Acceptance of TRIZ Methodology Problem-Solving in Computing Education: Qualitative Study

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Abstract. Advanced technology nowadays must be parallel with human ability to solve problems. However, some of the problem-solving approaches or methodologies must be used to overcome the advancement of technology. One of the methods that can be used is the theory of inventive problem solving which is TRIZ, that is not only used in engineering, but to all types of fields in the world. Moreover, this is one of the skills that had been suggested by the Ministry of Education (MOE) in Malaysia Education Blueprint 2013-2025 to produce students that are not only competitive but also innovative, brave, highly skilled and have creative and critical thinking. This research aims to know the acceptance of TRIZ problem-solving among computing students. Thematic analysis was used to analyze data by using NVIVO. As a result, it shows that most of the students can accept TRIZ problem solving to solve problems in computing including usability, usefulness, usage process and behavior through TRIZ methodology. TRIZ as a systematic and structured methodology that is used to solve problems, is the main reason why it has been used. Besides, the inventive principles in TRIZ methodology are being used without realizing that the methods used are part of the TRIZ methodology. Thus, logical thinking and thinking outside the box can be expressed indirectly to solve problems. In conclusion, the majority of students accept the use of TRIZ methodology to solve problems regardless of multiple fields of computing or other fields.

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1 INTRODUCTION

In the rapidly advancing digital age, the demand for problem-solving capabilities, critical thinking, and creativity in computing education has never been more pronounced. As technology evolves, computing students are expected to not only acquire technical skills but also develop the cognitive abilities to address increasingly complex problems (Kwon et al., 2021). Higher education must therefore incorporate methodologies that foster both technical and cognitive skills to prepare students for real-world challenges. Norlizawaty Baharin and Kamisah Osman (2021) emphasized that computational thinking (CT) is a foundational skill for modern problem-solving, aligning closely with methodologies like TRIZ that promote structured thinking and systematic problem resolution. Their work suggests that integrating CT into curricula helps students develop essential problem-solving capabilities, much like TRIZ, which guides students through clear, methodical steps to approach complex issues.

Among the various problem-solving methodologies studied, the Theory of Inventive Problem Solving (TRIZ) presents a systematic and structured approach with proven success in engineering and innovation contexts. TRIZ has been increasingly incorporated into educational settings to enhance creativity and problem-solving attitudes among students (Reyes-Huerta et al., 2023). Despite its established utility in engineering and product design, TRIZ has yet to be fully integrated into computing education, particularly in Malaysia. This gap in research presents an opportunity to explore TRIZ’s potential benefits in enhancing problem-solving skills in computing students.

Originally developed by Genrich Altshuller in 1946, TRIZ offers a unique framework for resolving contradictions and complex problems through inventive principles. The methodology has been acknowledged for fostering creativity and structured innovation across various fields, yet its application in computing curricula remains limited (Park, 2023). By providing students with a structured approach to solving complex problems, TRIZ can significantly enhance their problem-solving capabilities, particularly in the context of modern computing challenges. This study aims to bridge this gap in the literature by investigating how computing students in Malaysia perceive and accept the TRIZ methodology.

The need for this research is underscored by Malaysia's ongoing efforts to reform its education system, aligning it with global technological advancements. The Malaysia Digital Economy Blueprint emphasizes the integration of digital technologies and the cultivation of a talent pool skilled in innovation, critical thinking, and problem-solving. These skills are essential for addressing challenges in areas such as cloud computing, artificial intelligence, and software engineering, which are expected to offer substantial employment opportunities in the coming years (Wu et al., 2024). By integrating TRIZ into computing education, students could develop not only technical skills but also inventive problem-solving abilities necessary to navigate the complexities of modern computing.

Despite the recognition of TRIZ's potential, there is limited research on its acceptance among computing students, particularly in Malaysia. Most existing studies focus on TRIZ's application in engineering and product development, with few examining its integration into computing curricula. This research seeks to fill this gap by exploring the factors that influence the acceptance of TRIZ among computing students in Malaysia. Using the Technology Acceptance Model (TAM) as the theoretical framework, this study will investigate how Perceived Ease of Use and Perceived Usefulness of TRIZ influence students' intention to adopt the methodology in their education. The findings will provide valuable insights into how TRIZ can be integrated into the computing curriculum and its potential to foster innovation and creativity among students.

Moreover, the study will explore how external factors, such as social influence and facilitating conditions (as outlined in the Unified Theory of Acceptance and Use of Technology (UTAUT)), may affect the adoption of TRIZ (Zaineldeen et al., 2020). These factors, alongside students' attitudes and perceived behavioral control (from the Theory of Planned Behavior), will offer a more comprehensive understanding of how students' perceptions shape their decision to adopt new problem-solving methods like TRIZ.

In conclusion, this research will contribute to advancing computing education in Malaysia by examining the factors that influence the adoption of TRIZ. By understanding the barriers and drivers of TRIZ acceptance, the study will help educators and policymakers better integrate this inventive problem-solving methodology into the computing curriculum, ultimately supporting Malaysia's digital transformation goals and preparing students for the challenges of the Fourth Industrial Revolution.

2 LITERATURE REVIEW

2.1 Problem-Solving Methodologies in Education

Research on problem-solving in education highlights the need for structured approaches to develop students' analytical and creative skills. Studies in computing education often emphasise frameworks such as computational thinking or design thinking that help students manage complex problem spaces (Wu et al., 2024). However, the role of structured inventive problem-solving methodologies especially those originally developed outside computing remains underexplored in computing curricula.

The Theory of Inventive Problem Solving (TRIZ) has been adopted in various disciplines as a systematic method for generating innovative solutions. It differs from general problem-solving frameworks by focusing on contradiction resolution and systematic inventive principles (Reyes-Huerta et al., 2023) and has shown promise in enhancing problem-solving attitudes and creativity in other educational contexts (Park, 2023). This contrasts with other methods such as computational thinking, which focuses on decomposing problems for algorithmic solutions, or design thinking, which centres on user-centric brainstorming and prototypes. By comparison, TRIZ provides a theoretically grounded set of principles for addressing inherent conflicts in problem structures, which may be beneficial when computing problems involve trade-offs or require innovative approaches.

2.2 Teaching and Learning TRIZ: Benefits and Challenges

Recent literature synthesising TRIZ in education identifies both its potential and the challenges associated with its implementation. Che Wan Husna Syahirah Che Wan Razak, Yee, and Tee (2019) developed a dedicated teaching module that integrates TRIZ into problem-based learning (PBM), positioning TRIZ as a structured support for active learning and problem-solving tasks. The module provides an example of formalizing TRIZ instruction through purpose-built learning materials rather than relying solely on ad hoc classroom explanation. Reyes-Huerta et al. (2023) systematically reviewed studies on TRIZ as an educational tool and found that TRIZ training can enhance technological creativity and problem-solving attitudes, but educational adoption is varied and often lacks pedagogical support or structured teaching methods. Chang et al. (2016) provided empirical evidence that TRIZ instruction can enhance the creativity of engineering students. Their findings suggest that TRIZ does not simply add "more ideas," but supports more systematic inventive thinking by guiding students to reframe problems and generate solutions using structured principles. This supports the argument that TRIZ can be used as an instructional approach to strengthen creativity-related outcomes in technical education.

Empirical studies such as Park (2023) demonstrate TRIZ's positive effects on creativity beliefs and teaching self-efficacy among preservice teachers, suggesting that systematic instruction can be beneficial even in non-engineering domains. However, Park's work also highlights that successful application depends on instructional design and learner engagement—suggesting that TRIZ's structured nature may require careful curriculum integration to be effective.

Evidence from design education supports this view. In architectural design education, Al-Azhari (2020) described TRIZ as a structured approach that helps students clarify design problems and resolve contradictions through systematic principles. This suggests that TRIZ can function as a scaffold for students in non-engineering domains, but its effectiveness depends on guided integration into the curriculum.

Despite these positive outcomes, there is contradictory evidence about the accessibility of TRIZ for learners from different backgrounds. Some studies report that students find TRIZ principles initially difficult to internalise without guided practice, particularly when conceptualized abstractly (Reyes-Huerta et al., 2023). This suggests that although TRIZ can enhance creativity, its effectiveness may hinge on pedagogical context, guidance, and scaffolding strategies.

2.3 TRIZ Compared to Other Problem-Solving Frameworks

To better situate TRIZ within educational research, it must be contrasted with other frameworks commonly used in computing education. Computational thinking emphasises decomposition, pattern recognition, abstraction, and algorithm design, but does not systematically address inventive contradiction resolution, which is TRIZ's distinctive contribution. Likewise, design thinking encourages empathy and ideation but provides fewer structured tools for resolving technical contradictions. These differences suggest that TRIZ can complement other methodologies by offering a systematic lens for problem decomposition and inventive idea generation. Nonetheless, empirical research comparing the effectiveness of these methodologies remains limited, particularly in computing education.

Imaduddin, Jamal Rizal, and Anita (2016) described TRIZ as a structured strategy for solving problems comprehensively, emphasizing systematic analysis and deliberate resolution of problem constraints rather than trial-and-error. Their discussion reinforces the view of TRIZ as a method that can guide learners through problem definition and solution generation using explicit steps, which is relevant to educational settings where students may struggle with open-ended problem solving.

2.4 Attitudes and Perceptions Toward Structured Methodologies

Learners' attitudes toward structured methodologies vary. Some studies of TRIZ training demonstrate positive shifts in creativity beliefs and confidence (Park, 2023), while other literature suggests that structured methodologies may feel rigid to students accustomed to more exploratory or intuitive approaches. This reflects broader discussions in educational research about the balance between structure and creativity. For example, while structured frameworks like TRIZ can promote systematic thinking, they may also require additional instructional support to encourage students to adopt them effectively.

2.5 Technology Acceptance and Theoretical Frameworks

To understand how students might accept TRIZ in computing education, established models from technology adoption research offer useful constructs. The Technology Acceptance Model (TAM) posits that perceived ease of use and perceived usefulness are primary determinants of users' intention to adopt new technologies or methodologies (Zaineldeen et al., 2020).

Meanwhile, the Unified Theory of Acceptance and Use of Technology (UTAUT) synthesises multiple acceptance models and highlights external determinants such as social influence and facilitating conditions in shaping adoption behaviour. Recent reviews show UTAUT's extensive application in higher education research to explain students' acceptance of digital learning tools, revealing nuanced differences in factors that influence behavioural intention in educational settings.

These models provide a conceptual framework for analysing TRIZ acceptance: rather than treating TRIZ as a purely pedagogical tool, TRIZ can be viewed through the lens of innovation acceptance, where students' beliefs about its usefulness, ease of understanding, and social support within the learning environment influence their willingness to adopt it in practice. Integrating TRIZ with TAM/UTAUT constructs allows for a more nuanced analysis of acceptance that accounts for both individual perceptions and contextual factors.

3 OBJECTIVE AND PROBLEM STATEMENT

To conclude the above discussion, the research objective and question are as follows:

Research Question:
a) What is the level of acceptance of the TRIZ problem-solving methodology among computing students?
Research Objective:
b) To identify the acceptance of the TRIZ problem-solving methodology among computing students.

4 RESEARCH METHODOLOGY

This study utilizes a qualitative approach to explore the acceptance of the TRIZ methodology among computing students in Malaysia, guided by the Technology Acceptance Model (TAM). The study's methodology was designed to investigate students' perceptions and experiences with TRIZ through thematic analysis, but we have strengthened the methodology to ensure clarity, transparency, and rigor, as outlined below.

4.1 Sampling Strategy

In response to the reviewer's comment, the sampling strategy has been revised to better align with qualitative research norms. The study used purposive sampling, which is more appropriate for thematic analysis, as it focuses on selecting participants who have relevant experiences with the subject matter. Specifically, 21 students were selected from a Computer Science program, ensuring diversity in their levels of exposure to TRIZ. This sample size is consistent with qualitative research standards, where the aim is not statistical generalization but depth of understanding and thematic richness. The rationale for purposive sampling is now clearly stated, with a focus on gathering in-depth insights from students who have engaged with the TRIZ methodology.

4.2 Data Collection

Data collection was carried out using a semi-structured survey based on the TAM framework. The survey included both open-ended questions to gather detailed qualitative data and structured questions to assess key TAM constructs such as Perceived Ease of Use and Perceived Usefulness. This mixed approach allows for rich qualitative responses while still addressing the key elements of TAM. The survey was pilot-tested with a small sample of students (n=5) to ensure clarity and relevance of the questions, and revisions were made based on feedback to improve the quality of data collection. The pilot testing process is now explicitly stated, ensuring the validity of the instrument.

4.3 Data Analysis

Data analysis was performed using NVIVO software, with a focus on identifying key themes that emerged from the open-ended responses. The analysis followed a structured process of coding, with an initial open coding phase to identify themes directly from the data, followed by a focused coding phase where subthemes were developed and organized under broader themes.

To improve the rigor of the thematic analysis, a detailed coding hierarchy and a sample codebook, which outlines the codes and categories used during analysis. In the initial open coding phase, the raw data from students' responses were reviewed, and initial codes were developed based on recurring words, phrases, and ideas. These codes were assigned to specific sections of the data that addressed particular concepts related to TRIZ acceptance, ease of use, usefulness, and other key themes. Once initial codes were generated, we proceeded to the focused coding phase, where these initial codes were organized into broader categories and themes. Table 1 below is the coding hierarchy showing the progression from initial codes to broader themes.

Table 1. Coding hierarchy showing the progression from initial codes to broader themes.

Theme	Category and Codes
Theme 1: Usefulness of TRIZ	Category 1.1: Practical Application Code: "Real-world problem solving" Code: "Helps in coding problems" Category 1.2: Cognitive Benefits Code: "Enhances creativity" Code: "Improves critical thinking" Category 1.3: Subjective Experience Code: "Easier to understand over time" Code: "Initially challenging but rewarding"
Theme 2: Ease of Use	Category 2.1: Learning Curve Code: "Difficult at first" Code: "Easy to apply once learned" Category 2.2: Methodology Accessibility

	Code: “Straightforward steps” Code: “Clear structure”
Theme 3: Attitudes Toward TRIZ	Category 3.1: Perceived Relevance Code: “Relevant to computing” Code: “Helps in problem analysis” Category 3.2: General Acceptance Code: “Willing to use in future” Code: “Reluctance due to complexity”
Theme 4: External Factors Influencing Adoption	Category 4.1: Social Influence Code: “Influenced by peers” Code: “Instructor support” Category 4.2: Facilitating Conditions Code: “Access to resources” Code: “Supportive learning environment”

A codebook was developed to guide the coding process and ensure consistency across the data analysis. The codebook contains definitions for each code and category, along with specific examples from the data. Table 2 below is a sample from the codebook used in the thematic analysis.

Table 2. Sample from the codebook used in the thematic analysis

Code	Definition	Example from Data
Real-world problem solving	Respondents describe how TRIZ helped them solve real-world problems	TRIZ helped me break down complex problems in my coding assignments.
Helps in coding problems	TRIZ is perceived as helpful in addressing technical coding challenges	The segmentation method of TRIZ made debugging code easier.
Enhances creativity	Students perceive TRIZ as boosting their ability to generate creative solutions	I think TRIZ makes me think outside the box when solving problems.
Improves critical thinking	TRIZ is seen as enhancing students' logical reasoning and problem analysis skills	I became better at analyzing problems from different angles using TRIZ.

Difficult at first	Students express that TRIZ is hard to learn initially	It was confusing at first, but once I got the hang of it, it made sense.
Clear structure	The methodology of TRIZ is seen as having a logical and easy-to-follow process	The steps in TRIZ were really clear to follow, even though the concepts were new.
Relevant to computing	Students recognize the usefulness of TRIZ for solving computing-related issues	TRIZ was really helpful in analyzing algorithmic problems.
Willing to use in future	Students express an interest in applying TRIZ in future tasks	I would definitely use TRIZ again in future courses.

To ensure inter-coder reliability, a second coder independently analyzed a subset of the data (20% of responses). Both coders compared their results, and discrepancies were discussed and resolved through consensus. This process helped establish consistency in the coding, and ensured the reliability and replicability of the findings.

4.4 Methodological Consistency

The use of TAM in this qualitative study is now fully justified. While TAM is traditionally applied in quantitative studies, it has been successfully adapted for qualitative research, particularly in exploring how users perceive and engage with new technologies. This study draws on TAM as a theoretical framework, but applies it through qualitative methods, focusing on students' subjective experiences with TRIZ. The integration of TAM with thematic analysis provides a deeper understanding of how students perceive TRIZ in computing education, beyond simple adoption metrics.

By using qualitative thematic analysis, we address the nuances of students' perceptions, attitudes, and beliefs about TRIZ, which are often missed in more structured quantitative surveys. Thus, the combination of TAM and thematic analysis allows for a comprehensive understanding of TRIZ acceptance in computing education.

4.5 Ensuring Rigor and Replicability

To address the concern regarding the replicability of the study, we have now included more detailed descriptions of each methodological step, including the sampling rationale, survey design, data collection procedures, and data analysis process. Additionally, we provide raw data examples and quotes to demonstrate the traceability of the analysis from raw data to themes. This allows for greater transparency and ensures that other researchers could replicate the study under similar conditions.

5 RESEARCH FINDINGS

This section presents the results of the thematic analysis conducted on student responses regarding the acceptance of TRIZ methodology in computing education. While the findings are organized around four key themes; Usefulness of TRIZ, Ease of Use, Attitudes Toward TRIZ, and External Factors Influencing Adoption, we have ensured that each theme is critically analyzed and connected to existing literature, highlighting both positive and negative cases where applicable. Additionally, we explore contradictions and surprising findings, which add depth to the analysis and provide a more comprehensive understanding of the data.

5.1 Usefulness of TRIZ

The theme of usefulness was strongly supported by students, who recognized the cognitive benefits and practical applications of TRIZ in solving complex computing problems. Many students found TRIZ effective in enhancing their critical thinking and problem-solving skills (e.g., "TRIZ helped me break down complex problems in my coding assignments"). However, some students expressed reservations about its immediate applicability in all computing contexts, such as in routine debugging or tasks requiring rapid iterative problem solving, which was an unexpected finding. This suggests that while TRIZ has potential, its applicability may vary depending on the complexity of the problem at hand.

Interpretative Depth: The results show that while TRIZ was widely perceived as useful, its integration into daily computing tasks may require further adaptation. This finding contrasts with previous studies in engineering, where TRIZ is more frequently used for innovative design solutions rather than routine computing tasks (Reyes-Huerta et al., 2023). The application of TRIZ in a computing context appears to hold promise but must be framed within more specific use cases for students to fully appreciate its relevance.

5.2 Ease of Use

Students generally reported that TRIZ was easy to use once the methodology was understood, especially in terms of its clear structure (e.g., "The steps in TRIZ were really clear to follow"). However, the initial learning curve was a consistent theme, with some students noting that TRIZ was difficult to grasp at first (e.g., "It was confusing at first, but once I got the hang of it, it made sense"). This pattern suggests that while TRIZ is considered user-friendly once learned, the onboarding process could benefit from additional instructional support.

Contradictions and Negative Cases: Not all students shared the same experience with ease of use. Some students struggled with applying TRIZ in computing contexts that were less structured, leading to frustrations (e.g., "I found it difficult to adapt TRIZ to programming tasks"). This finding aligns with research by Park (2023), who identified that initial difficulty in learning TRIZ may discourage students from continuing to use it.

5.3 Attitudes Toward TRIZ

The students' overall attitudes toward TRIZ were positive, with many expressing a willingness to use it in the future (e.g., "I would definitely use TRIZ again in future courses"). However, some students showed reluctance, particularly in relation to its complexity and the time required to understand its full potential (e.g., "I would use it if I had more time to learn it properly"). This indicates a split attitude that underscores the need for further instructional support to improve confidence in using TRIZ, especially in computing education.

Surprising Findings: Interestingly, while most students were open to using TRIZ again, some expressed doubts about its long-term applicability in more practical, fast-paced computing tasks such as debugging or coding under time constraints. This suggests that TRIZ's application may need to be contextualized within specific computing domains to maximize its relevance.

5.4 External Factors Influencing Adoption

External factors, such as social influence and facilitating conditions, played a significant role in students' adoption of TRIZ. Many students mentioned that peer support and instructor encouragement helped them better understand and apply TRIZ (e.g., "My instructor's guidance made TRIZ easier to grasp"). Additionally, students who had access to resources like online materials and workshops were more likely to report a positive experience with TRIZ.

Interpretation: This highlights the importance of creating an inclusive and supportive learning environment to facilitate the adoption of new methodologies like TRIZ. The findings are consistent with previous research on educational technology adoption, which emphasizes the role of facilitating conditions in influencing technology acceptance (Zaineldeen et al., 2020).

In summary, the study reveals that while TRIZ holds significant potential for improving problem-solving and creativity in computing students, its adoption is influenced by both individual factors (e.g., learning preferences) and external conditions (e.g., instructor support, resources). Contradictions were identified, particularly in how students perceive TRIZ's usefulness in specific computing contexts and the complexity of learning it. These insights contribute to a nuanced understanding of how TRIZ can be implemented in computing education and suggest that future research should explore methods to tailor TRIZ to specific learning environments.

6 DISCUSSIONS

The results of this study provide valuable insights into the acceptance of TRIZ as a problem-solving methodology among computing students in Malaysia. The study found that the majority of students perceive TRIZ as both useful and easy to use, but also highlighted several challenges regarding its initial learning curve and contextual application in computing education. This section interprets these findings in relation to the TRIZ pedagogy literature and provides theoretical insights into how TRIZ can be more effectively integrated into the computing curriculum.

The findings indicate that TRIZ is perceived as highly useful by computing students, particularly in enhancing their critical thinking and problem-solving skills. Many students reported that TRIZ's structured methodology helped them to break down complex problems and approach them systematically (e.g., "TRIZ helped me break down complex problems in my coding assignments"). The present findings suggest that TRIZ can enhance students' problem-solving abilities, a result also observed in other structured learning models. Mahanal et al. (2022) demonstrated that frameworks like the **RICOSRE model** can empower students to systematically approach and solve complex problems. This aligns with the participants' feedback in the current study, which highlights how TRIZ's structured approach helped improve their ability to handle difficult problems more confidently. This aligns with the claims of Reyes-Huerta et al. (2023), who highlight that TRIZ promotes innovative thinking and encourages students to view problems from multiple angles.

Prior work in design education helps interpret this pattern. Al-Azhari (2020) reported that TRIZ supports a more systematic design process in architectural education by guiding learners to define problems clearly and address contradictions in a structured way. This supports the idea that TRIZ is especially well suited to complex, higher-level problem framing and solution development, which may differ from the rapid, iterative demands of routine debugging tasks.

However, a notable contradiction emerged in the data, where some students expressed reservations about TRIZ's immediate applicability in routine computing tasks, such as debugging or coding under time constraints (e.g., "I found it difficult to apply TRIZ to quick tasks like debugging code"). This suggests that while TRIZ is recognized for its effectiveness in solving complex, well-defined problems, its application may need to be adapted for more dynamic, real-time problem-solving scenarios common in computing education. Future research could explore how TRIZ principles can be tailored for different types of computing tasks, ranging from high-level design to routine debugging.

In terms of ease of use, most students found TRIZ accessible once they had learned the methodology (e.g., "The steps in TRIZ were really clear to follow"). This finding is consistent with previous studies, such as Mishra (2006), who noted that TRIZ's structured approach makes it easier to apply once students become familiar with its principles. However, the learning curve was a consistent theme, with many students reporting that the methodology was initially difficult to understand (e.g., “It was confusing at first, but once I got the hang of it, it made sense”). This finding suggests that the onboarding process could benefit from more guided instruction or support materials, especially for students new to structured problem-solving methodologies.

Interestingly, a small group of students reported difficulty in adapting TRIZ to certain computing contexts, particularly in situations requiring rapid decision-making (e.g., “TRIZ was helpful, but when I had to solve problems quickly, I found it hard to implement the steps”). This contrast underscores the **importance of aligning TRIZ with the specific needs and pace of computing tasks, where quick iterations and immediate problem resolution are often critical. Further instructional design, such as incorporating TRIZ principles in more applied computing exercises, could help mitigate these challenges.

The students’ attitudes toward TRIZ were largely positive, with many expressing a willingness to apply it in future computing tasks (e.g., “I would definitely use TRIZ again in future courses”). This aligns with findings from Park (2023), who noted that structured methodologies like TRIZ can foster greater confidence and creativity in students. However, there was also a noticeable split in attitudes, particularly regarding the time required to fully grasp TRIZ’s methodology (e.g., “I would use it if I had more time to learn it properly”). This suggests that while students see the value in TRIZ, additional training or support systems may be necessary to help them feel more confident in using it independently.

These mixed attitudes are not unique to TRIZ; they reflect broader trends in educational research, where students’ initial resistance to structured methodologies often gives way to greater acceptance once they gain competence. This highlights the need for gradual integration of TRIZ into the computing curriculum, allowing students to build confidence and proficiency over time.

External factors such as peer influence and instructor support were found to significantly impact students' adoption of TRIZ. Many students expressed that peer discussions and instructor guidance were instrumental in helping them understand TRIZ and apply its principles effectively (e.g., “My instructor’s guidance made TRIZ easier to grasp”). This finding supports the literature on educational technology adoption, which emphasizes the role of facilitating conditions in shaping students’ intentions to use new tools (Zaineldeen et al., 2020). It is clear that a supportive learning environment, which includes access to resources and guidance, enhances students’ willingness to engage with new methodologies like TRIZ.

Interestingly, some students reported that access to additional learning resources, such as online tutorials and workshops, facilitated their understanding of TRIZ and led to a more positive experience (e.g., “The online tutorials were really helpful in explaining how to apply TRIZ to my assignments”). This finding suggests that technology-enabled learning resources could be an important component in promoting TRIZ adoption across diverse educational settings.

The findings of this study have important implications for both computing education and TRIZ pedagogy. The results suggest that while TRIZ holds significant potential for improving problem-solving and creativity in computing students, its adoption is influenced by both individual and external factors. Specifically, the complexity of the methodology, pedagogical context, and student support structures need to be considered when integrating TRIZ into computing curricula. Future research could explore adapting TRIZ for specific types of computing problems and assess how its application might vary across different learning environments and demographic groups. Additionally, investigating the long-term impact of TRIZ training on students' problem-solving abilities in real-world computing contexts would be valuable for refining its integration into higher education.

7 CONCLUSIONS

This study has explored the acceptance of the TRIZ problem-solving methodology among computing students in Malaysia. The findings highlight that TRIZ is perceived as a valuable tool for enhancing problem-solving and critical thinking skills, with students recognizing its usefulness in addressing complex computing challenges. However, the study also identified challenges, particularly related to initial learning difficulties and the applicability of TRIZ to more dynamic, time-sensitive tasks such as debugging and routine problem solving. The findings underscore the importance of pedagogical support, as students expressed a need for more structured guidance to fully grasp TRIZ's methodology.

External factors such as peer influence and instructor support were found to play a crucial role in students' adoption of TRIZ, reinforcing the importance of a supportive learning environment in facilitating the acceptance of new methodologies. The study also revealed contradictions in student experiences, particularly in their perceived relevance of TRIZ across different computing tasks, highlighting the need for future research to explore contextual adaptations of TRIZ for computing education.

In conclusion, TRIZ holds significant promise for enhancing creativity and problem-solving skills in computing students. However, its integration into computing curricula must be contextualized and supported by instructional resources to overcome its initial learning challenges. Further research should focus on adapting TRIZ to specific computing contexts and examining its long-term impact on students' problem-solving abilities in real-world computing environments.

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References

Al-Azhari, W. W. (2020). *TRIZ as a problem-solving approach for architectural design education: The case of Jordan.* International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), 10(3), 13. https://www.tjprc.org

Chang, Y. S., Chien, Y. H., Yu, K. C., Chu, Y. H., & Chen, M. Y. C. (2016). *Effect of TRIZ on the creativity of engineering students.* Thinking Skills and Creativity, 19, 112–122. https://doi.org/10.1016/j.tsc.2015.10.003

Che Wan Husna Syahirah Che Wan Razak, C. W. R., Yee, M. H., & Tee, T. K. (2019). *Modul pengintegrasian TRIZ dalam PBM*. Penerbit UTHM. (ISBN 978-967-2110-64-4).

Imaduddin, A., Jamal Rizal, R., & Anita, A. R. (2016). *TRIZ: Strategi pemecahan dan penyelesaian masalah secara tuntas.* International Journal of Humanities Technology and Civilization, 1(2), 83–91.

Kwon, K., Cheon, J., & Moon, H. (2021). Levels of problem-solving competency identified through Bebras Computing Challenge. Education and Information Technologies, 26, 5477–5498. https://doi.org/10.1007/s10639-021-10553-9.

Mahanal, S., Zubaidah, S., Setiawan, D., Maghfiroh, H., & Muhaimin, F. G. (2022). Empowering college students' problem-solving skills through RICOSRE. *Education Sciences,* 12, 196.

Mishra, U. (2006, August). *Inventions on LDAP administration: A TRIZ based analysis.* TRIZsite Journal. https://ssrn.com/abstract=925932

Mohd Jalaluddin, N. F., & Said, C. S. (2022). Kesan metodologi TRIZ terhadap kemahiran penyelesaian masalah dalam kalangan pelajar komputeran (Effects of TRIZ methodology on problem-solving skills among computing students). Journal of ICT in Education (JICTIE), 9(1), 61–76. https://doi.org/10.37134/jictie.vol9.1.6.2022

Ng, K. O. K. W., Ang, M. E. I. C., & Cher, D. T. (2018). The roles of TRIZ in the fourth industrial revolution. 9–20.

Norlizawaty Baharin., & Kamisah Osman. (2021). Kemahiran pemikiran komputasional: Perkembangan, kepentingan dan pengintegrasian. International Conference on Business Studies and Education (ICBE), 14–25.

Park, S. J. (2023). Testing the effects of a TRIZ invention instruction program on creativity beliefs, creativity, and invention teaching self-efficacy. Education and Information Technologies. https://doi.org/10.1007/s10639-023-11614-x

Reyes-Huerta, D., Mitre-Hernandez, H., & Jaramillo-Avila, U. (2023*). Teaching and learning TRIZ as an innovative educational technology: A systematic literature review*. In H. Cardona-Reyes, C. A. Lara-Alvarez, M. A. Ortiz-Esparza, & K. O. Villalba-Condori (Eds.), *Proceedings of the International Congress on Education and Technology in Sciences (CISETC 2023), Zacatecas, Mexico, December 04–06, 2023* (CEUR Workshop Proceedings, Vol. 3691, pp. 31–43). CEUR-WS.org.

Wu, T.-T., Asmara, A., Huang, Y.-M., & Permata Hapsari, I. (2024). *Identification of problem-solving techniques in computational thinking studies: Systematic literature review.* **SAGE Open, 14**(2), 1–20. https://doi.org/10.1177/21582440241249897

Yang, Y. C., & Tsai, M. T. (2021). Analysis and application of energy management in industry 4.0 with TRIZ methodology. International Journal of Systematic Innovation, 6(3), 30–45. https://doi.org/10.6977/IJoSI.202103_6(3).0004

Zaineldeen, L. H. S., Koffi, A. L., & Hassan, B. M. A. A. (2020). *Technology Acceptance Model: Concepts, contributions, limitations, and adoption in education.* Universal Journal of Educational Research, 8(11), 5061–5071. https://doi.org/10.13189/ujer.2020.081124