The effectiveness of computer-based dynamic scaffolding on academic procrastination and spiritual intelligence

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Abstract

Introduction: The aim of the present study was to investigate the effectiveness of computer-based dynamic scaffolding on academic procrastination and spiritual intelligence of female students in the fifth grade of primary school in District 3 of Shiraz.
research methodology: The present study design was a semi-experimental pre-test-post-test design with a control group. The statistical population included all female students in the fifth grade of primary school in the academic year 1403-1404, from which a sample of 30 people was selected using multi-stage cluster random sampling method and according to the inclusion criteria for the study, and then they were randomly assigned to two groups of experimental and control people. Initially, all subjects in the two experimental and control groups completed the Academic Procrastination and Spiritual Intelligence Questionnaire as a pre-test.
Findings: The results showed that Duolingo application training was significantly effective on students' motivation and attitude towards learning and anxiety in English. Also, Duolingo application training has been significantly effective on preparing for exams, preparing for homework, and the desire to change the procrastination habit of fifth grade female elementary school students. Computer-based dynamic scaffolding is significantly effective on existential thinking, creating personal meaning, and expanding consciousness of fifth grade female elementary school students. ($p<0.01$).
Conclusion: Finally, according to the findings of the present study, it can be concluded that computer-based dynamic scaffolding is effective in increasing existential thinking, creating personal meaning, expanding consciousness, and preparing for exams, preparing for homework, and the desire to change the procrastination habit of students.

Key Words: Computer-based dynamic scaffolding, academic procrastination, spiritual intelligence, students.

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Introduction

Academic life is one of the most important aspects of life and important functions of individuals, which has a great impact on other aspects of life. One of the fundamental issues and problems of the academic life of individuals and the educational system of each country is the issue of the low level of academic performance of students in that country. Since the learning of learners is mainly measured by their academic performance, identifying the variable of academic procrastination is one of the important tasks of educational psychologists, so that controlling academic procrastination of students is necessary to improve their academic progress and motivation to learn (Saba and Imanparvar, 2010). Academic procrastination is a serious and common problem in students, and given the relationship it has with academic performance, academic failure, students' commitment to school, participation in academic affairs, and enthusiasm and enthusiasm for continuing their education, it is one of the important areas of research in the educational system (Garavand, Sabzian, and Pakmehr, 2024). This variable can be the result of low self-esteem, fear of success, and feelings of inferiority, and can generally be said to create academic burnout in the individual (Granschel et al., 2016). Procrastination is a negative and uncomfortable behavior that has unpleasant consequences and can never be defended by delaying the completion of tasks, believing that they can be done better. This variable is also described as a lack of self-regulation and a tendency to delay what is necessary to achieve a goal (Podineh-Ebrahimi et al., 1401). In addition to academic procrastination, one of the factors affecting academic success is spiritual intelligence, which is referred to in this study.

In education, spiritual intelligence unites resilience and emotional resilience and plays an important role in helping students/teachers understand their world and construct goals and values (Raya, 2022). Simply put, spiritual intelligence is related to an individual's ability to behave and act wisely and empathetically, while maintaining internal and external harmony regardless of the surrounding environment (Anwar, Ghani, & Rahman, 2020). According to Zohar (2010), this type of intelligence can enhance an individual's motivations for exploration, creativity, collaboration, self-mastery, situational mastery, and service provision. In the educational arena, spiritual intelligence is related to the dynamic interaction of the inner life of the mind, soul, and spirit of students or teachers and their connection to educational experiences and events (Arnot, 2020). One of the suggested strategies to reduce academic procrastination and improve and develop spiritual intelligence is computer-based dynamic scaffolding, which is addressed in this research.

The concept of scaffolding refers to the provision of additional support or scaffolding by a "master" teacher (e.g., a teacher, an expert, or a more capable peer) in a learning environment to aid students' cognitive development. The supports that teachers use to assist students in the learning process are called "scaffolding" (Sun et al., 2024). Scaffolding activities take various forms, depending on the needs of the students, such as models, clues, prompts, guidance, partial solutions, modeling out loud, and direct instruction. These

scaffolds help the learner to ultimately solve a problem, complete a task, master a concept, or achieve a goal. As students become able to act independently, the scaffolding/supports will be gradually removed (Faber et al., 2023). Various domestic and foreign studies have been conducted regarding the effect of computer-based dynamic scaffolding on academic procrastination and spiritual intelligence, which are briefly mentioned below:

Faghih Aliabadi et al. (2024) conducted a study entitled: Presenting a scaffolding model to improve educational quality through the mediation of time management and self-directed learning of first-year secondary school students. The findings showed that "scaffolding" includes six components, "time management" includes six components, "self-directed learning" includes eight components, and "educational quality" includes nine components. The results showed that scaffolding, time management, and self-directed learning have a significant effect on educational quality. Moradi et al. (2024) conducted a study entitled: Investigating the effectiveness of cognitive scaffolding strategy on academic satisfaction and enthusiasm of fourth-grade male students with intellectual disabilities in experimental science lessons. The results of univariate covariance analysis showed that teaching cognitive scaffolding strategy was effective in improving academic satisfaction and enthusiasm of students with intellectual disabilities. P. Khojasteh and Safarpour Dehkordi (2024) conducted a study titled This study aimed to investigate the effect of computer-based dynamic scaffolding training on the academic achievement and academic performance of fifth grade elementary school students in District 1 of Shiraz. The results showed that computer-based dynamic scaffolding has a significant effect on the academic achievement and academic performance of students. 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 learners develop their knowledge. The advantages of this method include the learner's activity, self-evaluation, and interaction with peers. In line with these, it can also be noted that students' interest and self-confidence increase. Fathi (2022) conducted a study titled The Effectiveness of Teachers' Motivational Scaffolding Based on the Intervention Mapping Model on Students' Creative Self-Efficacy and Executive Functions. The results of covariance analysis showed that the effectiveness of teachers' motivational scaffolding based on the intervention mapping model was effective on creative self-efficacy. The results also showed that the effectiveness of teachers' motivational scaffolding based on the intervention mapping model was effective on the executive functions and

subscales of inhibition, attention shifting, emotional regulation, working memory, planning, control, initiation, and organization of students.

Odo and Ilom (2024) conducted a study titled The Effect of Scaffolding Method on the Academic Achievement of Junior Secondary School Students in Social Studies in Abakaliki Educational Zone, Ebonyi State. The findings of the study, among others, showed that the use of scaffolding method or strategy in teaching social studies increased the academic achievement scores of students 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 strategy, which also favored boys. Lin et al. (2024) conducted a study titled The Effect of Gradual Dismantling of Scaffolding on Learning Performance, Engagement in Learning and Self-Regulated Learning in Primary School mBot Courses. Data analysis showed that the use of scaffolding significantly improved learning performance and engagement. However, no significant effect was observed on self-regulated learning. Pan et al. (2023) conducted a study titled Unraveling Academic Engagement and Psychological Well-being of Chinese English Language Students: The Role of Language Teachers' Emotional Scaffolding. The results of the study showed that English language teachers' emotional scaffolding positively and significantly predicted students' academic engagement and psychological well-being. Specifically, it was found that teachers' emotional scaffolding explained about 73% and 65% of the variances in English language students' academic engagement and psychological well-being, respectively. In addition, it was found that psychological well-being and academic engagement were positively correlated and predicted 56% of each other's variances. According to these findings, educators are advised to establish a harmonious teacher-student relationship to enhance students' psycho-emotional development. Based on the above, the main research question is whether computer-based dynamic scaffolding is effective on academic procrastination and spiritual intelligence of fifth-grade female students in District 3 of Shiraz city.

Research question

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Methodology

This research is an Applied Research in terms of its purpose and a descriptive-quasi-experimental one with pre-test and post-test in terms of data collection method. The statistical population of the research includes female students in the fifth grade of elementary school in District 3 of Shiraz in the academic year 2024- 2025, of which 30 people were placed in two experimental and control groups. The sampling method was multi-stage cluster random sampling. Two questionnaires of spiritual intelligence and academic procrastination were used to collect information as follows.

Spiritual Intelligence Questionnaire: This questionnaire was designed by King, which includes 24 questions and 4 dimensions of existential-critical thinking (1, 3, 5, 9, 13, 17, 21), creating personal meaning (07, 11, 15, 19, 23), transcendental awareness and expanding the state of consciousness (2, 6, 10, 14, 18, 20, 22) with a five-choice Likert scoring method. Expert professors have confirmed the content validity of the questionnaire, and the reliability of the questionnaire in the study of Kazemi et al. (2022) was obtained as 0.85 using the Cronbach's alpha method. Standard Questionnaire for Academic Procrastination: The standard questionnaire of Solomon and Rothblum (1984) was used to measure the variable of academic procrastination. This questionnaire has 27 items that measure three components: preparing for exams (1 to 6), preparing for homework (9 to 17), and preparing for end-of-term papers (20 to 25). In addition to the 21 questions mentioned, 6 questions (7, 8, 18, 19, 26, 27) are considered to measure two characteristics: feeling uncomfortable about being procrastinating and the desire to change the habit of procrastination. Its response range is 5-point. In this scale, Cronbach's alpha coefficient was used to determine the internal validity of this scale, which was reported to be 0.64. Also, the face and content validity of the questionnaire was approved by the questionnaire author, supervisors, and specialists and experts in educational sciences and psychology. The reliability of the academic procrastination questionnaire using the test-retest method was reported to be 0.90.

Table (1): Cronbach's alpha value in the Academic Procrastination

Reliability	Component
0/80	**Preparing for exams**
0/78	**Preparing for assignments**
0/70	**Preparing for term papers**

Computer-based dynamic scaffolding: For this purpose, computer-based dynamic scaffolding software was used, which classified students into 4 categories based on knowledge, experience, and cognitive and metacognitive characteristics based on the content of the training course and designed the computer-based dynamic scaffolding software, and provided computer-based dynamic scaffolding to support them in answering questions based on a combination of their performance in answering questions to the current question and the classification of students. Descriptive and inferential statistical methods were used to analyze the data. In the descriptive statistics section, central tendency indicators (mean), dispersion indicators (standard deviation) were used, and in the inferential statistics section, analysis of covariance was used using SPSS 26 software.

Research Findings

The descriptive findings of the present study include the mean and standard deviation of the scores of the sample members for all variables studied in this study. The mean and standard deviation of the scores of the research variables

in the experimental group and the control group (control) in the pre-test and post-test stages are listed in Table 1.

Table 1. Descriptive findings of academic procrastination in the pre-test and post-test stages

Group				Statistics	Variable
Experimental group		Control group			
Post-test	Pre-test	Post-test	Pre-test		
4/47	3/70	4/08	3/36	Average	**Preparing for an exam**
0/460	0/345	0/581	0/495	Standard Deviation	
3/88	3/41	3/64	3/54	Average	**Preparing for homework**
0/435	0/245	0/537	0/511	Standard Deviation	
3/57	3/25	3/41	2/97	Average	**Preparing for term papers**
0/532	0/567	0/460	0/509	Standard Deviation	
3/58	3/006	3/29	3/05	Average	**Desiring to change the habit of procrastination**
0/431	0/243	0/575	0/322	Standard Deviation	

Table 2. Descriptive findings of spiritual intelligence in the pre-test and post-test stages

Group				Statistics	Variable
Experimental group		Control group			
Post-test	Pre-test	Post-test	Pre-test		
4/01	3/37	3/69	3/01	Average	**Existential thinking**
0/320	0/430	0/537	0/446	Standard Deviation	
3/49	3/50	3/50	3/20	Average	**Creating personal meaning**
0/440	0/380	0/457	0/421	Standard Deviation	
3/35	3/04	3/20	3/11	Average	**Transcendental consciousness**
0/359	0/502	0/536	0/409	Standard Deviation	
3/87	2/60	3/24	2/83	Average	**Expansion of consciousness**
0/456	0/245	0/890	0/382	Standard Deviation	

The results of the descriptive table (Tables 1 and 2) show that the average of the variables of preparing for exams, preparing for homework, preparing for end-of-term papers, and the desire to change the habit of procrastination, existential thinking, creating personal meaning, transcendental awareness, and expanding consciousness of female students in the experimental group increased in the post-test phase compared to the pre-test phase, and the significance of this change was further examined by multivariate analysis of

covariance. Before presenting the results of the multivariate analysis of covariance, the underlying assumptions of this analysis (the assumption of normality, homogeneity of regression slopes, and homogeneity of variances) were examined. Accordingly, the results of the Kolmogorov-Smirnov test indicated that the assumption of sample normality of the data in the variables of preparing for exams, preparing for homework, preparing for end-of-term papers, and the desire to change the habit of procrastination, existential thinking, creating personal meaning, transcendental awareness, and expanding consciousness of female students in the experimental and control groups was valid in the pre-test and post-test stages ($p<0.05$). The results of the test to examine the homogeneity of the regression slope of the pre-test and post-test of the total score of preparing for exams, preparing for homework, preparing for end-of-term papers, and the desire to change the habit of procrastination, existential thinking, creating personal meaning, transcendental awareness, and expanding consciousness of female students in the experimental and control groups showed that the regression slope was valid for the total score of the variables. Levine's test was used to examine the homogeneity of variances. Based on this test, the homogeneity of variances in the groups was established ($p<0.05$). By establishing the assumptions of the analysis of covariance, the use of this test is not prohibited. The results of the multivariate analysis of covariance for comparing the means are presented in Table 3.

Research hypothesis: Computer-based dynamic scaffolding has a significant effect on academic procrastination and spiritual intelligence of fifth-grade female students.

Table 3. Summary of results of multivariate analysis of covariance for comparing mean post-test scores of dependent variables of the experimental and control groups

Significance level	Degree of freedom of error	Degree of freedom	F	Value	Test	Effect
0/001	28	1	20/625	0/623	Pillai	**Group**
0/001	28	1	20/625	0/377	Wilks's Lambda	
0/001	28	1	20/625	1/650	Hotelling	
0/001	28	1	20/625	1/650	Roy's Largest Root	

As the results in Table 3 show, there is a significant difference between the experimental and control groups in terms of academic procrastination and spiritual intelligence of students in the post-test phase ($p < 0.005$). In order to investigate the point of this difference, a univariate analysis of covariance was performed in the Mancova text on the dimensions of academic procrastination and spiritual intelligence of students, the results of which are presented in Tables 4 and 5, respectively.

Table 4. Results of univariate analysis of covariance to examine the difference in post-test academic procrastination in the experimental and control groups.

P	F	MS	Df	SS	Source of indicators
0/001	27/921	3/467	1	3/467	**Preparing for an exam**
0/029	5/407	1/274	1	1/274	**Preparing for homework**
0/056	4/042	0/592	1	0/592	**Preparing for term papers**
0/014	7/065	1/930	1	1/930	**Discomfort and desire to change the habit of procrastination**

As the results in Table 4 show, there is a significant difference between the experimental group and the control group in terms of research variables, and computer-based dynamic scaffolding has had a significant effect on the research variables, in that this training has significantly increased preparation for exams, preparation for homework, and the tendency to change the habit of procrastination among fifth-grade female elementary school students.

Table 5. Results of univariate analysis of covariance to examine the difference in post-test spiritual intelligence in the experimental and control groups.

P	F	MS	Df	SS	Source of indicators
0/002	12/276	2/565	1	2/565	**Existential Thinking**
0/042	8/342	1/428	1	1/428	**Creating Personal Meaning**
0/140	2/327	0/565	1	0/565	**Transcendental Awareness**
0/001	25/557	10/041	1	10/041	**Expanding Consciousness**

As the results in Table 5 show, there is a significant difference between the experimental group and the control group in terms of research variables, and computer-based dynamic scaffolding has had a significant effect on the research variables, in that this training has significantly increased existential thinking, created personal meaning, and expanded consciousness in fifth-grade female elementary school students.

Discussion and conclusion

The present study aimed to investigate the effectiveness of computer-based dynamic scaffolding on academic procrastination and spiritual intelligence of fifth-grade female students in District 3 of Shiraz. As the results showed, computer-based dynamic scaffolding has a significant effect on academic procrastination and spiritual intelligence of fifth-grade female students. The results of this finding are consistent with the results of studies conducted by Odo and Ilom (2024), Lin et al. (2024), Pan et al. (2023), Faghih Aliabadi et al.

(1403), Moradi et al. (1403), Pi Khojasteh (1403), Ta'et Nejad and Rahnama (1402), Fathi (1401). In explaining the findings of the study, it should be said that for students, academic procrastination is postponing homework, studying, and assignments until the last minute. Procrastination is an issue that affects students all over the world. What makes procrastination so dangerous is that it can stem from a variety of sources. Some of the causes of academic procrastination include perfectionism, fear of failure, making the wrong choice, and feeling superior. The result is a loss of motivation to complete assignments if the student does not feel that they can complete them to their full standards. Another cause of procrastination is the poor time management that many students face, where they are expected to organize their schedules. It also introduces students to new distractions, such as co-curricular activities, which can be an additional challenge for time management. Finally, anxiety and fear of failure caused by attending school can debilitate students and prevent them from completing assignments. One of the strategies proposed to reduce academic procrastination in students and to motivate and improve students' academic performance is computer-based dynamic scaffolding. The importance of scaffolding is because it engages and activates students' minds, develops the power of reasoning and analysis, and deeply understands scientific topics, develops critical thinking, creates challenges and engages students' minds for the purpose of academic engagement, which leads to motivation and academic performance in students, prevents procrastination and laziness in performing school tasks, and on the contrary increases academic enthusiasm and enthusiasm, and interest in the lesson and the teacher.

In addition, the results showed that computer-based dynamic scaffolding has a significant effect on the dimensions of academic procrastination in fifth-grade female elementary school students, and this intervention program has improved and developed academic achievement, reduced procrastination and academic dishonesty, and created motivation in students. The results of this finding are consistent with the results of research conducted by Odo and Ilom (2024), Lin et al. (2024), Pan et al. (2023), Faghih Aliabadi et al. (1403), Moradi et al. (1403), Pi Khojasteh (1403), Ta'et Nejad and Rahnama (1402), Fathi (1401). In explaining this finding, it can be said that students often procrastinate because they do not know how a project is relevant or important to them, do not understand the material, or do not know how to start. When you break it down, procrastination combines motivation, self-confidence, and comprehension issues. Most of the time, procrastination has very little to do with laziness or lack of care. In many cases, there are deeper issues that lead students to develop a procrastination problem. Procrastinating can harm schoolwork, grades, and even a student's overall health. Students who procrastinate experience higher levels of frustration, guilt, stress, and anxiety, which in some cases can lead to serious problems like low self-esteem and depression. The effects of procrastination can have a greater impact on high school students. When students reach high school and begin to receive more homework and larger projects, students who procrastinate until the last minute tend to receive lower grades than their peers. This can create a cycle of poor grades and low self-

esteem that is difficult for students to overcome. This can lead to additional stress and frustration when grades begin to affect students' post-secondary opportunities. One strategy that can help students prepare for exams and prevent them from procrastinating on homework is computer-based dynamic scaffolding, which, by its nature, increases students' academic engagement, develops creativity and critical thinking, and enhances analytical and problem-solving skills. Classroom scaffolding is an instructional strategy that provides students with structured support as they learn new concepts and skills. This approach emphasizes the importance of ensuring that students do not fall behind in any subject area while helping them gradually gain independence in their learning. Scaffolding involves assessing students' existing knowledge, setting clear learning goals, and introducing new skills in manageable increments that allow students to build confidence and competence over time. Teachers play a critical role in this process by monitoring group dynamics, encouraging collaboration, and intervening as necessary without undermining students' problem-solving efforts. Recent studies have also examined the application of scaffolding in online learning environments and emphasize the need for adaptive strategies that accommodate diverse learning styles. Overall, scaffolding is a flexible and dynamic approach that aims to increase educational success across contexts and age groups.

In addition, according to the results obtained, computer-based dynamic scaffolding has a significant effect on the dimensions of spiritual intelligence in fifth-grade female elementary school students, and this training develops spiritual intelligence in these students. No research was found that was consistent with the results of the research hypothesis. Spiritual intelligence is the highest type of intelligence that enables an individual to understand more about the Creator within. It moves students from being illiterate to being aware, from being one-dimensional to being multidimensional, from being powerless to being empowered. Spiritual intelligence is the ability to access the higher self and, as a result, access higher knowledge within the individual. Developing existential thinking can help students in their personal, social, and academic growth and create personal meaning in students and provide a basis for expanding consciousness. The higher the student's spiritual intelligence, the higher his or her calling to make a positive impact and the higher his or her connection to his or her soul identity as an inner guide and compass that shows the unique way in which a difference can be made. One of the strategies that can develop spiritual intelligence in students is computer-based dynamic scaffolding, which is characterized by trial and error, academic engagement, and motivation in students, as well as lifelong and self-directed learning in students, which leads to academic progress.

Among the limitations of this research are the limitations of the educational level and gender, which makes it better to be cautious in generalizing its results to male students and other educational levels. For this reason, it is suggested that future research on the same topic be conducted on male students as well as students with different educational levels and cultures. Obviously, efforts to

overcome the aforementioned limitations will give the research more credibility. Regarding practical suggestions, given the significant effect of computer-based dynamic scaffolding on the research variables, this intervention can be used by educational and training counselors in the form of an educational program to increase spiritual intelligence and reduce students' academic procrastination. It is also suggested that the Education Organization should take action by holding training courses and workshops with the aim of increasing the awareness of academic counselors and school psychologists about the positive effects of this educational intervention on preparing for exams, preparing for homework, and the desire to change the habit of procrastination, as well as increasing existential thinking, creating personal meaning, and expanding students' consciousness, as well as the method of implementing training sessions and strategies for using this educational intervention. In conclusion, it should be said that the results of this research can be useful for students, teachers, families, students, and professors who are involved in learning.

Conclusion

Finally, according to the findings of the present study, it can be concluded that in order to increase existential thinking, create personal meaning, and expand consciousness and prepare for exams, prepare for homework, and desire to change students' procrastination habits, computer-based dynamic scaffolding is effective.

Following the principles of research ethics

Informed consent forms were completed by all subjects in the present study.

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Conflicts of interest

According to the authors, the present article does not have any conflict of interest.

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