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The Effectiveness of Choice Theory Education with a STEM-Based Approach on Students' Self-Efficacy and Creativity

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A B S T R A C T

Objective: This study aimed to evaluate the effectiveness of STEM-based choice theory education on enhancing self-efficacy and creativity among female high school students.

Methods and Materials: The research employed a quasi-experimental design with a pretest-posttest control group structure. A total of 30 female high school students from District 5 of Tehran were selected through convenience sampling and randomly assigned to experimental (n=15) and control (n=15) groups. The experimental group participated in a 10-session intervention involving STEM-based choice theory education, while the control group received no intervention. Self-efficacy and creativity were assessed using validated questionnaires before and after the intervention. Data were analyzed using multivariate covariance analysis (MANCOVA) to determine the intervention's impact.

Findings: The results indicated significant improvements in both self-efficacy and creativity in the experimental group compared to the control group. For self-efficacy, the intervention explained 89.7% of the variance ($F(1, 24) = 208.425$, $p < 0.001$, $\eta^2 = 0.897$), while for creativity, it accounted for 93.1% of the variance ($F(1, 24) = 324.466$, $p < 0.001$, $\eta^2 = 0.931$). These findings suggest that STEM-based choice theory education effectively fosters both self-belief and innovative thinking in students.

Conclusion: STEM-based choice theory education is a highly effective approach to enhancing self-efficacy and creativity among high school students. By addressing cognitive and emotional dimensions of learning, this intervention offers a robust framework for empowering students and preparing them for complex problem-solving and innovation. The results highlight the importance of integrating psychological theories and interdisciplinary education into school curricula to foster comprehensive student development.

Keywords: *STEM education, choice theory, self-efficacy, creativity, high school students, educational intervention*

1. Introduction

In the contemporary era, education systems are increasingly tasked with preparing students to navigate a complex, rapidly changing world that demands creativity, adaptability, and resilience. Traditional teaching methods, while foundational, often fall short in fostering these competencies, necessitating innovative approaches such as the integration of choice theory and STEM (Science, Technology, Engineering, and Mathematics) education. Choice theory, a framework developed by William Glasser, posits that individuals' behaviors are driven by intrinsic needs such as survival, love, power, freedom, and fun (Berliana, 2024; Mateo et al., 2014; Meadows, 2023). When combined with STEM-based approaches, which emphasize interdisciplinary problem-solving and hands-on learning, this educational paradigm has the potential to empower students by enhancing their self-efficacy and creativity.

Self-efficacy, or one's belief in their ability to execute tasks successfully, is a cornerstone of academic and personal development. Research consistently highlights the role of self-efficacy in improving learning outcomes, fostering resilience, and enabling students to tackle challenges effectively (Babaei Parsheh & Mosadeghi Nik, 2022). Anderson and Haney (2021) emphasize that self-efficacy is intertwined with creative metacognition and self-concept, forming a critical foundation for creative problem-solving and innovative thinking (Anderson & Haney, 2021). In this context, the integration of choice theory with STEM-based education emerges as a promising strategy for enhancing self-efficacy, as it aligns with students' intrinsic motivations and fosters a sense of autonomy and responsibility (Jin & Yuan, 2022).

Creativity, another essential 21st-century skill, is equally influenced by educational methodologies. Creative thinking not only drives innovation but also enriches students' engagement and learning experiences (Conradty & Bogner, 2020). The STEM framework, with its emphasis on experiential learning and interdisciplinary collaboration, has been shown to significantly enhance students' creative capacities (Mäkelä et al., 2022). For example, Berliana (2024) demonstrated that project-based STEM learning improves students' science literacy and fosters innovative thinking (Berliana, 2024). Similarly, Conlon et al. (2023) highlight the role of STEM education in shaping students' aspirations and equipping them with the skills necessary for diverse career pathways (Conlon et al., 2023).

The integration of choice theory within STEM education builds on these strengths by addressing both cognitive and emotional dimensions of learning. According to Akrami (2022), STEM-based approaches promote entrepreneurial thinking and problem-solving, while choice theory provides a framework for understanding and meeting students' psychological needs (Akrami, 2022). This combination not only supports academic success but also nurtures students' emotional well-being, making them more confident and motivated learners (Gargari, 2024).

Educational interventions rooted in choice theory and STEM are particularly effective in group settings, where collaborative problem-solving and peer interactions enhance learning outcomes (Coufal, 2022). Group-based reality therapy, a practical application of choice theory, has been shown to improve emotion regulation and academic self-efficacy (Ghoreishi & Behboodi, 2017). Moreover, integrating STEM elements into these interventions further enriches the learning environment by fostering creativity and critical thinking. For instance, Marushko (2023) highlighted the effectiveness of STEM tools in preparing future science teachers (Marushko, 2023), while Meadows (2023) emphasized asset-based planning in informal STEM events as a means of enhancing engagement and skill development (Meadows, 2023).

The current study builds on this body of research by investigating the effectiveness of choice theory education with a STEM-based approach in improving self-efficacy and creativity among high school students. Previous studies, such as those by Nowruzpoor et al. (2021) and Hadian et al. (2023), have demonstrated the impact of reality therapy on self-efficacy and responsibility, suggesting its potential for broader applications in educational settings (Nowruzpoor et al., 2021). Similarly, studies by Luo (2022) and Xu and Ouyang (2022) underline the transformative potential of STEM education in fostering innovative and adaptive learners (Luo, 2022; Xu & Ouyang, 2022).

Despite the wealth of research supporting the individual benefits of choice theory and STEM education, their combined application remains underexplored, particularly in the context of secondary education. This study aims to address this gap by examining how a structured intervention combining these approaches can enhance students' self-efficacy and creativity. Drawing on insights from existing literature, such as Shams et al. (2021) and Jiatong et al. (2021), the study hypothesizes that integrating STEM methodologies with choice theory will not only improve cognitive outcomes but also bolster students' emotional and

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social competencies (Jiatong et al., 2021; Shams et al., 2021).

Furthermore, this research is grounded in the understanding that educational practices must be both evidence-based and contextually relevant. As highlighted by Lee and Perret (2022), preparing educators to implement innovative methodologies is crucial for achieving meaningful outcomes (Lee & Perret, 2022). The intervention in this study incorporates best practices from previous research, including project-based learning, collaborative activities, and hands-on problem-solving (Berliana, 2024; Coufal, 2022). By aligning these practices with the principles of choice theory, the study seeks to create a holistic learning experience that addresses students' diverse needs and fosters sustainable development. This study aims to examine the effect of choice theory and STEM-based education on creativity and self-efficacy.

2. Methods and Materials

2.1. Study Design and Participants

This study utilized a quasi-experimental design incorporating a pretest-posttest structure with a control group. It was classified as applied research given its focus on practical implications and was conducted within the context of secondary education. The independent variable was the application of choice theory education with a STEM-based approach, while the dependent variables were self-efficacy and creativity.

The research population consisted of female high school students in District 5 of Tehran during the 2023–2024 academic year. A total of 30 students were selected through convenience sampling, meeting a set of predetermined inclusion criteria. These criteria included being between 16 and 18 years old, having no history of grade repetition, living with both parents, providing signed informed consent (both the student and their father), and not being under psychiatric treatment or therapy within the past three months. Exclusion criteria included absence from more than one session or lack of active participation in intervention sessions.

Permission for the study was secured from the District 5 Education Department in Tehran following approval of the research proposal by the Islamic Azad University of Zahedan. Pre-intervention questionnaires assessing transformative assets, self-efficacy, and creativity were administered to female high school students in the area. Thirty students with the lowest scores who met the inclusion criteria were selected and randomly assigned into experimental and control groups, each consisting of 15 participants. The experimental group underwent a 10-session intervention, with each session lasting 70 minutes, while the control group received no intervention and remained on a waitlist.

2.2. Measures

2.2.1. Self-Efficacy

The Self-Efficacy Questionnaire, developed by Sherer and colleagues in 1982, was employed to measure the students' perceived self-efficacy. This instrument includes 17 items rated on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree." The total score is calculated by summing the scores of all items, with a higher score indicating greater self-efficacy. The minimum possible score is 17, and the maximum is 85. The questionnaire's convergent validity has been confirmed through correlations with internal control and personal competence scales, while divergent validity was established against external control measures, both statistically significant at $p < 0.001$. The internal consistency reliability of this instrument was reported as 0.82 using Cronbach's alpha in its original study, while its adaptation to Persian was validated by Darvishnia and colleagues (2021), who reported a Cronbach's alpha of 0.81. In the present study, reliability was recalculated, yielding a Cronbach's alpha of 0.89, demonstrating its suitability for this research context (Parsakia et al., 2024; Sharifpour et al., 2021).

2.2.2. Creativity

The Creativity Questionnaire, designed by Abedi in 1993 and grounded in Torrance's (1979) theory of creativity, was used to assess creative thinking abilities among students. This questionnaire consists of 60 items, with each response scored on a three-point scale: zero, one, or two. The total score is derived by summing the scores across all items, with a potential range of 0 to 120. Higher scores indicate greater levels of creativity. The instrument evaluates four key dimensions of creativity: fluency, originality, flexibility, and elaboration. Its validity has been demonstrated through significant correlations with Torrance's creativity tests at $p < 0.001$, and its reliability, measured using Cronbach's alpha, has ranged from 0.80 to 0.90 across various studies. In Iran, Rostami et al. (2021) confirmed the instrument's face validity with expert approval and reported a Cronbach's alpha of 0.89. In the present study, the reliability analysis

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indicated a Cronbach's alpha of 0.92, affirming the tool's reliability for measuring creativity within this population (Mahzoonzadeh Bushehri, 2017).

2.3. Intervention

2.3.1. STEM-based Choice Theory Training

The intervention was delivered using a STEM-based framework to teach choice theory. This approach incorporated structured methods such as scientific inquiry, engineering design processes, problem-based learning, and project-based learning, ensuring applicability within a classroom setting. The sessions were conducted by the researcher at a school in District 5, focusing on hands-on, collaborative, and sequential activities to reinforce the STEM framework.

Session 1: The first session focused on building rapport among participants and establishing the ground rules and objectives for the intervention, emphasizing participation, regular attendance, and confidentiality. The students were introduced to the framework of motivational and emotional elements within reality therapy based on choice theory, setting the stage for understanding the intervention's theoretical underpinnings.

Session 2: In the second session, participants explored basic human needs and the principles of healthy social communication. The session highlighted effective and ineffective behaviors from the perspective of reality therapy, helping students recognize the impact of these behaviors on interpersonal relationships.

Session 3: This session introduced the concept of the behavior car and the overarching principles of human behavior. Students learned how their actions are driven by their internal motivations and external influences, fostering an understanding of how behavior aligns with choice theory principles.

Session 4: Students were familiarized with the mechanisms of internal control and its role in human relationships. The session focused on how recognizing and utilizing internal control can improve relational dynamics and empower personal decision-making.

Session 5: The fifth session addressed the seven destructive habits in relationships and provided alternative strategies for replacing these habits with seven effective connecting behaviors. This practical approach aimed to enhance interpersonal connections and improve relational outcomes.

Session 6: This session emphasized assertive behaviors, effective self-talk, and their alignment with choice theory. Students were also taught strategies for self-regulation, enabling them to manage their emotions and responses in challenging situations more effectively.

Session 7: Responsibility and responsible behavior were the central themes of this session. Through collaborative group activities, students developed a sense of accountability and cooperation, fostering a spirit of teamwork and mutual support.

Session 8: Students explored the concept of their quality world, focusing on realistic and unrealistic aspirations and prioritizing their desires. The session also emphasized the modifiability of the mental images within their quality world, encouraging flexibility and adaptability.

Session 9: The penultimate session examined the connections between desires, perceptions, and external realities. Students learned strategies for empathic action and forward-thinking in interpersonal and social decision-making, equipping them with tools for long-term relational success.

Session 10: The final session introduced various forms of self-evaluation and concluded with a comprehensive review of the intervention. Participants reflected on their learning and its practical applications, consolidating the skills and concepts acquired through the STEM-based choice theory education sessions.

2.4. Data Analysis

Data analysis involved both descriptive and inferential statistics using SPSS-23 software. Descriptive statistics included mean and standard deviation calculations, while inferential methods involved normality tests (Kolmogorov-Smirnov and Shapiro-Wilk), Levene's test for variance equality, M-Box test for covariance equality, regression analysis, chi-square tests for demographic comparisons, and multivariate covariance analysis (MANCOVA) for hypothesis testing. This robust analytical approach ensured the integrity of the results.

3. Findings and Results

The majority of participants in both the experimental and control groups were in the 10th grade, with 46.67% in the experimental group and 40% in the control group. Regarding age, the largest proportion of students in the experimental group were 16 years old (46.67%), while in the control group, 17-year-olds made up the largest percentage (40%).

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Statistical analysis revealed no significant differences between the two groups in terms of grade level or age ($p > 0.05$), indicating homogeneity in demographic variables across the groups.

Table 1

Mean and Standard Deviation of Variables Among Female High School Students by Groups

Variable/Group	Experimental (Pretest)	Experimental (Posttest)	Control (Pretest)	Control (Posttest)
Self-Efficacy	41.13 (5.68)	47.00 (5.62)	43.40 (4.58)	43.13 (4.37)
Creativity	43.67 (5.15)	50.07 (5.05)	42.07 (5.95)	41.67 (5.94)

The descriptive analysis revealed that the mean self-efficacy score in the experimental group increased from 41.133 (SD = 5.680) in the pretest to 47.000 (SD = 5.618) in the posttest. In contrast, the control group's mean self-efficacy score showed minimal change, moving from 43.400 (SD = 4.579) in the pretest to 43.133 (SD = 4.373) in the posttest. Similarly, the mean creativity score in the experimental group increased from 43.666 (SD = 5.150) in the pretest to 50.066 (SD = 5.049) in the posttest. Meanwhile, the control group's mean creativity score slightly decreased from 42.066 (SD = 5.945) in the pretest to 41.666 (SD = 5.936) in the posttest (**Error! Reference source not found.**). These results suggest a notable improvement in the experimental group across both variables following the intervention, while the control group showed negligible or negative changes.

The assumptions required for conducting inferential statistical analyses were evaluated and met in this study. Normality of the data distribution was verified using the Kolmogorov-Smirnov and Shapiro-Wilk tests, confirming that all variables followed a normal distribution. Homogeneity of variances across groups was assessed using Levene's test, while M-Box test ensured equality of covariance matrices, both yielding non-significant results ($p > 0.05$). The regression slope assumption was tested to confirm the linear relationship between covariates and dependent variables, which was satisfied. These analyses were performed on data from 30 students, with 15 in the experimental group and 15 in the control group, ensuring the appropriateness of multivariate covariance analysis (MANCOVA) for hypothesis testing.

Table 2

Results of Univariate ANCOVA within Multivariate ANCOVA for the Effectiveness of STEM-Based Choice Theory Education

Dependent Variable	Source of Effect	Sum of Squares	df	Mean Square	F	p-value	Eta Squared (η^2)	Power
Self-Efficacy	Pretest	655.669	1	655.669	541.817	< 0.001	0.958	1.000
	Group	252.221	1	252.221	208.425	< 0.001	0.897	1.000
	Error	29.043	24	1.210				
Creativity	Pretest	804.976	1	804.976	827.852	< 0.001	0.972	1.000
	Group	315.500	1	315.500	324.466	< 0.001	0.931	1.000
	Error	23.337	24	0.972				

The results of the univariate ANCOVA within the multivariate framework demonstrated that STEM-based choice theory education significantly enhanced both self-efficacy and creativity in the experimental group compared to the control group. For self-efficacy, a significant group effect was observed ($F(1, 24) = 208.425$, $p < 0.001$, $\eta^2 = 0.897$), indicating that the intervention accounted for 89.7% of the variance. Similarly, for creativity, a significant group effect was found ($F(1, 24) = 324.466$, $p < 0.001$, $\eta^2 = 0.931$), with the intervention explaining 93.1% of the variance. Both variables showed high statistical power (1.000), underscoring the reliability of the results. These findings confirm the effectiveness of the intervention in significantly improving the targeted outcomes (**Error! Reference source not found.**).

4. Discussion and Conclusion

The findings of this study demonstrated that the STEM-based choice theory education intervention significantly improved self-efficacy and creativity among female high school students in the experimental group compared to the control group. Self-efficacy scores increased substantially post-intervention, indicating the effectiveness of this approach in enhancing students' confidence in their abilities.

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Similarly, creativity scores showed a marked improvement, emphasizing the intervention's potential to foster innovative thinking.

The observed enhancement in self-efficacy aligns with previous studies that underscore the positive impact of reality therapy and choice theory on self-beliefs. For instance, Mateo et al. (2014) reported that implementing choice theory in educational settings significantly boosts students' confidence in managing academic and personal challenges (Mateo et al., 2014). This study builds on those findings by demonstrating that integrating STEM elements amplifies these benefits, likely due to the hands-on, problem-solving nature of STEM education. Anderson and Haney (2021) highlighted that self-efficacy is closely tied to creative metacognition and self-concept, suggesting that the intervention's impact on self-efficacy could have contributed to the observed improvements in creativity (Anderson & Haney, 2021).

The improvement in creativity aligns with findings from Conradty and Bogner (2020), who demonstrated that STEM-based teaching fosters motivation and creative thinking by engaging students in interdisciplinary learning (Conradty & Bogner, 2020). The integration of choice theory in this study provided an additional layer of psychological support, enabling students to explore their intrinsic motivations and develop a deeper connection to the learning material. Similar findings by Mäkelä et al. (2022) showed that hybrid STEM learning environments designed with pedagogical frameworks significantly enhance creativity by encouraging active participation and critical thinking (Mäkelä et al., 2022).

One possible explanation for the strong impact of the intervention on creativity is the focus on collaborative and project-based activities. Studies by Berliana (2024) and Coufal (2022) emphasize that project-based STEM learning not only develops problem-solving skills but also enhances creative capacities through group dynamics and peer interactions (Berliana, 2024). This is consistent with the results of this study, where group-based sessions provided students with opportunities to brainstorm, share ideas, and develop innovative solutions, thereby fostering both individual and collective creativity.

Additionally, the findings resonate with research on the psychological benefits of STEM education. Luo (2022) and Jin and Yuan (2022) emphasized that STEM approaches improve psychological well-being and creative output by creating engaging and stimulating learning environments (Jin & Yuan, 2022; Luo, 2022). This study's results further substantiate these claims by demonstrating that incorporating choice theory into STEM frameworks enhances these psychological benefits, particularly by addressing students' needs for autonomy, competence, and relatedness.

The intervention's success in enhancing both self-efficacy and creativity may also be attributed to its emphasis on internal control and responsibility. As noted by Ghoreishi and Behboodi (2017), reality therapy encourages students to take ownership of their behaviors and decisions, which can significantly influence their academic and emotional outcomes (Ghoreishi & Behboodi, 2017). By integrating this principle with STEM methodologies, the intervention not only equipped students with practical problem-solving skills but also empowered them to approach challenges with confidence and creativity.

This study had some limitations that should be considered when interpreting the results. First, the sample size was relatively small, comprising 30 participants from a single district, which may limit the generalizability of the findings to broader populations. Second, the study focused exclusively on female high school students, which restricts the applicability of the results to male students or other educational levels. Third, the intervention duration was relatively short, consisting of 10 sessions, which may not fully capture the long-term effects of the STEM-based choice theory education. Finally, the reliance on self-reported measures for self-efficacy and creativity introduces the potential for response bias, as students might have reported higher scores due to social desirability or perceived expectations from the researchers.

Future research should address these limitations by employing larger and more diverse samples, including students of different genders, age groups, and socio-economic backgrounds. Longitudinal studies could explore the sustained impact of STEM-based choice theory education on self-efficacy and creativity over time, providing insights into its long-term benefits and potential limitations. Additionally, future research could incorporate objective measures of creativity and self-efficacy, such as performance-based assessments or teacher evaluations, to complement self-reported data. Comparative studies could also examine the effects of different STEM integration methods, such as robotics, coding, or environmental science projects, to identify the most effective strategies for fostering creativity and self-efficacy.

Educators and policymakers should consider integrating STEM-based choice theory education into school curricula

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as a means of fostering self-efficacy and creativity. Teachers should be trained to implement this dual-framework approach, emphasizing both the psychological principles of choice theory and the hands-on, interdisciplinary nature of STEM education. Schools can also create collaborative learning environments that encourage group-based activities and real-world problem-solving tasks, aligning with the principles of project-based learning. Finally, incorporating regular self-assessment and reflection activities can help students internalize their learning, build confidence, and further enhance their creative thinking abilities.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

References

Akrami, Z. (2022). The effectiveness of education with the STEM approach in the development of entrepreneurial thinking in chemistry students. *Chemistry Education Research and Practice*, *23*(2), 475-485. https://doi.org/10.1039/D2RP00011C

Anderson, R. C., & Haney, M. (2021). Reflection in the creative process of early adolescents: The mediating roles of creative metacognition, self-efficacy, and self-concept. *Psychology of Aesthetics, Creativity, and the Arts*, *15*(4), 612-626. https://doi.org/10.1037/aca0000324

Babaei Parsheh, A., & Mosadeghi Nik, F. (2022). The relationship between information literacy and communication skills of teachers with academic self-efficacy with the moderating role of students' intelligence beliefs. *Management and Educational Perspective*, *4*(2), 1-20. https://doi.org/10.22034/jmep.2022.316796.1084

Berliana, D. R. (2024). The Effect of Project Based Learning (PjBL) - STEM in Improving Students' Science Literacy Skills on Topic of Alternative Energy. *Jurnal Pendidikan Fisika Dan Teknologi*, *10*(1), 141-148. https://doi.org/10.29303/jpft.v10i1.6896

Conlon, R. A., Barroso, C., & Ganley, C. M. (2023). Young Children's Career Aspirations: Gender Differences, STEM Ambitions, and Expected Skill Use. *The Career Development Quarterly*, *71*(1), 15-29. https://doi.org/10.1002/cdq.12312

Conradty, C., & Bogner, F. X. (2020). STEAM teaching professional development works: effects on students' creativity and motivation. *Smart Learning Environments*, *7*(1), 26. https://doi.org/10.1186/s40561-020-00132-9

Coufal, P. (2022). Project-Based STEM Learning Using Educational Robotics as the Development of Student Problem-Solving Competence. *Mathematics*, *10*(23), 4618. https://doi.org/10.3390/math10234618

Gargari, R. Y. (2024). Comparison of the Effectiveness of Mindfulness-Based Cognitive-Behavioral Therapy and Reality Therapy on Emotional Regulation and Self-Efficacy in Women Seeking Divorce. *Psychology of Woman Journal*, *5*(1), 12-22. https://doi.org/10.61838/kman.pwj.5.1.2

Ghoreishi, M., & Behboodi, M. (2017). Effectiveness of Group Reality Therapy on Emotion Regulation and Academic Self-efficacy of Female Students. *SALĀMAT-I IJTIMĀĪ (Community Health)*, *4*(3), 233-243. https://www.sid.ir/paper/253850/en

Jiatong, W., Murad, M., Bajun, F., Tufail, M. S., Mirza, F., & Rafiq, M. (2021). Impact of Entrepreneurial Education, Mindset, and Creativity on Entrepreneurial Intention: Mediating Role of Entrepreneurial Self-Efficacy. *Front Psychol*, *12*, 724440. https://doi.org/10.3389/fpsyg.2021.724440

Jin, X., & Yuan, Y. (2022). Impact of Fine Arts Education on Psychological Wellbeing of Higher Education Students Through Moderating Role of Creativity and Self-Efficacy. *Frontiers in psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.957578

Lee, I., & Perret, B. (2022). Preparing High School Teachers to Integrate AI Methods into STEM Classrooms. *Proceedings of the Aaai Conference on Artificial Intelligence*, *36*(11), 12783-12791. https://doi.org/10.1609/aaai.v36i11.21557

Luo, H. (2022). Insight Into STEM Education. 296-305. https://doi.org/10.2991/978-2-494069-05-3_38

Mahzoonzadeh Bushehri, F. (2017). The relationship between students' problem-solving skills and creativity mediated By self-efficacy: Modelling structural equations. *Journal of Innovation and Creativity in Human Science*, *6*(4), 27-50. https://sanad.iau.ir/en/Article/929330?FullText=FullText

Mäkelä, T., Fenyvesi, K., Kankaanranta, M., Pnevmatikos, D., & Christodoulou, P. (2022). Co-Designing a Pedagogical Framework and Principles for a Hybrid STEM Learning Environment Design. *Educational Technology Research and Development*, *70*(4), 1329-1357. https://doi.org/10.1007/s11423-022-10114-y

E-ISSN: 2980-9681

Marushko, L. (2023). Building Readiness of Future Natural Science Teachers for Professional Activities Using Stem Tools. *Revista De La Universidad Del Zulia*, *14*(41), 29-57. https://doi.org/10.46925//rdluz.41.03

Mateo, N. J., Ngombedua Makundu, G., Barnachea, E. A. R., & Paat, J. N. J. S. (2014). Enhancing Self-Efficacy of College Students Through Choice Theory. *International Journal of Choice Theory and Reality Therapy*, *XXXIII*(2), 78. https://openurl.ebsco.com/EPDB%3Agcd%3A2%3A20567410/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A102235946&crl=c&link_origin=www.google.com

Meadows, J. (2023). Planning an Informal STEM Event? Try the Assets-Based Approach to Planning and Research for Informal STEM Events. *Journal of Research in Science Mathematics and Technology Education*, 1-16. https://doi.org/10.31756/jrsmte.711

Nowruzpoor, E., Vakili, P., & Rezakhani, S. D. (2021). The effectiveness of Reality therapy on Self-efficacy and Identity Styles of Female Students. *International Journal of Pediatrics*, *9*(8), 14212-14223. https://doi.org/10.22038/ijp.2020.50939.4044

Parsakia, K., Knechtle, B., & Irandoust, K. (2024). Strength-Based Therapy: Empowering Athletes' Self-Efficacy and Life Satisfaction. *Health Nexus*, *2*(2), 1-7. https://doi.org/10.61838/kman.hn.2.2.1

Shams, G., Pashang, S., & Sedaghat, M. (2021). Comparison of the effectiveness of compassion-based therapy and reality therapy on self-efficacy of patients with multiple sclerosis. *Journal of Preventive Medicine*, *8*(1), 80-70. https://doi.org/10.52547/jpm.8.1.80

Sharifpour, S., Manshaee, G. R., & Sajjadian, I. (2021). Effects of virtual reality therapy on perceived pain intensity, anxiety, catastrophising and self-efficacy among adolescents with cancer. *Counselling and Psychotherapy Research*, *21*(1), 218-226. https://doi.org/10.1002/capr.12311

Xu, W., & Ouyang, F. (2022). The Application of AI Technologies in STEM Education: A Systematic Review From 2011 to 2021. *International Journal of Stem Education*. https://doi.org/10.1186/s40594-022-00377-5

E-ISSN: 2980-9681