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An Examination of the Fit of an Educational Model Based on Ideation and Creativity Development in Technical Schools of Golestan Province

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A B S T R A C T

Purpose: The objective of this study was to develop and assess an educational model integrating ideation, creativity, and production-based learning in technical schools of Golestan province, Iran.

Methodology: This research employed a mixed-methods approach, combining qualitative and quantitative data collection. Initially, qualitative interviews with experts in technical education were conducted to identify key components of the proposed model. Based on the qualitative findings, a survey was developed and distributed to 297 participants, including technical school teachers and students. Descriptive and inferential statistics, including correlation analysis and paired t-tests, were used to evaluate the model's effectiveness. Confirmatory factor analysis (CFA) was also performed to validate the structural relationships between variables.

Findings: The results indicated that integrating creativity and ideation into technical education significantly improved student outcomes in areas such as curriculum engagement, participation in production, and interaction with the labor market. Positive correlations were found between teaching strategies, curriculum goals, and students' practical application of skills. However, there remained a notable gap between the current and desired states of the educational model, particularly in curriculum design and student participation in curriculum development. The model showed potential for broader application but required further refinement in its practical implementation.

Conclusion: The study concludes that the integration of creativity and production-based learning into technical education can enhance both creative thinking and practical skill development. However, ongoing adjustments are needed to fully realize the model's potential, especially in terms of student involvement and curriculum alignment with industry needs. Collaboration between educational institutions and industry is critical for the success of this model.

Keywords: *Creativity, ideation, technical education, vocational education, production-based learning, curriculum development, school-industry collaboration*

1. Introduction

One of the significant challenges in technical and vocational education is the need to bridge the gap between educational curricula and the practical requirements of the labor market. Several studies have highlighted that vocational education must not only focus on technical skills but also on fostering creativity and critical thinking (AtiŞ & DİLbaz, 2022; Blake et al., 2021). In line with this, Cai, Li, and Fan (2018) argue that modern vocational education should focus on innovation and adaptability to keep pace with rapid technological advancements. Similarly, in their research on engineering education, Abramova et al. (2023) emphasize the need for functional models that can enhance the integration of engineering practices with theoretical learning (Abramova et al., 2023).

The integration of creativity and ideation into technical education is not only necessary for student development but also aligns with broader educational trends. Creativity and ideation have been recognized as critical components of problem-solving and innovation, essential skills in many industries today (Alshaikh, 2023; Wang et al., 2024). Additionally, Alazzam et al. (2012) suggest that the readiness of technical education teachers to adopt new teaching strategies, including those that foster creativity, is vital to the success of these programs (Alazzam et al., 2012). This is further supported by research conducted by Hu, Zheng, and Liu (2023), who argue that vocational education must create strong collaborations between educational institutions and industries to ensure that students are equipped with both theoretical knowledge and practical skills (Hu et al., 2023).

In vocational education, one of the most critical areas for improvement is the engagement with industry and the labor market. Research has shown that strong school-industry partnerships can significantly enhance the relevance and applicability of vocational training (Ibeneme & Ashiebi, 2022). For instance, studies in Brazil have demonstrated that vocational schools with direct links to industries see higher student performance and employment outcomes (Elacqua et al., 2019). Furthermore, Bernardim and Silva (2016) highlight that vocational education should not be limited to technical skills but should also integrate general education components that develop students' broader intellectual and creative capacities (Bernardim & Silva, 2016).

Moreover, vocational and technical schools often face challenges related to the effectiveness of their curriculum design and teaching strategies. Research by Brinia and Manioudakis (2018) underscores the importance of evaluating the effectiveness of laboratory centers in technical schools to ensure students are receiving high-quality, hands-on training (Brinia & Manioudakis, 2018). These findings align with those of Bykov and Shyshkina (2014), who stress the importance of emerging technologies in vocational education to enhance learning outcomes (Bykov & Shyshkina, 2014).

Another key component of effective vocational education is the role of teachers and school leaders. According to Atış and Dilbaz (2022), the management skills of school leaders play a crucial role in creating an environment conducive to learning and innovation (AtiŞ & DİLbaz, 2022). In a study of school management practices in OECD and MENA countries, Bhutoria and Aljabri (2022) found that effective managerial practices significantly impact school efficiency and student outcomes (Bhutoria & Aljabri, 2022). These findings are particularly relevant in the context of technical education, where school leaders must be able to manage complex programs that integrate both technical and creative learning (Al-Ali, 2022).

While the importance of creativity and innovation in vocational education is well-documented, there is also a need to address the practical challenges of implementing such educational models. One significant barrier is the traditional focus on rote learning and memorization, which is still prevalent in many technical schools (Mikhaylova & Revina, 2019). To overcome this, educational systems must adopt new pedagogical approaches that encourage active learning and student engagement (Eck, 2020; Herawati et al., 2024; Maarefvand & Shafiabady, 2024; Sadat Mousavi & Ebrahimi, 2024). For example, the use of project-based learning, where students work on real-world problems and develop practical solutions, has been shown to foster creativity and critical thinking (Domingue et al., 2017).

Moreover, the COVID-19 pandemic has accelerated the shift towards digital and blended learning in vocational education. Cheng (2020) notes that the pandemic forced schools to adopt new technologies and teaching methods, which has had both positive and negative impacts on vocational education (Cheng, 2020). While digital tools have enabled more flexible learning environments, there have also been challenges related to student engagement and the quality of hands-on training (Elstrodt-Wefing & Ritterfeld, 2020). In this regard, the integration of digital tools with traditional vocational training methods offers an opportunity to enhance both creativity and technical skills (Walther et al., 2022).

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In addition to these challenges, vocational education must also address the broader social and economic factors that influence student outcomes. Research by Mwangi (2011) highlights the importance of entrepreneurship education in technical programs, as it can provide students with the skills needed to start their own businesses and contribute to economic development (Mwangi, 2011). Similarly, Valencia-Arias, Arango-Botero, and Restrepo (2021) found that fostering an entrepreneurial mindset in students can enhance their career prospects and improve their adaptability to changing labor markets (Valencia-Arias et al., 2021).

The literature suggests that an effective vocational education model must integrate several key elements: creativity and ideation, practical skills, industry collaboration, and entrepreneurial education. However, the successful implementation of such a model requires a supportive institutional environment and effective leadership (Gestupa, 2023). According to Blancada (2023), school leaders must possess strong management skills and be able to foster a culture of innovation and collaboration among teachers and students (Blancada, 2023).

In conclusion, the integration of creativity and ideation into vocational education is critical for preparing students to meet the challenges of the 21st-century workforce. As previous research has shown, vocational schools must adapt to the evolving needs of industries by fostering innovation and practical skills (Ranieri, 2021). In recent years, education systems around the world have faced increasing pressures to adapt to the rapid changes brought about by globalization, technological advancements, and evolving labor market demands. In response, educational models have shifted towards fostering creativity, innovation, and technical skills to better prepare students for a dynamic global workforce. This shift is particularly relevant in vocational and technical education (VTE), which plays a crucial role in equipping students with the practical skills necessary for their careers. Vocational education, therefore, demands continuous innovation and adaptation to meet the changing needs of industries and students. This study aims to explore the development of an educational model that integrates creativity, ideation, and production processes in technical schools within Golestan province, Iran, and assess its effectiveness.

2. Methods and Materials

2.1. Study Design and Participants

The research methodology for this study was designed as a mixed-methods approach (qualitative-quantitative), with an exploratory sequential design. The primary goal of this research is to examine and propose an educational model based on ideation and creativity development in technical schools in Golestan province. Initially, qualitative methods were employed to collect and analyze data, and these findings were then used as the foundation for constructing the quantitative tools. The study was conducted cross-sectionally, where in the qualitative phase, data were gathered from interviews with experts to identify key indicators and components of the proposed model. In the quantitative phase, these indicators and components were assessed through a structured questionnaire.

Study Design and Participants: The research followed an exploratory sequential mixed-method design, starting with qualitative data collection to explore the research problem in depth. The qualitative participants included experts in curriculum planning, technical and vocational education, and those with experience in designing creative learning programs. These experts were selected using purposive sampling. In the quantitative phase, the participants included all educational specialists from vocational schools and institutions in Golestan province. From a population of 1,306 individuals, a sample size of 297 participants was determined using Krejcie and Morgan's sample size table, and the sampling method was stratified random sampling.

2.2. Data Collection

In the qualitative phase, semi-structured interviews were conducted with the selected experts. These interviews aimed to explore key dimensions and components related to the feasibility and design of an educational model focused on ideation and creativity development. Each interview lasted between 30 to 90 minutes, and the conversations were recorded with the participants' consent for later analysis. The qualitative findings were used to construct a researcher-developed questionnaire, which was used in the quantitative phase. This questionnaire contained two sections: demographic information (age, gender, education, work experience) and 56 items related to the identified dimensions of the educational model. The questionnaire was scored on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree." The reliability of the questionnaire was tested using Cronbach's alpha on a sample of 30 participants before distribution to the full sample.

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2.3. Data Analysis

In the qualitative phase, thematic analysis was employed to identify key themes and components of the proposed model. Open coding was used to extract initial concepts from the interview data, followed by axial coding to connect these concepts into broader categories. The identified themes were then used to construct the questionnaire for the quantitative phase. In the quantitative phase, descriptive statistics, such as frequency, mean, and standard deviation, were calculated to describe the demographic characteristics of the sample. Inferential statistics, including Pearson's correlation, one-sample t-tests, structural equation modeling (SEM), and confirmatory factor analysis (CFA), were conducted to validate the model and test its components. The analysis was carried out using SPSS and LISREL software.

3. Findings and Results

The results of this study are presented through descriptive and inferential analyses to evaluate the educational model based on ideation and creativity development in technical schools in Golestan province.

Table 1 presents the mean, standard deviation, minimum, and maximum scores for the structural, behavioral, and environmental variables and their subscales for the sample of 297 participants. According to the contents of the table, the mean (and standard deviation) for the structural dimension across various subscales, such as content and organization, curriculum goals, teaching strategies, and engagement with the labor market, are as follows:

Table 1

Descriptive Findings for Research Variables

Variable	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Content and organization	4.00	4.00	4	0.68	1.80	5.00
Curriculum goals	3.86	3.86	4	0.60	2.07	5.00
Teaching and learning strategies	3.60	3.57	3	0.80	1.00	5.00
Labor market interaction	3.82	4.00	4	0.79	1.67	5.00
Participation in curriculum production	3.49	3.50	3	0.97	1.50	5.00
Education and counseling	3.78	3.75	4	0.79	1.50	5.00
Curriculum design principles	3.52	3.33	3	0.93	1.00	5.00
Evaluation	3.69	3.71	3	0.76	1.29	5.00
Activation and production	3.54	3.49	4	0.57	2.22	5.00
Continuous interaction with scientific centers	3.36	3.33	4	1.08	1.00	5.00
Characteristics	6.36	3.33	3	1.09	1.00	5.00

Table 2 indicates that most research variables show significant correlations with one another. For example, content and organization are significantly correlated with curriculum goals, teaching strategies, and labor market interaction, among others.

Table 2

Correlation Coefficients Between Variables

Variable	1	2	3	4	5	6	7	8	9	10	11
Content and organization	1										
Curriculum goals	0.163	1									
Teaching and learning strategies	0.238	0.350	1								
Labor market interaction	0.425	0.272	0.294	1							
Participation in curriculum production	0.061	0.106	0.157	0.147	1						
Education and counseling	0.313	0.234	0.154	0.369	0.255	1					
Curriculum design principles	0.178	0.266	0.157	0.360	0.179	0.655	1				
Evaluation	0.381	0.461	0.370	0.472	0.168	0.478	0.562	1			
Activation and production	0.395	0.559	0.420	0.547	0.332	0.575	0.551	0.700	1		
Continuous interaction with scientific centers	0.307	0.101	0.201	-0.019	0.164	0.097	-0.047	0.089	0.159	1	
Characteristics	0.125	0.313	0.068	0.086	-0.162	0.028	0.076	0.139	0.264	0.013	1

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To better evaluate the gap between the current and desired states of the variables, a paired t-test was performed. The results are presented in Table 3.

Table 3

Paired t-Test for Variables

Variable	t-Value	df	p	Lower Bound (95% CI)	Upper Bound (95% CI)
Content and organization	-13.726	296	0.000*	-0.30	-0.23
Curriculum goals	-20.112	296	0.000*	-0.41	-0.33
Teaching and learning strategies	-21.216	296	0.000*	-0.52	-0.43
Labor market interaction	-14.843	296	0.000*	-0.41	-0.31
Participation in curriculum production	-21.989	296	0.000*	-0.60	-0.50
Education and counseling	-16.417	296	0.000*	-0.43	-0.33
Curriculum design principles	-21.878	296	0.000*	-0.59	-0.49
Evaluation	-21.691	296	0.000*	-0.47	-0.39
Activation and production	-26.791	296	0.000*	-0.24	-0.21
Continuous interaction with scientific centers	-20.905	296	0.000*	-0.59	-0.48
Characteristics	-20.279	296	0.000*	-0.59	-0.48

As shown in Table 3, there is a significant difference between the current and desired states for all variables. The absolute t-values for content and organization (-13.726), curriculum goals (-20.112), teaching and learning strategies (-21.216), labor market interaction (-14.843), and other dimensions indicate statistically significant gaps between the current and desired states.

To confirm the validity of the research model, confirmatory factor analysis was conducted. The CFA tested the relationship between latent variables and their indicators, ensuring that the questionnaire items accurately measured the constructs. Factor loadings above 0.30 indicate acceptable correlations between latent variables and observed variables.

Based on the t-value analysis, all factor loadings were statistically significant. The fit indices, including Bentler-Bonett's normalized fit, relative fit index (RFI), incremental fit index (IFI), and root mean square error of approximation (RMSEA), suggest an acceptable fit for the model.

Table 4

Fit Indices for the Final Model

Fit Index	Standard Value	Reported Value	Assessment
Chi-square	-	3676.75	Acceptable
Chi-square normalized	1-5	2.572	Acceptable
RMSEA	<0.08	0.075	Acceptable
RFI	>0.90	0.923	Acceptable
NFI	>0.90	0.945	Acceptable
IFI	>0.90	0.927	Acceptable

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Figure 1

Model with T-Values

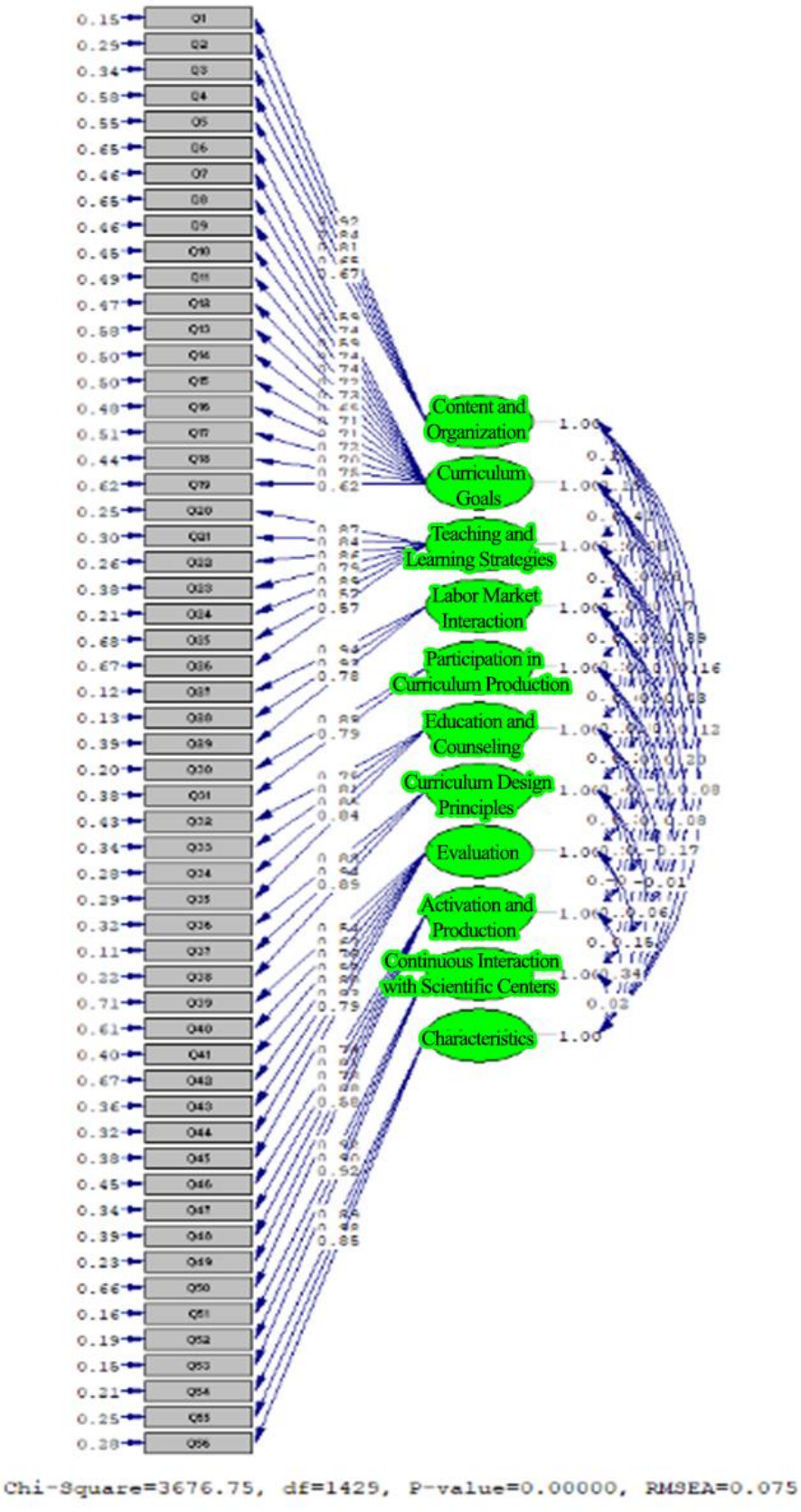

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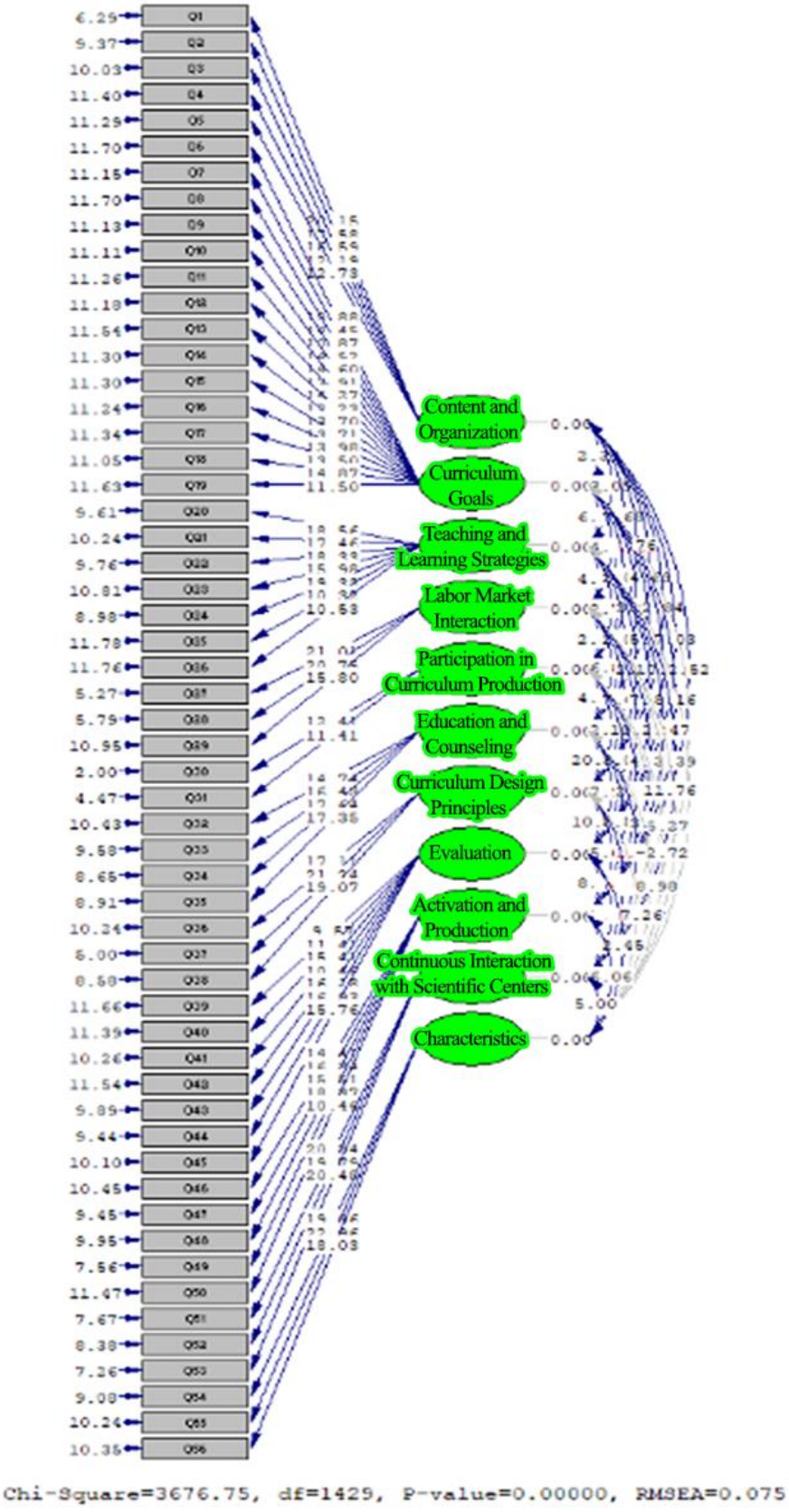
Figure 2

Model with Beta Coefficients



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4. Discussion and Conclusion

The findings of this study demonstrate that integrating creativity, ideation, and production-based learning into vocational and technical education (VTE) in Golestan province can significantly enhance both the structural and behavioral aspects of students' learning experiences. The descriptive and inferential statistics show that students in the technical schools involved in this study benefited from a model that emphasizes both practical skills and creative thinking. The analysis revealed significant correlations between structural factors, such as curriculum content, teaching strategies, and interaction with the labor market, and behavioral outcomes, including student participation in curriculum production and continuous learning engagement. These findings align with the growing body of research that supports the incorporation of creativity and innovation into technical education to prepare students for the demands of a rapidly changing global workforce (Abramova et al., 2023; Alshaikh, 2023; Cai et al., 2018).

One of the most notable results from this study is the significant positive relationship between teaching and learning strategies and the students' interaction with the labor market. This finding suggests that students who were exposed to more dynamic, creative teaching strategies were better able to engage with industry requirements and apply their skills in real-world settings. Previous studies have emphasized the importance of active learning and hands-on experiences in technical education (Brinia & Manioudakis, 2018; Hu et al., 2023), and the current study's results reinforce this notion by showing that when teaching strategies are aligned with industry needs, students are more likely to succeed in their vocational careers. This is further supported by research from Bernardim and Silva (2016), who argue that integrating general education with technical skills helps students develop broader intellectual capacities, thus improving their adaptability in the labor market (Bernardim & Silva, 2016).

The results also highlight the importance of curriculum design in fostering creativity and innovation. The strong correlation between curriculum goals and student creativity suggests that when curricula are designed with creativity in mind, students are more likely to engage in ideation and innovation. This aligns with the findings of Bykov and Shyshkina (2014), who argue that the adoption of emerging technologies in vocational education can enhance student learning outcomes by providing opportunities for creative exploration. Furthermore, the significant positive relationship between the curriculum design principles and student engagement in continuous learning highlights the importance of having a well-structured curriculum that encourages both technical skill development and creative thinking (Al-Ali, 2022; Cai et al., 2018).

A significant finding from the paired t-tests is the gap between the current and desired states of various elements of the educational model, particularly in areas such as content organization and teaching strategies. This suggests that while progress has been made in integrating creativity into the curriculum, there are still areas that require further development. For instance, the students' level of participation in curriculum production was lower than expected, indicating a need for more inclusive and student-centered approaches to curriculum design (Elacqua et al., 2019). This finding echoes the concerns raised by Cheng (2020) about the need for educational systems to move away from traditional, rote-learning models and toward more interactive and creative learning environments (Cheng, 2020).

Moreover, the study's results underscore the critical role of continuous interaction with scientific centers and industry. Students who had more exposure to scientific research and industry partnerships were found to have better outcomes in terms of creativity and problem-solving skills. This finding supports the research of Ibeneme and Ashiebi (2022), who emphasize the importance of school-industry collaboration in improving the quality and relevance of technical education (Ibeneme & Ashiebi, 2022). Similarly, studies by Domingue et al. (2017) and Eck (2020) highlight the positive impact of real-world industry involvement on student learning, suggesting that when schools and industries collaborate effectively, students are more likely to develop both technical and creative skills (Domingue et al., 2017).

The positive impact of digital and blended learning, highlighted in this study, is another important finding. As noted in previous research, the COVID-19 pandemic accelerated the adoption of digital learning tools, which provided both opportunities and challenges for vocational education (Cheng, 2020). The current study found that digital learning tools, when combined with traditional hands-on training, can enhance students' creativity and engagement. This is consistent with the findings of Walther et al. (2022), who argue that the integration of digital education in technical schools offers opportunities to

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complement practical learning with creative problem-solving (Walther et al., 2022). Furthermore, digital learning can provide students with the flexibility to explore creative ideas at their own pace, a finding that aligns with the research of Atış and Dilbaz (2022) on the importance of adaptive learning environments (AtiŞ & DİLbaz, 2022).

The results also reveal some challenges associated with the integration of creativity into technical education. For instance, while students demonstrated improvements in ideation and creativity, there were still notable gaps in their ability to apply these skills in real-world production settings. This could be attributed to a lack of sufficient training in bridging the gap between creative ideation and practical implementation. Research by Bernardim and Silva (2016) similarly identifies this challenge, emphasizing that while students may excel in creative thinking, they often lack the technical expertise or industry knowledge to translate these ideas into practical solutions.

Despite the valuable insights provided by this study, several limitations must be acknowledged. First, the study was conducted within a specific geographical and cultural context—technical schools in Golestan province, Iran—which may limit the generalizability of the findings to other regions or countries. Different educational systems, industries, and labor market demands may require tailored models for creativity and technical skill development. Second, the study relied on self-reported data from students and teachers, which may introduce biases such as social desirability or recall bias. While efforts were made to ensure the reliability and validity of the data, these biases could affect the accuracy of the findings. Finally, the study did not include a longitudinal component, which would have provided more comprehensive insights into the long-term impact of the educational model on student outcomes. Given that creativity and technical skills may develop over time, a longitudinal approach would have allowed for a better understanding of the model's sustained effects.

Future research should consider expanding the scope of the study to include diverse geographical and cultural contexts. Investigating the implementation of creativity-based educational models in different countries or regions with varying labor market demands would provide valuable insights into the adaptability and effectiveness of such models across different settings. Additionally, future studies should consider incorporating longitudinal designs to examine the long-term impact of creativity-based models on student outcomes, particularly in terms of their employability and career progression. This approach would offer a more comprehensive understanding of how these models influence student development over time. Furthermore, research should explore the role of specific teaching strategies and digital tools in enhancing creativity in technical education. For example, experimental studies that compare different teaching methods (e.g., project-based learning, flipped classrooms, etc.) could provide more precise data on which approaches are most effective in fostering creativity and technical skill development. Finally, future research should investigate the potential challenges and barriers to implementing creativity-based models, particularly in under-resourced educational settings where access to technology and industry partnerships may be limited.

From a practical standpoint, the findings of this study suggest several key strategies for improving vocational and technical education through creativity and ideation. First, schools should prioritize developing stronger partnerships with industries to ensure that their curricula are aligned with labor market needs. This could involve creating internship programs, facilitating guest lectures from industry professionals, and encouraging collaboration on real-world projects. As highlighted by Ibeneme and Ashiebi (2022) and Elacqua et al. (2019), school-industry collaboration is critical for ensuring that students develop the skills necessary for their future careers (Elacqua et al., 2019; Ibeneme & Ashiebi, 2022). Second, educators should adopt more student-centered approaches to curriculum design, allowing students to actively participate in the creation of learning materials and course content. This not only fosters creativity but also empowers students to take ownership of their learning process. Third, schools should integrate digital tools into their teaching methods to complement traditional hands-on training. The study's findings suggest that digital learning environments can enhance creativity by allowing students to explore ideas at their own pace. However, these tools should be used in combination with practical experiences to ensure that students develop both creative and technical skills (Cheng, 2020; Walther et al., 2022). Finally, educational leaders should focus on professional development for teachers to ensure they are equipped with the skills and knowledge needed to foster creativity in their classrooms. This includes providing training on new teaching strategies, digital tools, and ways to facilitate school-industry collaborations.

In conclusion, the integration of creativity and ideation into vocational and technical education holds great promise for enhancing student learning outcomes and preparing them

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for the demands of the modern workforce. By addressing the gaps identified in this study and adopting the suggested strategies, schools can create more dynamic and effective learning environments that foster innovation, practical skills, and career readiness.

Authors' Contributions

All authors significantly contributed to this study.

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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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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