study criteria. The inclusion criteria included studying in the first year of a nursing bachelor's degree, willingness to participate in the study, lack of previous familiarity with co-teaching, and enrollment in the fundamental nursing skills course. If the students did not want to continue the collaboration, they were excluded from the study.

**The Fundamental of Nursing course**

The theory course of Fundamental of Nursing is one of the specialized courses of the undergraduate nursing education program for two and a half units, 43 hours, and consisting of 20 two-hour sessions (3 hours related to formative and summative evaluation), which is taught by one of the faculty members of both faculties. This course aims to acquaint nursing students with the basic concepts of providing care to clients in the nursing process framework and acquire the necessary skills to implement clinical procedures based on compliance with laws, regulations, ethics, and professional communication. It should be noted that the course design and planning of the educational process were done with the participation of the teachers of both faculties according to the ADDIE model (Figure 1). ADDIE stands for Analyze, Design, Develop, Implement, and Evaluate, and that is a leading learning development model used for instructional design, which is the complete process of designing, developing, and serving learning content.

**Intervention**

Regarding the teaching approach, during the first ten weeks, in the intervention group, a lecturer taught in a traditional method (lecture with questions and answers with assignments

in the learning management system). The teacher conducted the second ten weeks in the co-teaching method. In the control group, the sessions were continued by the same teacher as traditional.

**Intervention group**

In the co-teaching method, an undergraduate student was present as an assistant in all sessions. He was an active student interested in the relevant course and one of the students in the sixth semester who volunteered to participate in the study. In addition to participating in the classroom, this assistant actively participated in all stages of instructional design, from learner analysis to evaluation.

Also, according to the key elements of collaborative teaching, including co-planning, collaborative teaching, and co-evaluation, the teaching assistant participated in the desired stages.

One of the most critical issues in this teaching method is coordination and collaborative planning between teachers before each session and the entire course.

**Before each educational session**

For coordination before each educational session, in an informal and friendly meeting, the criteria of the educational aid model used for the classroom were provided to the teachers. Before the beginning of each face-to-face session, it was specially planned for the assistant's sitting place because it is crucial where the assistant sits and how to be introduced. Also, what body language do both instructors use with each other? How to interrupt each other's conversations? All these issues were discussed before the beginning of each session.

**In each educational session**

The person who acted as an assistant observed the students during the semester and answered their possible questions.

**At the end of each session**

At the end of each session, a half-hour meeting was held to post-instruction reflections on all teaching events, performance, and class achievements, and plans were made to solve possible future problems and increase the efficiency

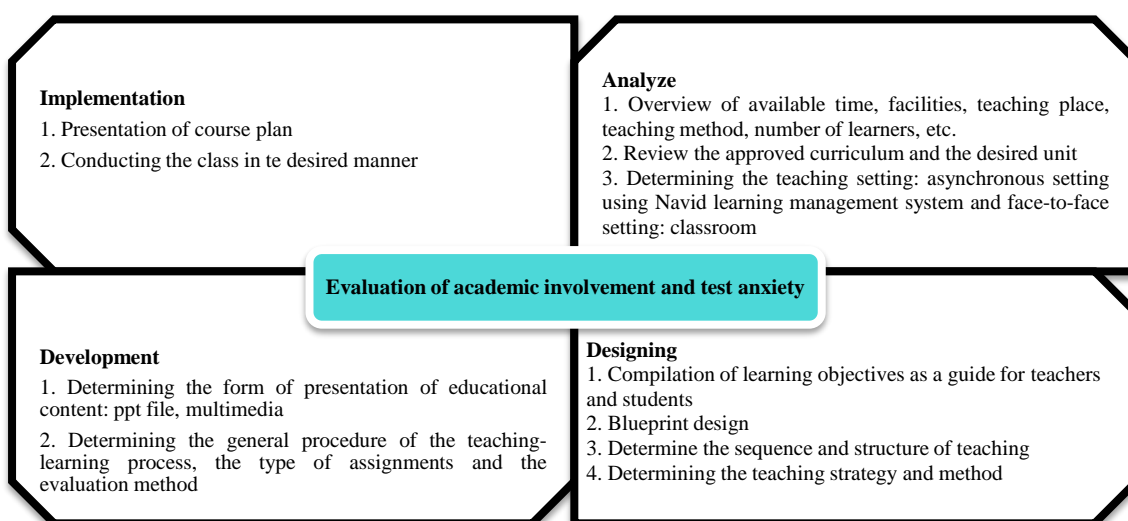


Figure 1. The course design and planning of the educational process base on the ADDIE model

of the teaching method. Both instructors discussed the students' problems in the field of learning and other problems and tried to find solutions and solve them. Also, the teachers tried to take a united decision in front of the learners when facing predictable problems.

**Control group**

In the control group, all sessions (from the first to the end of the 20th) were taught by an instructor in a lecture with question-and-answer techniques.

**Instruments**

The variables were measured at two-time points, the end of the 10th session and the end of the 20th week, by completing the academic engagement scale and the test anxiety scale by the participants remotely and by sending a link through WhatsApp social messenger. At the end of the intervention, the student's academic success (scores obtained in the middle of the semester and at the end) was compared in the two groups.

**Academic Engagement Scale**

To assess students' academic engagement Reeve and Tseng's (2011) scale was used to assess students' academic engagement. This scale has 22 items and four subscales, including behavioural engagement (5 items), Agentic engagement (5 items), cognitive engagement (8 items), and emotional engagement (4 items). It is based on a five-point scale from always (5) to never (1). The range of scores for each item is between 22 and 110. Reeve and Tseng (2011) reported

the reliability and validity of this tool as high and acceptable [29]. In Iran, the reliability of the total scale instrument has been reached using Cronbach's alpha of 0.87. Cronbach's alpha of the subscales has been reported from 0.71 to 0.81. In this study, Cronbach's alpha of the tool was confirmed from 0.70 to 0.78.

**Sarason Test Anxiety Questionnaire**

Sarason designed this tool in 1977. It has one dimension and 25 items that must be answered with "yes and no" and completed within 10 to 15 minutes. Due to the appropriate psychometric characteristics, using it in measuring test anxiety is prevalent. This tool makes it possible to obtain the person's psychological states and physiological experiences during the exam, before and after it, based on a self-report method. Abolghasmi (2012) used Cronbach's alpha method to measure the reliability coefficient of the questionnaire at 0.89, the correlation coefficient of the anxiety test with the final inhibitory sub-scale ( $P < 0.001$ ,  $r = 0.50$ ), and the facilitator ( $r = 67$ ,  $P < 0.001$ ) 0.001 has reported to be significant.

**Data analysis**

Data were analyzed using t-test, paired t-test, and chi-square in Stata 17 software.

**RESULTS**

There was no significant difference between the two groups regarding sociodemographic variables, and the two groups were similar (Table 1).

Table 1. Sociodemographic of the participants					
Variables		Experimental n (%)	Control N (%)	P value	$\chi^2$
Gender	Male	9(52.94)	9(50)	0.862	0.03
	Female	8(47.06)	9(50)		
Economic status	Good	5(29.41)	4(22.22)	0.627	0.236
	Average	12(70.59)	14(77.78)		
Living status	With family	3(17.65)	6(33.33)	0.289	1.13
	Dormitory	14(82.35)	12(66.67)		
Father's level of education	Diploma	7(41.18)	2(11.11)	0.033	6.81
	High school	5(29.41)	3(16.67)		
	Higher than diploma	5(29.41)	13(72.22)		
Father's job	Employee	7(41.18)	16(88.89)	0.003	11.86
	freelance job	10(58.82)	1(5.56)		
	Unemployed	0(0.0)	1(5.56)		
Mother's education level	Diploma	6(35.29)	9(50)	0.056	5.78
	High school	8(47.06)	2(11.11)		
	Higher than diploma	3(17.65)	7(38.89)		
Mother's job	Employee	3(17.65)	6(33.33)	0.289	1.13
	Unemployed	14(82.35)	12(66.67)		
		<b>Mean (SD)</b>	<b>Mean (SD)</b>	<b>P value</b>	<b>t</b>
Age		20.04 (2.43)	20.27 (2.63)	0.77	-0.28
Grade point average(GPA)		18.50 (0.99)	18.46(1.04)	0.89	0.13

The mean (standard deviation) total score and the intensity of students' test anxiety are shown in Table 2. The mean score of total test anxiety and the intensity of test anxiety of the two groups, before and after the intervention, had no significant difference (Table 2).

The results of the mean score of academic engagement before and after the intervention in the two groups showed that no statistically significant difference between the two groups was evident ( $P=0.659$ ). Also, comparing academic engagement subscales, including agent engagement, behavioral engagement, emotional engagement, and cognitive engagement of the two groups before and after, showed no significant difference ( $P>0.05$ ) (Table 3).

**DISCUSSION**

This study aimed to determine the effect of co-teaching on the academic engagement and test anxiety of first-semester nursing students. The findings showed that the student's academic engagement could have improved after the co-

teaching implementation. However, the current study's findings do not support the previous research (13, 20, 21). Hassani et al. (2020) showed that co-teaching as one teacher and one assistant positively increased students' learning in the understanding of foreign language lessons (21). This differs from the findings presented here. Also, this outcome is contrary to that of Lochner et al. (2019), who found that the learners trained by the co-teaching method had higher cognitive engagement than those trained by the traditional single instructor (13).

A possible explanation might be that most of the studies on co-teaching and its impact on academic engagement have focused on the student community. Fewer studies have been done in the field of higher education. In some higher education studies, the findings align with this study. According to the findings of the qualitative study by Hart et al., students sometimes needed clarification on the structure of co-teaching courses. Some students preferred traditional approaches in class. They believed co-teaching requires more

**Table 2. The comparison of the intensity and mean score of test anxiety of two groups before and after intervention**

Variables		Experimental Mean(SD)	Control Mean(SD)	t	P value
Agentic	Before	11.82(6,14)	11(7.1)	-0.385	0.702
	After	12.86(5.43)	13.55(4.33)	0.438	0.663
Behavioral	Before	11.77(7.65)	10.22(8.65)	-0.601	0.551
	After	12.41(6)	12(6.85)	-0.173	0.863
Emotional	Before	9.14(5.62)	7.78(6.41)	-0.713	0.479
	After	9.45(1.18)	10.22(1.26)	0.444	0.659
Cognitive	Before	19.23(7.1)	18.94(12.81)	-0.085	0.932
	After	19.04(1.86)	23.17(1.97)	1.512	0.138
Total engagement	Before	51.95(5.18)	53.77(4.71)	-0.462	0.648
	After	47.94(7.74)	59(5)	-1.427	0.172

**Table 3. Comparisons of the total and subscales scores of engagement between two groups**

Group	Variables			$\chi^2$	p-value	Post n(%)			$\chi^2$	p-value	Pre M (SD)	t	Post M (SD)	t	p-value
	Low	Moderate	Sever			Low	Moderate	Sever							
Experimental	5 (22.73)	1 (4.55)	16 (72.73)	0.751	P=0.69	4 (18.18)	1 (4.55)	17 (77.27)	1.343	P=0.51	3.36 (7.07)	0.836 P=0.408	13.4 (6.64)	-0.189	P=0.851
Control	3 (16.67)	2 (11.11)	13 (72.22)			5 (27.78)	2 (11.11)	11 (61.11)			15.17 (6.41)		13 (7)		

effort to follow two instructors instead of one (22). Personality conflicts, differences in epistemology, the power imbalance of instructors, and their negative behavior toward students lead to co-teaching failure. Also, the different teaching styles of instructors must be clarified for students (24, 25).

Especially in the present study, the first-semester students were the research population. In Iran, students study in high school before entering university and they enter university after passing the national entrance exam. The students of the first semester are in the transition stage. The study by Chong and Soo (2021) showed that the participation and engagement of first-year university students regarding reading textbooks before attending class, asking questions in class, and borrowing books from the university library could be more robust (23). Students' development in the future aims to increase their transition from school to university by encouraging active participation in class and creating the opportunity for their integration with the university, and improving their academic engagement at this point (25). Therefore, by paying attention to the fact that the first-year students need more opportunities to engage with their peers, teachers, and the university environment, implementing new teaching approaches, such as co-teaching, is better used for senior students.

On the other hand, due to the complexity of academic engagement and its multi-dimensional nature, it is impossible to achieve this goal by simply relying on changing the teaching approaches. The concept is a multi-dimensional phenomenon that may be caused by various individual factors such as demographic characteristics (such as age and gender), activities such as research activities, social relations of the individual, previous educational experiences, expectations, sense of belonging and sense of being a student, and context in which learning takes place (23-25). However, academic engagement is more driven by motivations and individual characteristics and is less influenced by academic characteristics or the learning context (26).

Another finding observed in this study was that the test anxiety in co-teaching class students was not different from traditional teaching class students. Various factors can affect test anxiety. Tsegay et al. 2019 showed in a study that gender is significantly related to test anxiety. Also, they found that the risk of test anxiety in first-year students is ten times that of fifth-year students (19).

Another finding in this study was that test anxiety in co-teaching classes was not different from traditional teaching classes. A study that was similar to the present study was not found. Various factors can affect test anxiety. Tsegay et al. 2019 showed in a study that gender and academic year are significantly related to test anxiety. Also, they found out that the risk of test anxiety in first-year students is 10 times that of fifth-year students (22). Guidance during the teaching process gives students more time and opportunity to consult with the teacher. Therefore, students do not have too much anxiety or fear in asking questions. This teaching approach improves students' understanding of concepts (26). A study was conducted to determine

students' understanding of math lessons and anxiety using collaborative teaching in two control and intervention groups. The results indicated a significant increase in mathematical understanding in the pre-test and post-test. Math test anxiety was medium in the intervention group and high in the control group. This shows that the cooperative teaching model only partially affects the understanding of mathematics. However, it affects the anxiety of the math test (24), which is not consistent with the results of the present study.

On the other hand, the results of another study showed no significant correlation between students' exam anxiety and teaching style. The researchers stated that the non-significant relationship might be due to a set of confounding variables, including self-confidence, source of control or personality characteristics of the students, which were not examined in their research, which is in line with the current research (24). Evidence indicates an inverse relationship between exam anxiety and students' personality traits such as extroversion, conscientiousness, and emotional stability. Therefore, it is very important to use effective and appropriate teaching-learning methods according to students' personality characteristics (25). The results of Bukar's research showed that the use of team teaching techniques significantly reduces students' anxiety compared to the control group that used the single-teacher teaching strategy (26), which is not consistent with the results of the present study. However, evidence related to collaborative teaching in medical education is generally limited (27), and more studies are needed.

The study's sample size was small, so conducting further studies with a larger sample size is recommended. It is also suggested that this method be used for senior students and other outcomes be measured.

There was no significant correlation between test anxiety and academic engagement with teaching methods. However, co-teaching teaching had a lower mean score in test anxiety and higher academic engagement than conventional teaching. These findings have the potential to change the way of teaching. Therefore, more studies are suggested for co-teaching planning.

#### Ethical considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors. The code of ethics was also obtained from Research Ethics Committees of National Agency for Strategic Research in Medical Education (IR.NASRME.REC.1400.314).

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