



ORIGINAL RESEARCH PAPER

Effect of Web-based Peer Assessment on Students' Self-Directed Learning Skills

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ABSTRACT

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Background and Objectives: The changes in the new world, due to social, cultural, and the development of information and communication technologies (ICTs), have led to a modification in the objectives and educational approaches to align with the changes occurring in the learners' environment. One of the new approaches that has received attention in teaching and learning to acquire 21st-century skills is peer assessment. This study examined the impact of web-based peer assessment on the self-directed learning skills of educational sciences students at Arak University.

Materials and Methods: Researchers employed a quasi-experimental research method with a pre-test-post-test design and included a control group in the study. The target population consisted of all educational sciences students in the academic year 2022-2023 at Arak University (178 students), from which 31 participants were selected through the convenience sampling method and assigned randomly into two groups: experimental and control. To gather data for the study, the researchers utilized the Self-directed Learning Readiness Questionnaire, which comprised 40 items and three subscales: self-management, desire for learning, and self-control. The questionnaire was administered before and after the course. During the 10 sessions, web-based peer assessment was integrated into the training process in the experimental group. In this way, courses, students, and the instructor were defined in the Learning Management System (LMS) of Arak University. After each teaching session, the teacher added an activity (peer assessment) in the system, in such a way that the students did homework related to the subject of the lesson. The teaching approach in both the experimental and control groups involved the teacher following a lesson plan and allowing the learners to ask questions during the teaching process. However, there was a difference in how the two groups were assessed. In the experimental group, peer assessment was utilized, where students reviewed and assessed their classmates' assignments. On the other hand, the control group followed a conventional evaluation method. In the classroom, the teacher delivered lessons and assigned homework to the students. The students needed to complete the assignments and submit them to the teacher for assessment. The teacher reviewed the student's homework in each session and provided feedback. Statistical analyses, including descriptive statistics (i.e., mean and standard deviation), as well as inferential statistics (i.e., Analysis of Covariance), were employed to analyze the data.

Findings: The findings indicated that peer assessment training had a notable impact on self-directed learning skills and their sub-scales, including self-management, desire for learning, and self-control ($p < 0.05$).

Conclusions: Based on the findings of this research, utilizing peer assessment can serve as an effective approach to enhance students' self-directed learning abilities, a crucial skill for learners in the 21st century. However, the successful implementation of peer assessment requires certain conditions that teachers should consider. These include having an appropriate e-learning platform, the instructor's formulation of assessment criteria, and providing proper guidance to learners acting as evaluators. It is important to note that the implementation of peer assessment comes with its own set of challenges, which should be thoroughly explored in studies examining its different aspects.



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مقاله پژوهشی

تأثیر همتارزیابی مبتنی بر وب بر مهارت های یادگیری خودراهبری دانشجویان

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چکیده

پیشینه و اهداف: تغییرات دنیای جدید به واسطه پیچیدگی‌های اجتماعی، فرهنگی و توسعه فناوری‌های اطلاعات و ارتباط منجر به تغییر در اهداف و رویکردهای آموزشی جهت تطابق با تغییرات ایجاد شده در محیط پیرامون یادگیرندگان شده است. از جمله رویکردهای جدید که در فرایند آموزش و یادگیری جهت ایجاد مهارت‌های قرن بیست و یکم در یادگیرندگان مورد توجه قرار گرفته است همتارزیابی است. این مطالعه با هدف بررسی تأثیر همتارزیابی مبتنی بر وب بر مهارت‌های یادگیری خودراهبری دانشجویان علوم تربیتی دانشگاه اراک انجام شد.

روش‌ها: محققان از روش پژوهش شبه تجربی و از طرح پیش آزمون-پس آزمون همراه با گروه گواه استفاده کردند. جامعه پژوهش کلیه دانشجویان علوم تربیتی در سال تحصیلی ۱۴۰۱-۱۴۰۲ به تعداد ۱۷۸ نفر بودند که از میان آن‌ها ۳۲ نفر به عنوان نمونه به صورت در دسترس انتخاب شدند و در دو گروه آزمایش و کنترل به صورت تصادفی توزیع شدند. جهت جمع آوری داده‌های مورد نیاز در این پژوهش از پرسشنامه آمادگی یادگیری خودراهبری استفاده شد. این پرسشنامه دارای ۴۰ سوال و سه زیرمقیاس خود مدیریتی، لذت از یادگیری و خود کنترلی است. پرسشنامه پیش و پس از دوره به اجرا درآمد. در گروه آزمایش به مدت ۱۰ جلسه فرایند آموزش همراه با همتارزیابی مبتنی بر وب انجام شد. به این صورت که درس، دانشجویان و استاد درس در سامانه مدیریت دروس تعریف شدند. بعد از هر جلسه تدریس، استاد درس یک فعالیت (همتارزیابی) در سامانه اضافه می کرد، به نحوی که دانشجویان در رابطه با موضوع درس تکلیفی را انجام می دادند، سپس استاد با استفاده از افزونه کارگاه آموزشی موجود در سامانه، فعالیت همتارزیابی را اجرا می کرد. فرایند آموزش در گروه آزمایش و گواه به این صورت بود که استاد درس بر اساس طرح درس، موضوعات درسی را تدریس می کرد، در خلال تدریس امکان پرسش و پاسخ توسط یادگیرندگان وجود داشت. تفاوت دو گروه در بکارگیری همتارزیابی در گروه آزمایش بود و دانشجویان تکالیف همکلاسی‌ها را مورد بررسی و ارزیابی قرار می دادند، در حالیکه در گروه گواه شیوه ارزیابی به شکل مرسوم صورت گرفت. به این صورت که مدرس در کلاس درس آموزش‌ها را ارائه می داد، سپس تکالیفی برای دانشجویان تعریف می شد. آنها موظف به انجام تکالیف و ارسال آن به مدرس بودند، مدرس هر جلسه تکالیف دانشجویان را بررسی می کرد و به آنها بازخورد می داد. جهت تحلیل داده‌های پژوهش از آمار توصیفی (میانگین و انحراف معیار) و آمار استنباطی (آزمون تحلیل کوواریانس) استفاده شد.

یافته‌ها: داده‌های پژوهش نشان داد آموزش به همراه همتارزیابی بر مهارت‌های یادگیری خودراهبری و زیرمقیاس آن (خود مدیریتی، لذت از یادگیری، کنترل یادگیری) تأثیر معنی داری دارد ($p < 0.5$).

نتیجه‌گیری: با توجه به نتایج این مطالعه، روش همتارزیابی به عنوان روشی جهت افزایش مهارت‌های یادگیری خودراهبری دانشجویان، که از مهارت‌های مورد نیاز در یادگیرندگان قرن بیست و یکم است، می تواند مورد استفاده قرار گیرد. اجرای همتارزیابی مستلزم وجود شرایطی است که لازم است مورد توجه مدرسان قرار گیرد از جمله: پلتفرم آموزش الکترونیکی مناسب، تدوین معیارهای ارزیابی توسط مدرس و راهنمایی مناسب یادگیرندگان به عنوان ارزیاب. لازم است جنبه‌های مختلف چالش‌های اجرای همتارزیابی در مطالعات تکمیلی مورد بررسی قرار گیرد.

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Introduction

In the rapidly evolving and ever-changing world we live in today, education plays a crucial role in preparing individuals to navigate the complexities of society and adapt to emerging challenges [1]. The advancements in

technology, globalization, and the interconnectedness of our world have given rise to a new paradigm of learning as lifelong learning [2]. To make learning a lifelong and high-quality experience, we need to look for solutions and processes that go beyond a particular moment in time [3]. One of the

effective solutions in education is self-directed learning [4], which enhances learners' self-confidence and ability to learn independently, particularly in challenging educational environments [5]. Correctly learned, self-directed learning provides a foundation for lifelong learning. In other words, active learning, which emphasizes the learner's role in the learning process and is highly valued in education today, is the most stable form of learning. It is now widely accepted that knowledge created by learners themselves is useful and can be applied in other learning situations [6].

Self-directed learning (SDL) was first introduced by Malcolm Knowles in 1978 [7]. In this type of learning, the learner's acquisition of knowledge surpasses that of traditional teacher-centered learning. SDL fosters learners' motivation and interest in the learning process, allowing them to retain what they learn and apply to expand their knowledge and keep up with new developments [8]. SDL is a process where individuals take the initiative, with or without assistance from others, to identify their learning needs, formulate goals, identify resources (both human and material) for learning, select appropriate learning strategies, and evaluate learning outcomes [9]. Self-directed learners are proactive and self-motivated individuals who take the initiative to learn rather than waiting passively. They engage in purposeful and meaningful learning, and their high motivation leads to stable and continuous learning. Such individuals are generally more responsible in their lives and benefit from self-discipline in their learning [10].

People with high levels of self-directed learning exhibit characteristics of active learners, such as a strong desire to learn, problem-solving skills, and the ability to engage in independent learning activities and manage their learning autonomously [11]. In this

process, learners are expected to consciously take responsibility for directing their learning [12, 13]. SDL empowers individuals to pursue and learn what they need to learn. Over the past few decades, developing and fostering SDL skills has become a key goal in adult education, leading to increased research on the topic worldwide. It is possible to design and plan educational conditions in a way that fosters learners' self-directed learning skills. such as: implementing project-based and research-based methods that encourage active learner involvement [14], teaching metacognitive strategies such as goal-setting, planning, monitoring, and evaluating their learning [15], integrating technology into the teaching and learning process, providing access to diverse resources [16], promoting peer learning, and incorporating self-assessment and peer assessment [17].

Peer assessment has gained attention in recent years as a means of developing basic skills in learners [18]. In this type of assessment, learners work closely together for extended periods, providing them with opportunities to evaluate each other's work [19]. Peer assessment refers to the evaluation of the activities of other people in the group, and it can provide valuable information for feedback to the student or educational staff [20].

Peer assessment can be used to evaluate the quality of a range of products, including writing, oral presentations, portfolios, test performance, or other skilled behaviors [21]. It can be collective or formative and aims to help learners plan their learning, identify their strengths and weaknesses, develop metacognition, and improve other personal and professional skills. Peer feedback is available in greater volume and with greater urgency than teacher feedback. Even a peer evaluator with less skill in evaluation but more time to do it can create a valid assessment, which can be as valid as a teacher's assessment [22]. Indeed, peer

assessment has been shown to have a positive impact on students' independence, motivation, self-regulation, and metacognition, in addition to improving performance standards and duties [23]. The primary objective of peer assessment is to cultivate a sense of responsibility in individual and peer learning [24,25].

Review of the Related Literature

Several studies have examined how peer assessment affects the overall learning process, as discussed below.

The study conducted by Kalbasi et al. [26] examined how the utilization of peer assessment impacted the knowledge, skills, and attitudes of student teachers. The outcome of their investigation revealed that both teachers and students acknowledged the beneficial influence of this assessment method in enhancing the knowledge, attitude, and skills of students. As Vedjani and Saeedi's study showed [27] peer assessment is an effective technique that enhances students' learning across multiple educational disciplines. The authors suggested that obtaining constructive feedback through this method requires learners to acquire specific skills and knowledge beforehand to ensure accurate and valuable evaluation.

Hongli et al. [28] revealed that the advantages of incorporating peer assessment into the educational process cannot be assumed without meeting certain circumstances. The research analyzed the factors that potentially influence the effectiveness of peer assessment and identified rating as the most significant determinant. Specifically, the study found that the impact of peer assessment is more substantial when students receive training on how to assess and receive evaluator training, compared to when they do not receive such training.

Jones and Alcock [29] highlighted the importance of appropriate assessment criteria in peer assessment. They found high validity and reliability between expert evaluators and novice evaluators (students and peers), indicating that peers perform well as evaluators and have a positive impact on the learning process. Li and Geo [30] also noted the increasing integration of peer assessment into educational settings as a means of enhancing learning. They examined the use of peer assessment by students with different learning levels, including weak, average, and strong students. The results showed that students with low and medium progress had significant improvement immediately after the integration of the peer assessment model, while the model had less impact on the performance of students with high progress. Taheri and Abdollahi-Guilan [31] also highlighted the impact of peer feedback on the writing performance of language learners, specifically students learning English. They found that this type of assessment had an effective impact on learning.

Najafipour [32] conducted a study comparing self-assessment and peer assessment of the clinical ability of medical students. The researcher suggested that the assessment of students' abilities in the areas of professionalism, teamwork, and communication skills in the clinical environment should be done using a range of evaluators, including instructors, peers, and the learners themselves. The study concluded that self-assessment and peer assessment are complementary, applicable, accessible, and useful methods for evaluating students' achievement of expected capabilities in the education evaluation system.

Spiller [33] identified peer assessment as a useful way to acquire and improve critical assessment skills. The author suggested that through suggestions for the work of other

learners, giving and receiving immediate and relevant feedback from one or more classmates, and understanding learners' learning strengths and weaknesses, peer assessment can enhance evaluation skills. In a qualitative study conducted by Egan and Costello [34], students' experiences with peer assessment were examined. The findings indicated that students believed that the opportunities provided by conducting peer assessment led to an increase in a range of skills, including assessment, communication skills, and self-reflection skills.

In Birtland's [35] study, the primary objective was to investigate the influence of peer-supported e-portfolios on the enhancement of learners' self-directed learning abilities. The results indicated that when learners actively participate in giving and receiving feedback within electronic portfolios, they not only receive assistance from their peers during the learning journey but also contribute to their classmates' comprehension of various concepts. As a result, this collaborative approach significantly enriched their self-directed learning skills.

In the rapidly evolving new world, students need to acquire a diverse set of skills to thrive and succeed. These skills go beyond traditional academic knowledge and focus on equipping students with the abilities necessary to navigate an increasingly complex and interconnected global society. Conventional teaching methodologies have long been the norm in education, with a focus on teacher-led instruction and a structured curriculum. However, in today's rapidly changing world, this traditional approach often falls short of supporting students' self-directed learning.

It is true that in Bloom's Taxonomy, evaluation is considered a high-level educational objective that builds upon lower-level objectives such as understanding,

applying, analyzing, and synthesizing. Traditional methods of teaching and assessment are often unable to meet the high-level learning goals required in today's society. While traditional methods have played a crucial role in shaping our understanding of the world, they have inherent limitations that hinder the attainment of advanced knowledge and skills. In this era of innovation and progress, it has become evident that relying solely on conventional approaches to learning is insufficient. To truly achieve high-level learning goals, we must explore alternative methods and embrace the transformative power of modern educational techniques. Peer assessment has been shown to improve high-level skills in learners such as critical thinking, questioning, and analysis, which can promote the development of self-directed learning skills. In the 21st century, self-directed learning is becoming an increasingly important skill for learners to develop.

Despite the growing body of research on peer assessment, it has received little attention in higher education in Iran. However, the impact of the peer assessment method on self-directed learning skills needs to be investigated further. Therefore, this study aims to investigate the effect of peer assessment on students' self-directed learning skills. By conducting this type of research, more insights can be gained into how this method can be used to promote independent learning among students. This can have important implications for the design and implementation of educational programs in Iran, as well as for the development of policies and practices related to assessment and evaluation in higher education. Overall, exploring the potential of peer assessment to promote self-directed learning skills in the context of Iranian higher education can contribute to the ongoing efforts to enhance the quality of education and support the development of 21st-century skills among students.

Method

The present study utilized a quasi-experimental design with a pre-test-post-test format and a control group. The statistical population consisted of all educational science students enrolled in Arak University during the 1400-1401 academic year (178 students). The sample consisted of 32 students enrolled in Programming Course, with 16 students randomly assigned to the experimental and control groups. The experimental group received the peer assessment method, while the control group received conventional training and evaluation methods.

To collect data on self-directed learning readiness, Fisher et al.'s [36] Self-directed Learning Readiness Questionnaire was utilized. This questionnaire comprises 40 items and employs a five-point Likert scale to assess self-directed learning readiness in three domains: self-control (15 items), desire for learning (13 items), and self-management (12 items). Since Fisher et al., developed and implemented the readiness scale for self-directed learning in Australia for English speakers, Nadi and Sajjadian [37] translated and standardized the questionnaire for Iranian sample. Fisher et al.'s findings in Australia demonstrated that the overall reliability of this instrument via Cronbach's alpha method was found to be 0.83, while it was 0.87 for the self-management subscale, 0.85 for desire for learning at, and 0.80 for self-control. The item-total correlation ranged from 0.26 to 0.84. Additionally, the validity of this scale was established through construct validity and confirmatory factor analysis. In Nadi and Sajjadian's study, Cronbach's alpha method was used to assess the reliability of the scale, which yielded 0.82 for the whole test, 0.78 for the self-management subscale, 0.71 for the desire for learning, and 0.60 for self-control.

This research was implemented in the context of a Programming Course from early September 2022 to December 2022,. The experimental group was exposed to peer assessment, while the control group received conventional teaching and evaluation methods. In both the experimental and control groups, the teaching method consisted of the teacher adhering to a predetermined lesson plan while encouraging learners to ask questions. Nevertheless, the groups differed in terms of their assessment methods. The Arak University Learning Management System (LMS) was employed for peer assessment. Courses, students, and the instructor were defined in the system. Following each teaching session, the instructor added an activity (peer assessment) to the system. Students completed homework related to the lesson's subject, and then the instructor utilized the workshop extension in the LMS system to conduct the peer assessment activity. The peer assessment process consisted of five stages: 1) the instructor reviewed and verified assignments, 2) the instructor established assessment criteria and communicated them to students, 3) assignments were randomly and anonymously sent to three classmates for assessment, 4) classmates evaluated assignments based on the established criteria, and 5) feedback on evaluated assignments was provided to the person who submitted the assignment. Table (1) displays the topics of the lessons.

The control group received conventional evaluation methods, where the instructor presented lessons in the classroom, assigned homework to the students, and required them to submit their completed assignments. The teacher reviewed the students' homework every session and provided feedback.

Table 1: Topic of the lesson

Sessions	Topics
First session	Getting to know basic HTML tags
Second session	How to insert sound, image, and video in HTML environment
Third session	Familiarity with internal and external CSS
Fourth session	How to create links
Fifth session	How to design menus, buttons, and templates
Sixth session	Designing tables
Seventh session	Getting to know the concepts of margin and padding
Eighth session	Getting to know the basics of educational websites

Results and Findings

To analyze the data collected in this study, descriptive statistics such as mean and standard deviation, as well as inferential statistics like Multivariate Analysis of Covariance, were employed. All analyses were conducted using SPSS 23. Table 2 displays the descriptive statistics, including the mean and standard deviation, for both the experimental and control groups.

Table 2 shows that the mean scores in the experimental and control groups in the pre-test of self-directed learning skills in general and in its subscales including self-control, learning enjoyment, and self-management are almost similar to each other, while the means of the two groups after the implementation of the training course are different. To analyze the data, Multivariate Analysis of Covariance was used. At first the assumptions such as the normal distribution of the data, and the homogeneity of the variances were examined. The results are presented in Tables 3 and 4. As can be seen in Table 3, considering that the significance level of the numbers is greater than 0.05, it can be said that the data is normally distributed.

Table 3: Test of normality for self-directed learning skill and its subscales.

Pre and post-test	F	N	Sig.
SDL	2.98	32	0.09
Self-management	3.66	32	0.07
Desire for learning	0.494	32	0.486
Self-control	0.266	32	0.609

Table 2: Descriptive statistics of self-directed learning readiness scores and its sub-components by group

Variable	Test	Group	N	Mean	SD
Self-directed learning	Pre-test	Experimental	16	124.4	6.20
		Control	16	128	6.58
	Post-test	Experimental	16	136.4	4.89
		Control	16	123.4	6.63
Self-management	Pre-test	Experimental	16	45.63	3.99
		Control	16	49.59	3.92
	Post-test	Experimental	16	51.22	2.94
		Control	16	46.40	5.23
Desire for learning	Pre-test	Experimental	16	40.90	3.96
		Control	16	39.45	4.17
	Post-test	Experimental	16	42.18	3.23
		Control	16	39.50	3.63
Self-control	Pre-test	Experimental	16	37.86	3.22
		Control	16	38.95	3.98
	Post-test	Experimental	16	42.77	3.18
		Control	16	38.36	3.25

Table 4: Levine's test related to the homogeneity of variances in self-directed learning skills and its subscales

Pre and post-tests	Statistics	N	Sig.
Pre-test of SDL	0.970	32	0.294
Post-test of SDL	0.964	32	0.189
Pre-test of self-management	0.952	32	0.064
Post-test of self-management	0.959	32	0.115
Pre-test of desire for learning	0.974	32	0.423
Post-test of desire for learning	0.954	32	0.076
Pre-test of self-control	0.966	32	0.214
Post-test of self-control	0.961	32	0.142

Based on Table 4, it can be seen that all p values are greater than 0.05. Therefore, it can be said that the variance of the two groups is similar in all variables. Considering the confirmation of the assumptions related to the Multivariate Analysis of Covariance, this test can be used in data analysis. Below are the results:

Table 6 shows that after controlling the effect of the pre-tests, the group effect had a significant effect on the dependent variables, in other words, in the self-directed learning skill and its subscales, including self-management, learning enjoyment, and self-control, the difference between the experimental and control groups is significant ($p > 0.05$).

Discussion

Developing independent learners who do not always rely on their teachers is a crucial aim of education. Self-directed learners are active, spontaneous, and take the initiative to learn. They do not wait passively for learning opportunities to come their way. Their learning

is purposeful, meaningful, and driven by high motivation, making it stable and continuous. They are responsible individuals who practice self-discipline in their learning. The results of this study demonstrate a positive and significant effect of peer assessment on the self-directed learning skills of students.

Peer assessment is an interactive assessment method of the learners that can promote self-directed learning. When used appropriately, peer assessment can be a useful tool for improving students' self-efficacy, self-management, independence in learning, and even yield positive learning outcomes. The components of self-directed learning, such as independence in learning and the desire to manage learning autonomously, align with the use of peer assessment. Breed [38] suggested that the structure of group work activities significantly impacts various aspects of self-directed learning, such as assessment, monitoring of learning, interpersonal skills, and preparation for self-directed learning. Therefore, peer assessment can be an effective tool to promote self-directed learning.

Table 5: Multivariate tests of dependent variables

Pre and post-test	Value	Hypothesis df	Error df	Sig
Pillai's Trace	0.689	3	25	0.001
Wills' Lambda	0.311	3	25	0.001
Hotellings' Trace	2.210	3	25	0.001
Roy's Largest Root	2.210	3	25	0.001

Table 6: Results of Multivariate Analysis of Covariance to examine dependent variables

Source	Value	Type III Sum of Squares	df	Mean Square	F	Sig
Group	Post-test of SDL	1239.648	1	1239.648	33.45	0.001
	Post-test of self-management	114.059	1	114.059	5.97	0.02
	Post-test of desire for learning	76.43	1	76.43	5.12	0.03
	Post-test of self-control	294.20	1	294.20	35.16	0.001

The results of this study are consistent with Villarreal's [23] research, which indicates that peer assessment has a positive impact on students' autonomy, motivation, self-regulation, and metacognition. Additionally, the study by Egan and Costello [34] on the effects of peer assessment on communication and self-reflection skills, as well as Najafipour's [32] research on the benefits of peer assessment for independent learning, teamwork, and communication skills, are in agreement with these findings. The outcomes of this study align with Spiller's [33], and Jones and Alcock's research, indicating that peer assessment has a favorable impact on self-directed learning skills, leading to independent and profound learning. Furthermore, the study results of Kalbasi et al. [26] and Taheri and Abdullahi-Gulan [31] support this notion, indicating that peer assessment contributes to learning and knowledge enhancement. In addition, Hongli and Xiong [28], and Vejdani and Saeedi [27] highlight the importance of providing training for evaluators before conducting peer assessment, as this can be beneficial in the successful implementation of such projects. Their research results also emphasize the impact of peer assessment on independent learning. Peer assessment has emerged as a powerful tool in promoting the development of self-directed learning skills among students. Through the process of evaluating and providing feedback to their peers, students not only enhance their understanding of the subject matter but also cultivate critical thinking, self-reflection, and

self-regulation abilities. The act of assessing their peers' work requires students to assume a more active role in their learning journey, as they must analyze, evaluate, and provide constructive feedback based on established criteria. This engagement fosters a sense of ownership and responsibility for their learning, empowering them to take charge of their educational experiences. Moreover, peer assessment offers students the opportunity to refine their metacognitive skills, as they reflect on their work in light of the feedback received from their peers. This process enhances their ability to set goals, monitor progress, and adapt their learning strategies accordingly. As students become more self-directed in their learning, they develop a sense of autonomy and agency, enabling them to navigate complex challenges and pursue learning beyond the confines of the classroom.

Conclusions

This study aimed to examine how peer assessment affects students' self-directed learning. The results suggest that peer assessment has a noteworthy effect on the self-directed skills of students. In conclusion, peer assessment plays a pivotal role in fostering self-directed learning skills among students. By engaging in the evaluation of their peers' work, students develop critical thinking, collaboration, and metacognitive abilities, empowering them to take ownership of their learning journey. As educators continue to integrate peer assessment into their

pedagogical practices, they provide students with a valuable tool to cultivate lifelong learning skills and thrive in an ever-changing world.

It is important to acknowledge the limitations of research studies, particularly in the context of peer assessment and self-directed learning. Several limitations can be identified, with one significant limitation being the lack of generalizability of the results. This study was conducted in the Department of Educational Sciences at Arak University in Iran, with a limited sample size. Consequently, the findings may not be applicable to a broader population or diverse contexts. The characteristics and demographics of the participants, as well as the specific instructional methods employed, can vary widely, making it challenging to generalize the results to other educational settings or student populations.

Additionally, research in this area often relies on self-report measures or subjective assessments, which can introduce biases and limitations. Students' perceptions of their self-directed learning skills or the effectiveness of peer assessment may not always align with their actual behaviors or outcomes. Objective measures, such as standardized tests or independent evaluations, could provide a more comprehensive and reliable assessment of the impact of peer assessment on self-directed learning skills. Furthermore, longitudinal studies that track students' progress over an extended period are relatively scarce in the field of peer assessment and self-directed learning. The long-term effects of peer assessment on self-directed learning skills, including its sustainability and transferability to real-life situations, remain relatively unexplored. Longitudinal research designs would provide valuable insights into the durability and practical implications of incorporating peer assessment into educational practices.

Authors' Contribution

In this study, the first author prepared the research design and wrote the manuscript. The second author was responsible for collecting data, and the third author was involved in the implementation and analysis of data.

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Conflicts of Interest

The authors declare that they have no conflict of interest.

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