JTH

https://jthkkss.com/
e-ISSN 2805-4431
DOI: https://doi.org/10.53797/jthkks.v6i2.6.2025

The Needs Analysis for Developing TRIZ-GP Module in Creativity and Innovation Courses at Malaysian TVET Institutions

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Received 13 November 2025; Accepted 27 November 2025; Available online 01 Dec 2025

Abstract: The purpose of this study was to determine whether TRIZ-GP modules should be developed for use in creativity and innovation courses in TVET institutions in Malaysia. To improve the effectiveness of teaching and learning, this module is proposed as a pedagogical intervention that combines inventive problem-solving strategies with student learning choices. Five experts with extensive experience in TVET, curriculum and pedagogy of creativity and innovation participated in structured interviews as part of the study's qualitative methodology. The thematic analysis of interview transcripts had four main goals: (i) students' challenges in developing inventive problem-solving skills; (ii) the significance of identifying learning styles as entry points to cognitive processes; (iii) the role of inventive problem-solving skills as a crucial part of the Creativity and Innovation course; and (iv) the necessity of TRIZ-GP integrative modules to support lectures and boost student confidence. According to the study's findings, students still struggled to use organized mental processes, were terrified of making mistakes, and frequently turned to the student workers for assistance. In addition to supporting TRIZ theory and experiential learning, the TRIZ-GP module has the potential to be a cutting-edge pedagogical model that advances Malaysia's national TVET agenda by turning out graduates who are creative, competitive, and prepared to take on the challenges of the Industrial Revolution 4.0.

Keywords: TRIZ, inventive problem-solving, learning style, creativity and innovation, TVET

1. Introduction

Producing graduates who are not only technically proficient but also imaginative, resourceful, and able to solve creative challenges methodically is now a major challenge for Malaysia's technical and vocational education (TVET). While creativity and innovation courses are sometimes considered a place to teach students how to think for themselves, the truth is that students still struggle with an organized approach to problem-solving. They often rely on the examples provided by lecturers, struggle to recognize the functional components of the system, and are afraid of making mistakes. According to a recent meta-analysis, students' creativity is directly influenced by problem-solving-based pedagogy; however, the effectiveness of this approach varies depending on the learning style and teaching situation (Zhan et al., 2024).

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Altshuller (1996) developed the Inventive Problem-Solving Theory (TRIZ), which has gained international recognition as a methodical approach to resolving design and technical disputes. According to recent research, flipped learning and the integration of TRIZ with STEM enhance both students' creative thinking and the efficacy of instruction (Yıldırım, 2023). According to Adunka (2023), TRIZ is really being considered as a source for future educational tools, including interaction with AI. The current TRIZ module places less emphasis on integrating students' learning styles as the foundation of teaching and more emphasis on technical factors and product creation. According to Souchkov (2023) and CEUR (2023), this difference causes learning results to become disproportionate and makes it harder for students to engage fully.

The TRIZ-GP module is suggested as a pedagogical intervention to address these issues by fusing students' learning styles with creative problem-solving techniques. TRIZ-GP adapts tasks to the student's visual, analytical, or experiential tendencies while emphasizing staged cognitive processes, reflection, and the bravery to fail, in contrast to typical interventions that focus on creative theory or technical training. Because of its distinctiveness, TRIZ-GP is not only a technical instrument but also a customized learning strategy that may help TVET students become more resilient, self-reliant, and confident. To develop graduates who are creative, competitive, and prepared to take on the difficulties of the complex workplace, TRIZ-GP aligns with both Malaysia's national TVET strategy and the requirements of the Industrial Revolution 4.0.

This study is distinct due to the suggested integrated strategies. The TRIZ-GP module introduces the idea of innovative challenges and adapts instructional strategies to suit students' chosen learning styles. This approach places greater emphasis on learning via reflection, openness to fail, and staged cognitive processes than traditional techniques that are more theory focused. Furthermore, the study relates to the demand of sectors that want graduates who are competitive in an innovation-based economy due to its focus on TVET settings. The importance of TVET as a major force in the Industrial Revolution 4.0 period is also highlighted by the recent changes to Malaysia's education policy (TVET Madani, 2024; Star, 2024; DOSM, 2025). In addition, the effectiveness of industry-based strategies is demonstrated by the employment rate of TVET graduates which reached over 97% by 2024 (Bernama, 2025). The TRIZ-GP module has the potential to be a cutting-edge pedagogical model that can be incorporated into the Malaysian and Asian TVET curriculum, supporting the country's goal of enhancing technical and vocational education.

2. Literature Review

2.1 TRIZ in TVET Education

Altshuller (1996) created Inventive Problem-Solving Theory (TRIZ), which has long been recognized as a methodical approach to inventive problem-solving. TRIZ is gaining prominence in educational settings for its ability to teach students how to solve complex issues that have contradictions rationally and artistically. According to research by Mann (2007), TRIZ offers an organized framework that can be used in several domains, such as product innovation and technical design. According to a recent study, incorporating TRIZ into STEM and TVET education improves students' ability to recognize conflicts and creatively develop inventive solutions (Yıldırım, 2023). In fact, TRIZ is now seen as a source of instruments for future education, including integration with artificial intelligence, according to the ITC 2023 study (Adunka, 2023; Souchkov, 2023). This shows that TRIZ is important as a pedagogical approach in technical and vocational education as well as relevant in industry.

2.2 Learning Style

The effectiveness of teaching in creativity and innovation courses, largely depends on how well the technique fits into the student's learning style. According to Kolb's (1984) experiential learning theory, students learn through cycles of active exploration, abstract conceptualization, reflection, and concrete experiences. According to Kleinheksel et al. (2023) and Kolb and Kolb (2021), the level of engagement and understanding increases dramatically when teaching tactics are tailored to students' learning styles. According to Mainemelis, Boyatzis, and Kolb (2002), students who are aware of their learning style in TVET are more confident and able to make connections between theory and real-world applications. Therefore, TRIZ-GP modules that combine inventive problem-solving methods with learning styles have the potential to increase the effectiveness of holistic learning.

2.3 Inventive Problem-Solving as a Core Skill

Inventive problem-solving abilities are considered important in technical education because they help students think analytically, reflectively, and creatively and critically. According to a meta-analysis by Zhan et al. (2024), problem-solving-based pedagogy directly influences students' creativity, although its effectiveness varies depending on the teaching environment. According to Fraenkel et al. (2019), students in TVET who do not acquire these abilities often lose motivation and are completely dependent on instructors. However, students who are instructed using structured methods likes TRIZ are better equipped to deal with complex workplace difficulties (Zakri et al., 2018). As a result,

inventive problem-solving is essential for Creativity and Innovation courses as well as for the advancement of technical and professional skills.

2.4 Malaysian TVET and TRIZ-GP Module Requirements

TVET is now a national priority in Malaysia to create a workforce that can compete in the fourth industrial revolution. Official estimates indicate that by 2024, the employment rate of TVET graduates will exceed 97%, proving the efficacy of industry-based strategies (Bernama, 2025). However, a crucial challenge is making sure that students are not only technically proficient but also capable of unique problem-solving and creative thinking (TVET Madani, 2024; Bintang, 2024). The study's suggested TRIZ-GP module may function as an instructional intervention that promotes goals. By fusing innovative problem-solving techniques with students' learning goals, these modules improve teaching efficacy and aid in the development of TVET curriculum that are more pertinent to the demands of the future industry (DOSM, 2025).

3. Methodology

Expert opinions on the necessity of developing TRIZ-GP modules for the Creativity and Innovation course at Malaysian TVET institutions were investigated in this study using a qualitative methodology through structured interviews. Because they enable methodical investigation of intricate educational issues while preserving participant comparability, structured interviews were used (Cohen et al., 2018). When researchers want to investigate complex educational phenomena including social interaction and learning experiences, a qualitative approach is useful (Creswell & Poth, 2018). Participants who genuinely fit the criterion of "expert" are chosen via purposeful sampling. According to this study, an expert is someone who has taught or developed TVET curricula for at least five years, is directly involved in the creation of creative and innovative modules or pedagogy, and has been recognized professionally through publications, training sessions, or leadership roles in curriculum development. Professional networks, institutional recommendations, and direct invitations to those who are known to be involved in the area are used to find participants. Five experts in all consented to take part in the study; despite this small number, it was deemed adequate because qualitative research prioritized the depth of data above its breadth (Patton, 2015). According to Nowell et al. (2017), topic saturation was reached when no new themes surfaced after the fifth interview, suggesting enough participants for the study's scope.

Interviews last between thirty-five and forty-five minutes and are performed both in-person and virtually. With the participants' permission, all sessions are videotaped and verbatim transcribed. There is complete adherence to ethical standards such voluntary involvement, informed consent, and secrecy (Noble & Smith, 2015). A theme analysis approach based on Braun and Clarke's (2021) six-phase framework was utilized to analyze the data. While deductive components were employed in accordance with Kolb's experiential learning framework and the TRIZ theory, inductive coding was utilized to record the participants' actual experiences. Transcripts are used to create the initial code, which is subsequently merged into more general categories including module needs, learning styles, and student problems. The primary researcher completes the coding process, which is then examined by another coder to ensure consistency. Any differences are addressed until an agreement is reached. A few steps are taken to guarantee reliability, such as member checking with participants to confirm the results, keeping an audit trail to document the outcomes of coding and theme development, holding discussion sessions with curriculum experts to review interpretations, and creating thorough context descriptions and participant profiles so that readers can evaluate the findings' applicability in different contexts. This approach ensures that the study's findings are authentic, reliable, and truly based on expert perspectives, while maintaining alignment with TRIZ theory (Yıldırım, 2024; Tee et al., 2025) and experiential learning principles (Kolb, 1984; Kolb & Kolb, 2021).

4. Study Findings

Based on the study's objectives; identifying students' difficulties with creative problem-solving, evaluating the significance of learning styles, and evaluating the requirements of the TRIZ-GP module. Structured interview tools were created. "*What are the main issues that students face in the Creativity and Innovation course?*" is an example of how interview questions are crafted to align with these goals. In keeping with the goal of recognizing obstacles, "*Is learning style important in developing inventive problem-solving skills?*" (consistent with the goal of evaluating learning styles), and "*Is it appropriate for modules that combine TRIZ with learning styles to be developed?*" (in keeping with the goal of evaluating the module's needs). Curriculum specialists examine the instruments to assure their validity, and two researchers' cross-code review and member checking method increase their dependability.

4.1 Question 1

What are the common issues that students face when studying the Creativity and Innovation course? Are inventive problem-solving abilities difficult to master?

Expert	Expertise Answers
P1	*"I've observed that even when students have ideas, sometimes it's weird, they get stuck when we ask them to address real problems, even basic ones. They don't seem to know where to start. They can't answer questions like "Why is this idea appropriate?" and "How to implement it?" Therefore, I believe they need proper*

Expert	Expertise Answers
	guidance on how to think step by step. In my opinion, an attempt to resolve this issue is more important than just contemplating without taking any action."
P2	*"They are not used to thinking in conflict, which is a major problem. Conflicting issues easily become difficult when we talk about them. They tend to wait for lecturers' ideas before starting to create them. This habit makes them feel at ease. Because our educational system is overly preoccupied with finding the correct answers, they are frightened to make mistakes. I try to support them in making mistakes and then growing from them. However, they remain afraid because they believe it is a mistake. In the meantime, we need to be brave enough not to learn."*
P3	*"When asked to come up with inventive problem-solving, many students become anxious. " Is my idea correct?" is the question they ask again. "Are there any examples?" They feel safer when they rely on example. This suggests that they are still unfamiliar with open design methodologies. They seek a safe answer rather than taking risks. Overcoming creative obstacles calls for a blend of intellectual, affective, and introspective abilities. If there are instructional resources that provide a detailed explanation of the procedure, I believe they can get better.*
P4	*"The word "Creativity" makes this subject seem simple to many students. However, they understand that solution design calls for discipline. They must comprehend the problems, be knowledgeable about the technical aspects, and come up with logical solutions. I believe that they require appropriate, step-by-step assistance. It's still challenging for me to describe the process because there aren't enough tools to demonstrate how to learn creatively."*
P5	*"There are still students who still don't know what inventive problems are. It sounds funny, but the reality is that they treat inventive problems as common problems. When we say, 'solve the problem', they ask again 'What problem?'. They require staged training with a clear context. If given the freedom to think and try, I see that even weak students can succeed. But there must be a way. We just need to create a safe environment for them to experiment and learn from mistakes."*

4.2 Question 2

Is it important to identify learning styles to help students and lecturers develop problem-solving abilities in creativity and innovation?

Expert	Expertise Answers
P1	*"I think it is very important to identify students' learning styles, especially in creativity and innovation courses. It is illogical if we assume that all students learn in the same way. Some like to see first, some keep trying. When we know their style, we can modify the activities so that they are easier to understand and they are more confident. If we force them to follow only one way, they feel depressed. But when given the opportunity to follow their own style, they're more willing to try."*
P2	*"For me, the learning style is the gateway to students' thinking. If we know it's difficult, we can give them time to reflect and write. If they're active, we give them space to create and chat. Students must be aware that different people have different ways of solving problems. When they are aware of their style, we can help them develop strategies according to their strengths. This is important to support the holistic development of students."*
P3	*"If only I knew every type of fighter; students' teachings, I could shape activities accordingly. For example, I give sketches to visual students, data to analytical students. They will struggle if they don't fit our style. Understanding their style is therefore crucial. Pupils who are aware of how they learn are more self-assured and pick up information faster. Additionally, the modified approach lessens reliance on instructors."*
P4	*"Many students don't even know their learning style. When we do reflection exercises, they realize 'Oh, I like to learn by example first' or 'I understand better when I do it myself'. When they are aware of their style, they learn more efficiently and confidently. Lecturers can also design exercises that are more relevant and less generic. I believe students can take charge of their education when they are aware of their own learning styles."*
Pg5	*"I consider determining the learning style of students as the first step before we help them develop any type of skills, including problem-solving skills. If we don't know how they learn, we might give them activities that they don't understand. But when we know, we can adjust the approach. I've seen passive learners become active when we adapt to their style. So, for me, this is the basis before we start any instruction."*

4.3 Question 3

Do inventive problem-solving abilities play an important role in the Creativity and Innovation course?

Expert	Expertise Answers
P1	*"I think this capability is very important. If students can't identify issues and come up with workable solutions, their ideas are just wishful thinking. Many students can give a 'wow' suggestion, but when asked 'How to do it?' they are silent. So, they need instructions to think in stages. Creativity is not only an interesting concept, but it must be used to address practical issues."*
P2	*"Every student has potential, but they lack confidence. Their first question when asked to come up with something inventive is 'Is my idea correct?' or 'Is there an example?'. They only rely on examples because they are terrified of being mistaken. I believe a creative approach to problem-solving can help them feel more confident. This ability encompasses not just reasoning but also emotions and self-reflection. Students are more eager to attempt new things when they possess these abilities."*
P3	*"Students frequently inquire, "Which step comes first?" or "Is there an example response?" When challenged to formulate or resolve conflictual situations once more, they flee. They're not accustomed to free thought. As a result, it's critical to educate kids to identify the problem, dissect it into its component elements, and consider alternative solutions. They can adjust to the circumstances when they possess these abilities. Instead of being bought off with answers, lecturers may concentrate on critical thinking."*
P4	*"Students must comprehend the problems, be conversant with the technical aspects, and come up with logical answers in this course. They just obey directions without considering their significance if they lack this capacity. When they can see problems, conduct analysis, and find viable solutions, they are considered mature. Lecturers can also focus on enrichment, not repetition."*
P5	*"When asked to think 'outside the box', students find it difficult. They have an idea, but they don't know how to test it. They are still not familiar with the design phase. Modules that teach them to recognize issues, values, and develop solutions are very beneficial. The structured process also helps the lecturer to see the student's progress. Without these skills, students only learn to complete the course, not to solve real problems."*

4.4 Question 4

Are teaching modules that emphasize the integration of inventive problem-solving techniques and learning styles appropriate to develop?

Expert	Expertise Answers
P1	*"I think modules that integrate inventive problem-solving techniques with learning styles are necessary. The reason is, our students have different ways of learning, some like visuals, some like to think first before acting. If there was a module that could teach them to think in phases while knowing their own style of thinking, that would be very helpful. We cannot assume that all students learn in the same way. Modules like these can be useful tools for students and lecturers alike, as they facilitate the planning of more relevant activities."*
P2	*"I think this type of module is indeed worth developing. This will help them not only understand the concept but also apply it to practical issues. I think students get more confident when they see that their style is appreciated. Because the module format aligns with the students' cognitive processes, lecturers also find it easier to track their development. These kinds of modules not only help students, but they also make it simpler for instructors to design engaging lessons."*
P3	*"It will be challenging for pupils to comprehend the creative problem-solving approach we teach if they are unaware of how they learn. Thus, I think that this kind of module might serve as a helpful guide for both instructors and students."*
P4	*"I think problem-solving and learning styles are two really important elements. It aids lecturers in creating more relevant course plans in addition to helping students better understand themselves. Many kids don't know what their unique style is, so when we teach them how to think rationally and creatively while also helping them identify it, they become more self-assured. Integrative modules like this are indeed interesting and should exist."*
P5	*"So, for me, a module that combines inventive problem-solving techniques with a learning style is not only important, but a must in a course like this. Students become more confident; lecturers are more comfortable*

Expert	Expertise Answers
	monitoring progress. Modules like this can help students who are constantly struggling when asked to find solutions, as they teach them to think in phases while knowing their own learning styles."

The study's objectives, sample interview questions, and the topics of the data analysis's findings are all directly related to each other in table 1 that follows. This arrangement seeks to demonstrate how the interview instrument is genuinely in line with the study's goals and to guarantee that every question advances the research objective. In this manner, the reader may evaluate the precision of the instrument's design, see the coherence between the goals and the results, and comprehend how the key topics are combined from the perspective of an expert.

Table 1: Table of Matching Objectives, Questions, and Findings Themes

Study Objectives	Sample Interview Questions	Findings Theme
Identify students' challenges in learning inventive problem-solving	"What are the main issues that students face in the Creativity and Innovation course?"	Students find it difficult to start the process, are afraid of making mistakes, rely too much on lecturers → need structured training and a safe environment
Assess the importance of learning styles in improving teaching effectiveness	"Is learning style important in developing inventive problem-solving skills?"	Learning style as a cognitive entrance; students are more confident when their style is recognized; Reflection helps self-awareness
Assess the role of inventive problem-solving skills in the Creativity and Innovation course	"Are inventive problem-solving skills important in this course?"	Without these skills, students' ideas remain abstract; Need a phased process for problem analysis and practical solutions
Determine the requirements of TRIZ-GP modules that combine learning styles and problem-solving strategies	"Is it appropriate for modules that combine TRIZ with learning styles to be developed?"	All experts support integrative modules; increase student confidence, facilitate lecturers to plan relevant activities, the basis of teaching

5. Discussion

Research results show that students often struggle to recognize the functional elements of the system, understand the structure of the problem, and develop rational solutions. According to previous research, technical students often find it difficult to deal with open problems that do not have a single solution (Zakri et al., 2018). Students' fear of making errors is also influenced by a learning culture that places more emphasis on right answers than critical thinking (Zhan et al., 2024). In addition, Altshuller (1996) and Mann (2007) claim that TRIZ is an instructional tool that may assist students in identifying discrepancies and developing creative, logical solutions to problems. TRIZ-GP modules must give experience-based and staged training top priority to overcome this flaw.

Every expert also stressed the significance of learning style as a cognitive doorway. Critical conversations must acknowledge that identifying learning styles has ramifications for TVET curriculum design in addition to boosting students' self-esteem. In addition to supporting Kolb's idea of the cycle of experience, reflection, conceptualization, and active exploration, the TRIZ-GP module makes teaching more inclusive if it effectively blends problem-solving techniques with learning styles. To put it another way, these courses can help students become less reliant on lecturers as they study using methods that fit their own cognitive preferences.

A deeper examination of the importance of creative problem-solving abilities in the Creativity and Innovation course is also necessary. Experts concur that this capacity is crucial, but critical conversations reveal that it is necessary for students to be able to translate abstract concepts into workable solutions. Courses that lack these abilities only result in students who can "think outside the box" but are unable to test or put their ideas into practice. With its focus on staged and reflective processes, TRIZ-GP may serve as a link between creativity and real-world application, satisfying the expectations of a market that seeks graduates who are both innovative and competitive.

The suggested TRIZ-GP module was created as an educational intervention that integrates students' learning style with the ideas of Inventive Problem-Solving Theory (TRIZ). The purpose of this module, which was created especially for TVET Malaysia's Creativity and Innovation course, is to help students solve creative challenges in an organized manner while tailoring the exercises to their own cognitive preferences. This module's content presents the fundamental ideas of TRIZ, including how to recognize conflicts, use creative principles, and employ phased exercises to generate original and useful solutions. By offering visual exercises like mind maps and sketches, analytical exercises like data analysis and technical scenarios, experiential exercises like small experiments or industrial projects, and reflective exercises like journal writing and group discussions, the module simultaneously incorporates a learning style approach. This program is divided into four key sections: learning style awareness and introduction, staged TRIZ training, activity integration based on learning styles, and reflection and outcome evaluation.

This approach is consistent with current research demonstrating that incorporating TRIZ into pedagogy can increase the efficacy of learning. For instance, Yıldırım (2024) shown that TRIZ-STEM in the flipped learning paradigm enhances instructors' capacity for creativity and problem-solving. In a similar vein, Tee et al. (2025) discovered that creative problem-solving techniques in project-based learning (PBL) boost Malaysian TVET students' self-esteem. Additionally, a systematic evaluation by Reyes-Huerta et al. (2023) highlights the pedagogical difficulties of TRIZ and the necessity of creative modules that blend creative approaches with learning styles. Together, these TRIZ-GP modules give instructors more pertinent and adaptable teaching resources while also assisting students in developing self-assurance, the bravery to fail, and the capacity for methodical thought. TVET graduates that are more creative, self-reliant, and prepared to take on the difficulties of the Industrial Revolution 4.0 are anticipated to support Madani's TVET agenda and the demands of the future industry.

Lastly, the unanimity among experts about the necessity of the TRIZ-GP integrative module demonstrates that, in the context of Malaysian TVET, it is an urgent requirement rather than merely an addition to the curriculum. Experts may have somewhat different priorities, but this does not negate the necessity of the module. This demonstrates that TRIZ-GP has the potential to develop into a new pedagogical model that supports Madani's TVET program and helps graduates be ready for the challenges of the fourth industrial revolution. This curriculum aims to develop students who are more introspective, brave to fail, and capable of methodically solving challenging tasks by fusing TRIZ theory with learning styles.

6. Conclusion

The findings of the five experts indicate that students still struggle with creative problem-solving processes, over-reliance on lecturers, and lack confidence to try alternative solutions; all experts concur that learning styles need to be integrated with problem-solving strategies to increase the effectiveness of teaching. These findings highlight the potential of the TRIZ-GP module as a pertinent pedagogical intervention in the Creativity and Innovation course at TVET Malaysia. However, this conclusion should be interpreted cautiously because the study's scope is restricted to qualitative interviews with a small number of participants. As a result, the effects discussed are preliminary in nature and are not universal to the entire TVET system or national workforce readiness in the Industrial Revolution 4.0. Therefore, before the TRIZ-GP module is suggested as a national strategy, more studies with a larger sample, directly involving students and lecturers, and using mixed methods are required to validate its effectiveness in a broader context.

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