The Effectiveness of Computer-Based Dynamic Scaffolding on Academic Performance and Motivation

Dr. Babak Rostami[1]*, Mohammad Ali Keshvari[2], Sepideh Safarpoor dehkordi[3]

Abstract

Introduction: The aim of the present study was to investigate The Effectiveness of Computer-Based Dynamic Scaffolding on Academic Performance and Motivation for Academic Achievement of Sixth Grade Male Students in District 3 of Shiraz City.

research methodology: This research is applied in terms of its purpose and causal-comparative in terms of its data collection method. The statistical population of the research includes sixth-grade male students of primary schools in District 3 of Shiraz city, which according to the report of Education and Training of District 3 of Shiraz city, the number of male students is 72. The sampling method was cluster random. Using the Morgan-Krejci sample size table, 60 people were selected as a statistical sample. Two questionnaires were used to collect information: the Helmrich and Spence (1977) Academic Achievement Motivation Questionnaire and the Dupal et al. (1991). Cronbach's alpha coefficient and content and face validity were used to measure reliability. Data analysis was performed using descriptive and inferential statistics, which used frequency, mean, and standard deviation at the descriptive statistics level, and the analysis of covariance test at the inferential statistics level.

Findings: Duolingo application training has a significant effect on students' motivation and attitude towards learning and anxiety about English. Duolingo application training has a significant effect on students' motivation and attitude towards learning English. Duolingo application training has a significant effect on students' English anxiety. (p<0.01).

Conclusion: Computer-based dynamic scaffolding training is considered to be an important and vital factor in motivating students to achieve academic success and academic performance, and based on such an approach, the cornerstone of this research was laid.

Key Words: Computer-based dynamic scaffolding, academic performance, academic achievement motivation, students.

1- Assistant Professor, Department of Educational Technology, Shiraz Branch, Islamic Azad University, Shiraz, Iran . (corresponding author) - Email:barostami23@yahoo.com

2- Master's student, Department of Educational Technology, Shiraz Branch, Islamic Azad University, Shiraz, Iran

3-Department of Educational Management, Shi.c., lslamic Azad University, Shiraz, Iran

Introduction

Scaffolding refers to the support or guidance provided by a mechanism so that learners do not think that it is too difficult to complete a task effectively. Scaffolding is considered an essential component of effective teaching because it has unique features that make it superior to other forms of instructional support (Chen & Tseng, 2021). Scaffolding strategies are widely used, including tools to support learners (Bland, 2014; Wang & et.al, 2023). Computer-based support tools that can provide scaffolding are known as computer-based scaffolding (Wu & et.al, 2017). Dynamic scaffolding can provide scaffolding for a specific learner according to his or her needs to complete a specific learning task. Dynamic computer-based scaffolding is tailored to the individual progress of learners. In dynamic computer-based scaffolding, learner behavior is analyzed and then appropriate scaffolding is selected. Therefore, computer-based dynamic scaffolding refers to the personalization of computer-based scaffolding. Computer-based dynamic personalization is inextricably linked to computer-based dynamic assessment (Rashidi et al, 2023). Among the antecedents of computer-based dynamic scaffolding is academic performance, which is discussed in this study. Academic performance is all the activities and efforts that an individual shows in order to acquire science and knowledge and pass various grades and levels of education in educational centers (Hosseini and Mohammadzadeh, 2020). In other words, academic performance is a measure of student abilities that reflects the student's learning during the formation process. It also assumes the student's ability to respond to educational stimuli. In this sense, academic performance is related to competence (Gougis, 2020). In other words, academic performance can be considered the basis of learning, and the higher the student's level of learning, the higher his performance index will be (Salehi and Jafari, 2022). Among other antecedents of dynamic computer scaffolding, we can mention the motivation for academic progress, which is discussed in this study. Since an important condition for the growth and prosperity of any society is the existence of knowledgeable, efficient, and creative individuals, cultivating and strengthening the motivation for progress creates energy and appropriate direction of behavior, interests, and needs of individuals towards valuable and specific goals (Bagheri HossinAbadi, 2020). Academic motivation is another variable related to students that has many effects on the learning process of students and the better implementation of teacher training programs (Bagheri Hosseinabadi and Yousefi, 2023).

In connection with this research, several studies have been conducted. Here are a few briefly mentioned: (Asadi Maharloi and Safarpour Dehkordi, 2025), conducted a study titled The Effectiveness of Computer-Based Dynamic Scaffolding on Academic Procrastination and Spiritual Intelligence of Fifth Grade Primary School Female Students in District 3 of Shiraz City. The results showed that computer-based dynamic scaffolding is significantly effective in existential thinking, creating personal meaning, and expanding consciousness of fifth grade primary school female students. Computer-based dynamic scaffolding significantly increased preparation for exams, preparation for

homework, and the desire to change the habit of procrastination of fifth grade primary school female students. Pi Khojasteh (Pi Khojasteh, 2024), conducted a study titled This study aimed to investigate the effect of computer-based dynamic scaffolding training on academic achievement and academic performance of fifth grade primary school students in District 1 of Shiraz City. The results showed that computer-based dynamic scaffolding has a significant effect on students' academic achievement and academic performance. There is a significant difference between the dimensions of planning and self-efficacy of the two groups in the post-test phase. Computer-based dynamic scaffolding training has a significant effect on the dimensions of academic production and academic success of students. Ta'at Nejad and Rahnama (2023) conducted a study titled The Relationship between Scaffolding and Constructivism and Their Role in the Teaching and Learning Process. The results showed that the efficiency and effectiveness of teaching work will increase. Facilitation of learning is quite evident in both. The support-building strategy has its roots in the theories of social constructivists such as Vygotsky. Both are in contrast to traditional methods. Scaffolding helps to grow learners' knowledge recognition. The advantages of this method include the learner's activeness, self-evaluation, and interaction with peers. Also, in line with these cases, it can be noted that it increases students' interest and self-confidence. (Awodun, 2024), conducted a study titled The Effect of Scaffolding Teaching Strategy on the Academic Performance of Secondary School Physics Students Inkit Status for Creativity and Economic Development. The results of the analyses showed that there was a significant difference between the academic performance of physics students in the experimental and control groups in favor of the experimental group. Based on the findings of the study, it was concluded that the scaffolding teaching strategy is more powerful than the conventional method common in the country in enhancing students' performance in physics lessons in secondary schools. (Li & et.al, 2024), conducted a study titled Investigating the Effect of Teacher Scaffolding in the Knowledge-Building Environment: Insights from Students' Interaction Patterns, Social Epistemological Networks, and Academic Performance. The findings indicate that teacher scaffolding can effectively enhance students' reflective behaviors, enhance social and epistemological participation, and improve academic performance in technology-supported knowledge-building environments. This study provides valuable insights into the design and implementation of teacher scaffolding to facilitate student processes and outcomes. (Odoh & Elom, 2024), conducted a study titled The Effect of Scaffolding Instructional Method on Academic Achievement of Junior Secondary School Students in Social Studies in Abakaliki Educational Service Area of Ebonyi State. The findings of the study, among others, showed that the use of scaffolding instructional method/strategy in teaching social studies increased students' academic achievement scores more than the use of conventional methods which favored boys. Gender also had a significant effect on the academic achievement of students taught with scaffolding instructional strategy which also favored boys. (Shin & et.al, 2020), conducted a study titled Examining the Framework of Rigid, Peer and Teacher Scaffolding in Advanced

Technology-Based Learning Environments: Impact on Academic Achievement and Group Performance. The statistical results show that students' perceived usefulness of hard scaffolding, followed by peer scaffolding, is the most important variable for predicting individual academic achievement. However, only perceived usefulness of peer scaffolding was a significant predictor of group performance. Among the factors that contribute to low achievement of sixth grade male students is the poor instructional approach to teaching by teachers. The teaching strategy adopted by teachers can either enhance or hinder students' academic achievement in any subject. Exposing learners to understanding basic concepts and achieving desired outcomes requires the use of creative, innovative, and interactive instructional approaches such as educational scaffolding, which may stimulate learner interest and make difficult concepts ambiguous. Educational scaffolding is an instructional strategy that emphasizes teaching new skills by involving students in tasks that are difficult for them to do alone. It is one of the participatory instructional strategies for teaching and learning. In scaffolding, less support or guidance is provided as students' competence increases. This is an educational strategy designed to support learning as students become familiar with a new topic. Scaffolding is a form of coaching and supporting students who are learning new skills or learning new concepts. In addition, presenting ideas to learners without fully engaging them in the learning process has the opposite effect on students' academic progress and performance. Given that the primary school period is very sensitive and effective and efficient teaching and learning plays a vital role in the education system and students' academic success, it is necessary to pay attention to new and effective teaching methods. In addition, educational weaknesses in teaching and learning of students, academic decline, and decreased motivation for academic progress and performance of students cause teachers and experts in the education system to search for effective and proven educational strategies in the field of teaching teachers in the classroom that can encourage motivation for progress and learning in students and ultimately lead to desirable academic performance and academic success. Considering the above, the main question of the research is whether computer-based dynamic scaffolding has a significant effect on academic performance and motivation for academic progress of male students.

The research hypothesis is: 1. Computer-based dynamic scaffolding has a significant effect on the academic performance and motivation of sixth-grade male students.

Research question

Does computer-based dynamic scaffolding have a significant effect on academic performance and motivation for academic achievement of male students?

Methodology

This research is applied research in terms of its purpose and causal-comparative in terms of its data collection method. The statistical population of the research includes sixth-grade male students of primary schools in District 3 of Shiraz city. According to the report of Education and Training of District 3 of Shiraz

city, the number of male students is 1000. Using the Morgan-Krejci sample size table, 60 people were selected as a statistical sample. The sampling method was cluster random. The measurement tool in this research is a questionnaire. Educational Achievement Motivation Questionnaire: This questionnaire was developed by Helmrich and Spence (1977) and has 23 questions in 4 components: work bias, mastery, competitiveness, and personal disinterest.

In Darabi's (1999) study, the validity of the scale was confirmed by factor analysis and the correlation of all items with the total score was significant. The correlation of the total scores with the grade point average was also reported to be significant. In the Berger report, the validity and reliability of the test were reported to be satisfactory. Sharifi and Darabi translated it into Persian for the first time and the validity, reliability and norm indices of the test were re-examined. (Darabi and Sharifi, 1999) In this study, the reliability coefficient of the test with the three-week time interval test method was 0.81, with the split-half method it was 0.83, and Cronbach's alpha was reported as follows: Cronbach's alpha for the achievement motivation questionnaire is 0.75.

Academic Performance Questionnaire: This questionnaire was developed by Dupal et al. (1991) with 16 questions and 3 components: academic production, academic success, and impulse control. It measures academic performance based on a Likert scale with questions such as (to what extent do students follow teacher instructions or class discussions accurately when teaching the whole class). In Mogharnezhad's (2019) study, the content, face, and criterion validity of this questionnaire were assessed as appropriate. The Cronbach's alpha coefficient calculated in Mogharnezhad's (2019) study for this questionnaire was estimated to be above 0.7.

Research Findings

After collecting the raw data from the questionnaires, they were analyzed at two descriptive and inferential levels using SPSS software. At the descriptive level, descriptive indices of the variables such as mean and standard deviation were calculated, and then at the inferential stage, the research hypotheses were examined using the analysis of covariance test. Table 5 shows the descriptive statistics of the variable of motivation for academic achievement, broken down by mean and standard deviation.

Table 1. Mean and standard deviation of participants' motivation for academic achievement

Experimental group		Statistics	Variable
Post-test	Pre-test		
3/56	3/24	Average	Motivation academic achievement
0/560	0/400	Standard Deviation	
2/77	1/84	Average	Academic performance
0/577	0/346	Standard Deviation	

Table 1 shows the descriptive statistics of the variables of motivation for academic achievement and academic performance, broken down by mean and standard deviation.

Table 2. Results of Kolmogorov-Smirnov test related to academic achievement motivation and academic performance

Significance level	Value of z-statistics	Frequency	Variable
0/200	0/062	60	Motivation academic achievement
0/200	0/074	60	Academic performance

Since the significance level obtained for academic achievement motivation and academic performance is greater than 0.05, we can consider the distribution of scores to be normal; therefore, a parametric multiple analysis of covariance test was used to examine the hypotheses.

Research hypothesis: Computer-based dynamic scaffolding has a significant effect on the academic performance and motivation of sixth grade male students.

To examine this hypothesis, a multivariate analysis of covariance test was used, the results of which are presented below.

Table 3. Multivariate analysis of covariance test to examine the main research hypothesis

Significance level	Degrees of freedom Error	Degrees of freedom	F	Value	Test	Effect
0/001	58	1	50/498	0/661	Pillai	
0/001	58	1	50/498	0/339	Wilks's Lambda	
0/001	58	1	50/498	1/947	Hotelling	Group
0/001	58	1	50/498	1/947	Roy's Largest Root	

As can be seen in the table above, the significance level of the multivariate analysis of variance test ($p \geq 0.001$) is smaller than the significance level ($\alpha = 0.05$). Therefore, there is a significant difference between academic performance and academic achievement motivation.

Discussion and conclusion

The first hypothesis of the research states that computer-based dynamic scaffolding training has a significant effect on academic achievement and academic performance. The research hypothesis was confirmed. In terms of the effect of computer-based dynamic scaffolding training on academic achievement motivation and academic performance, it is consistent with the studies of Khojasteh and Safarpour Dehkordi (2014). This result can be explained as follows: when a learner has a specific limitation that prevents learning through conventional methods, the teacher or educational system can (and should) find ways to compensate for it by providing alternative methods to facilitate learning. One of the strategies introduced in order to develop learning motivation and academic achievement and academic performance is computer-based dynamic scaffolding in students. Given the lack of familiarity of students with these educational strategies, it is necessary for teachers to comply with educational standards in this field that lead to desirable and lifelong learning and enthusiasm of students. Scaffolding is an instructional method in which the teacher gradually removes guidance and support as students learn and become more competent. Support can be for content,

processes, and learning strategies. This requires careful planning, an initial assessment of students' prior knowledge, and monitoring of growth to determine which supports are needed and which can be removed. As students grow, they begin to face more difficult challenges that require new supports that eventually fade away. The goals of scaffolding are to increase students' proficiency and develop their skills as self-regulated learners. This is achieved by providing the appropriate amount of instructional support based on the students' needs and the complexity of the context. Scaffolding can change, decrease, or be removed over time as students grow as learners. Considering the results of the hypothesis that computer-based dynamic scaffolding training has a significant impact on academic achievement and performance, it is suggested that a workshop be held on the topic of computer-based dynamic scaffolding and its educational and training consequences in the educational process.

Conclusion

By comparing the results of the present study with previous studies, it can be concluded that the results of this study are consistent with most previous studies; because in all the studies mentioned, computer-based dynamic scaffolding training has an effect on academic achievement and academic performance, which is also true in the present study. In the case of this study, it is important to point out that computer-based dynamic scaffolding training is considered an important and vital issue for students' motivation for academic achievement and academic performance, and the cornerstone of this study was laid based on such an approach.

Following the principles of research ethics

In this study, an attempt was made to ensure that the subjects answered their questions without stress and with a sense of responsibility. They were told not to write their first and last names. They were also assured that their answers would remain confidential.

Financial sponsor

The costs of this study were covered by the authors of the article.

Conflicts of interest

According to the authors, this article is free of any conflict of interest.

References

1. Awodun, A. O. (2024). Effects of scaffolding teaching strategy on students' academic performance in secondary school physics inekiti state for creativity and economic development. IPHO-Journal of Advance Research in Education & Literature, 2(02), 08-20.

2. Bagheri Hossein Abadi, F., & Abedi, M. R. (2020). Construction and validation of academic welfare questionnaire. Islamic Humanities, 25, 10-39. [Persian].

3. Bagheri Hosseinabadi, Fatemeh and Yousefi, Naser. (2023). The effectiveness of a combined intervention based on motivational interviewing and metacognitive skills on academic procrastination, academic resilience and academic achievement motivation in students with a history of truancy, Psychological Achievements, 30 (2): 302- 281.

4. Bagheri Hosseinabadi, Fatemeh and Yousefi, Naser. (2023). The effectiveness of a combined intervention based on motivational interviewing and metacognitive skills on academic procrastination, academic resilience and academic achievement motivation in students with a history of truancy, Psychological Achievements, 30 (2): 281-302.

5. Chen, S. Y., & Tseng, Y. F. (2021). The impacts of scaffolding e-assessment English learning: A cognitive style perspective. *Computer Assisted Language Learning*, *34*(8), 1105-1127.

6. Gougis, R. A. (2020). The effects of prejudice and stress on the academic performance of Black-Americans. In *The school achievement of minority children* (pp. 145-158). Routledge.

7. Hosseini, S. and Mohammadzadeh, J. (2019). Study of factors affecting academic progress and performance of high school students, Second Congress of New Findings in the Field of Family Mental Health, Disorders Prevention and Education, Tehran.

8. Li, J., Wang, C., & King, R. B. (2024). Which comes first? Modeling longitudinal associations among self-efficacy, motivation, and academic achievement. System, 121, 103268.

9. Obafemi, K. E., Saadu, U. T., Yahaya, O., Obafemi, T. O., & Yakubu, F. M. (2023). Exploration of the effect of scaffolding instructional strategy on pupils' academic performance in mathematics. *ASEAN Journal for Science Education*, *2*(2), 121-128.

10. Odoh, S. O., & Elom, P. (2024). Effects of Scaffolding Instructional Method on The Academic Achievement of Junior Secondary School Students in Social Studies Education in Abakaliki Education Zone of Ebonyi State. *Ebonyi State College of Education, Ikwo Journal of Educational Research*, *10*(1), 1-77.

11. P. Khojasteh, Zohreh. (2024). The effectiveness of computer-based dynamic scaffolding on academic achievement and performance of fifth grade elementary school students in Shiraz, Master's thesis, Islamic Azad University, Shiraz Branch.

12. Rashidi, Zeinab; Nili, Mohammad Reza; Zarei, Esmaeil and Delavar, Ali. (2022). Design and validation of a computer-based dynamic scaffolding model

in virtual in-service training of teachers, Human Resources Education and Development, 9 (34): 136 – 101.

13. Salehi Seresht, Fatemeh and Jafari Harandi, Reza. (2022). Predicting academic performance based on social skills and social acceptance components, Quarterly Journal of School and Educational Psychology, 11 (3).

14. Shin, Y., Kim, D., & Song, D. (2020). Types and timing of scaffolding to promote meaningful peer interaction and increase learning performance in computer-supported collaborative learning environments. *Journal of Educational Computing Research*, *58*(3), 640-661.

15. Ta'at Nejad, Kiarash and Rahnama, Farid. (2023). The relationship between scaffolding and constructivism and their role in the teaching and learning process, 8th National Conference on Modern Research in Educational Sciences and Psychology in Iran.

16. Wang, H. S., Chen, S., & Yen, M. H. (2021). Effects of metacognitive scaffolding on students' performance and confidence judgments in simulation-based inquiry. *Physical Review Physics Education Research*, *17*(2), 020108.

17. Wang, T., Zheng, J., Tan, C., & Lajoie, S. P. (2023). Computer-based scaffoldings influence students' metacognitive monitoring and problem-solving efficiency in an intelligent tutoring system. *Journal of Computer Assisted Learning*.

18. Wu, C. H., Chen, Y. S., & Chen, T. G. (2017). An adaptive e-learning system for enhancing learning performance: Based on dynamic scaffolding theory. *EURASIA journal of mathematics, science and technology education*, *14*(3), 903-913.