SCIENTIFIC CULTURE
www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 4, (2026), pp. 7594-7600
Open Access. Online & Print

DOI: 10.5281/zenodo.12426766

THE INFLUENCE OF CREATIVE PROBLEM SOLVING LEARNING STRATEGY ON PROCEDURAL AND COMMUNICATION SKILLS IN PATIENT SAFETY EDUCATION

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Received: 18/09/2025
Accepted: 15/01/2026

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ABSTRACT

This study examined how students' procedural and communication skills in patient safety education were influenced by Creative Problem Solving (CPS) and learning autonomy. Undergraduate healthcare students were divided into groups based on their level of autonomy and were given either CPS training or traditional problem-solving training. The study used a quasi-experimental 2x2 factorial design. Validated tools for procedural and communication skills were used to collect data, and MANOVA was used to analyze the results after the assumptions of normality and homogeneity were tested. Compared with conventional methods, the results showed that CPS significantly improved procedural and communication skills. Furthermore, while procedural performance was not affected, communication skills were significantly influenced by learning autonomy. There was no clear relationship between the strategy and autonomy. These results suggest the strategic use of learner autonomy support and the integration of CPS in healthcare education as a means to improve safety competencies.

KEYWORDS: Creative Problem Solving, Learning Autonomy, Procedural Skills, Communication Skills, Patient Safety, Health Education.

1. INTRODUCTION

According to the World Health Organization, one in ten patients in wealthy countries is injured while receiving hospital care, making patient safety a critical concern in healthcare systems worldwide. Many of these adverse outcomes are avoidable and often stem from poor communication or incorrect implementation of procedures. Educational institutions must adapt by incorporating critical safety competencies such as proper procedures and effective communication into their curricula as healthcare becomes increasingly complex. The extent to which the learning process actively and meaningfully engages students is a key determinant of the success of these educational initiatives. This change requires teaching approaches that support student ownership of their education, creativity, and critical thinking. Autonomous learning encourages a self-directed approach to lifelong learning, while Creative Problem Solving (CPS) is a technique that encourages students to approach problems with inventive and introspective thinking. When combined, these tactics have the power to transform students' attitudes about learning as well as what they learn.

In the specific context of patient safety education, a crucial part of healthcare professional training, this study aims to investigate the combined and individual effects of CPS (Clinical Procedures/Critical Patient Safety) and learning autonomy. It is hoped that the results will provide empirical support for curriculum reforms aimed at enhancing student competency and improving the quality of healthcare services.

2. LITERATURE REVIEW

2.1 Creative Problem Solving (CPS) in an Educational Context

The CPS model is a dynamic learning approach that includes the phases of problem definition, idea generation, idea development, and execution. This model was originally proposed by Osborn and later refined by Parnes and Treffinger. Because it combines convergent thinking (selecting the best applicable idea) and divergent thinking (generating multiple ideas), CPS is highly flexible in various learning contexts.

CPS has been shown to increase student engagement, foster creativity, and enhance problem-solving skills in the classroom. Research shows that CPS improves students' ability to collaborate, understand complex problems, and generate creative solutions (1). Because CPS aligns with real-world clinical situations that require structured yet adaptable responses, this model is highly relevant to healthcare education.

2.2 CPS and Procedural Skill Development

In the healthcare industry, procedural skills are crucial for work that must be completed accurately, consistently, and according to established norms. By enabling students to see errors, understand the rationale behind processes, and iterate on solutions, CPS offers a framework for developing these skills. Skill mastery and experience enhance self-efficacy and the learning experience(2). One study found that CPS significantly improves procedural understanding and application in a simulated setting (3).

Furthermore, CPS assignments often incorporate concepts from experiential learning theory through scenario-based learning and hands-on practice. These situations force students to make choices under pressure, reinforcing the stages of the process and fostering flexibility, a crucial skill in clinical settings.

2.3 CPS and Communication Skills Development

One of the main reasons for medical errors is poor communication. By promoting cooperative problem-solving and thoughtful discussion, CPS can reduce this risk. Students collaborate in groups, explain their thinking, defend their decisions, and discuss opposing viewpoints during CPS exercises. This procedure enhances empathy, active listening, verbal and nonverbal communication, and confidence in expressing opinions.

Students participating in CPS-based learning demonstrate increased clarity and confidence in their clinical communication (4). These skills are crucial in multidisciplinary healthcare teams when accurate and timely communication of information is essential.

2.4 Learning Autonomy in Higher Education

Constructivist thinkers such as Vygotsky and Knowles have placed strong emphasis on learning autonomy, the capacity to direct one's own learning process. Autonomous learners choose materials, set goals, manage their time, and assess their own progress. Autonomy in professional education equips students for lifelong learning, which is especially important in rapidly changing professions such as nursing and medicine.

Research shows that learning autonomy increases motivation, improves academic achievement, and enhances adaptability to new

learning contexts. Furthermore, metacognition and critical reflection two essential components of professional competence are more likely to be practiced by autonomous learners (5).

2.5 The Role of Learning Autonomy in Patient Safety

Autonomy is crucial in patient safety education because it helps students understand and internalize the rationale behind actions rather than simply following directions. When a process deviates from the norm, a learner with high autonomy is more likely to ask questions, identify potential risks, and take control.

In clinical simulations, self-directed learners have been shown to outperform their peers (6). They often demonstrate faster reaction times and more effective communication under pressure. This implies that autonomy is a protective factor in actual clinical performance as well as a desired educational goal.

2.6 The Interaction Between CPS and Learning Autonomy

By requiring students to make their own decisions, assess outcomes, and consider their own learning processes, CPS naturally fosters autonomy. Students with high levels of autonomy can engage more fully with each phase of CPS, using their self-regulation capacities to improve their procedural and communicative skills.

However, some research cautions that children with low autonomy may struggle to fully benefit from CPS (Children's Psychological Skills) without adequate support. This suggests that directed instruction and autonomy support need to be balanced, a notion reinforced by Vygotsky's zone of proximal development.

By empirically investigating how CPS and autonomy interact to influence procedural and communication skills in the context of patient safety training, this study adds to the existing body of knowledge.

3. METHODOLOGY

3.1 Research Design

This study used a 2x2 factorial model within a quasi-experimental research approach. The learning approach (creative versus traditional problem-solving) and the level of student learning autonomy (high versus low) were the two independent factors. This design allowed the researcher to examine not only the individual effects of each independent variable but also their interaction on two dependent variables: procedural skills and communication skills.

3.2 Participants

Undergraduate students from a health sciences program at an Indonesian polytechnic served as participants. To ensure proportional representation across different levels of autonomy, 80 students were selected through stratified random sampling. Students were randomly assigned to either the CPS or PS instructional group after being classified according to their results on the standardized Learning Autonomy Questionnaire. There were 20 students in each of the four resulting groups.

3.3 Learning Intervention

Treffinger's CPS model, which includes the stages of problem clarification, idea generation, solution development, and implementation planning, served as the basis for the education provided to the CPS group students. The CPS module heavily emphasized group projects, brainstorming sessions, and reflective practice, all inspired by real-life patient safety situations.

The control group, on the other hand, received traditional problem-solving training, which typically includes teacher-led explanations, individual problem analysis, and solution formulation without any formal phases or elements that encourage creative participation. Six 90-minute sessions were used to teach both teaching styles.

3.4 Instruments

- Learning Autonomy Questionnaire: This self-report tool, based on the Brookfield model, has thirty items with a 5-point Likert scale. It assesses motivation, self-monitoring, goal-setting skills, and help-seeking behavior. According to reliability testing, the Cronbach's alpha was 0.87.
- Procedural Skills Assessment Tool: Trained assessors used this instrument, developed based on national health education requirements, to observe students as they completed clinical tasks related to patient safety (e.g., medication administration, hand hygiene, emergency response protocols). Scores ranged from 0 to 100 based on efficiency, safety adherence, accuracy, and sequence.
- Communication Skills Rubric: Students' communication skills with colleagues and patients were evaluated using this rubric. This rubric assesses attentiveness, empathy, clarity, and active listening. During pre- and post-tests,

observers used the rubric to rate recorded simulations.

• CPS Learning Module: A learning package featuring case studies, guiding questions, creative ideation prompts, and collaborative planning templates was provided to the CPS group. Prior to use, the module was piloted with small groups and validated by expert review.

3.5 Procedure

This study was conducted over four weeks. All participants completed the Learning Autonomy Questionnaire, the Procedural Skills pre-test, and the Communication Skills pre-test before the intervention. Each group then participated in six learning sessions according to their assigned learning approach.

After the lessons, post-tests were administered for communication and procedural skills. Independent assessors blindly scored each assessment. All students provided informed consent to participate in the study, and ethical clearance was obtained.

3.6 Data Analysis

IBM SPSS was used to evaluate all data. The Shapiro-Wilk and Levene tests were used to verify the multivariate analytical assumptions of normality and homogeneity of variance, respectively. To determine the main effects of learning strategy and autonomy level, as well as their interaction effects, on the two dependent variables, a MANOVA was conducted.

4. RESULTS

4.1 Descriptive Statistics

To compile the performance results of each group on the procedural and communication skills tests, a preliminary descriptive analysis was conducted. All groups demonstrated similar baseline scores before the intervention, indicating no significant differences. To ensure the validity of the treatment effects seen in the post-test phase, this equivalence was necessary.

Significant variation between groups was found based on the post-test results. The PS group with high autonomy had the lowest mean score in communication skills (M = 75.56, SD = 5.84), while the group receiving the CPS intervention with low autonomy had the highest mean score (M = 87.5, SD = 4.44). At both levels of autonomy, CPS participants performed better than PS participants in procedural skills. Table 1 presents the complete descriptive results.

Table 1. Mean Post-Test Scores by Group

Group	Procedural Skills (M±SD)	Communication Skills (M±SD)
CPS - High Autonomy	85.45 ± 5.90	85.47 ± 4.95
CPS - Low Autonomy	85.68 ± 5.02	87.50 ± 4.44
PS - High Autonomy	77.38 ± 6.11	75.56 ± 5.84
PS - Low Autonomy	75.15 ± 6.42	77.14 ± 6.42

4.2 Testing Assumptions

Data for each group were found to be normally distributed ($p > 0.05$ for all variables) using the Shapiro-Wilk normality test. Furthermore, Levene's test confirmed homogeneity of variance ($p > 0.05$), meeting the MANOVA assumptions.

4.3 Multivariate Analysis (MANOVA)

Learning technique had a significant main effect on the combined dependent variable of procedural and communicative skills, according to the MANOVA results (Wilks' Lambda = 0.374, $F(2, 75) = 62.56$, $p < 0.001$, $\eta^2 = 0.626$). Learning autonomy was also found to have a significant main effect (Wilks' Lambda = 0.886, $F(2, 75) = 4.82$, $p = 0.010$, $\eta^2 = 0.114$). Wilks' Lambda = 0.958, $F(2, 75) = 1.65$, $p = 0.199$, indicating no significant interaction between strategy and autonomy.

4.4 Univariate ANOVA

Further ANOVA showed that learning strategies had a significant effect on both:

• Procedural Skills: $F(1, 76) = 61.72$, $p < 0.001$, $\eta^2 = 0.448$

• Communication Skills: $F(1, 76) = 54.31$, $p < 0.001$, $\eta^2 = 0.417$

Autonomous learning only significantly affected communication skills:

• Communication Skills: $F(1, 76) = 4.95$, $p = 0.030$, $\eta^2 = 0.061$

• Procedural Skills: $F(1, 76) = 1.29$, $p = 0.259$ (not significant)

No significant interaction effect was observed for either variable.

These findings imply that both skill domains are positively influenced by CPS techniques in a strong and statistically significant manner, with communication being more influenced by autonomy than procedural competence. The absence of a significant interaction indicates that the impact of CPS strategies remains constant across levels of autonomy.

5. DISCUSSION

The conclusions of this study provide important new information on the effectiveness of the Creative

Problem Solving (CPS) approach and the contribution of autonomous learning to the development of critical skills in medical students, particularly in patient safety instruction.

5.1 Effectiveness of CPS on Procedural Skills

The importance of structured and innovative techniques in clinical training is highlighted by the significant improvement in procedural skills among students taught using the CPS model. CPS is a conceptual model that focuses on the use of higher-order thinking skills to address authentic problems during learning (7). Unlike conventional approaches to problem-solving, which emphasize the search for a single correct answer, CPS encourages introspection, iterative learning, and the investigation of multiple solutions. This is well suited to the clinical environment, as performing procedures often requires accuracy and flexibility. Better procedural mastery is facilitated by the CPS model's emphasis on problem awareness, ideation, solution evaluation, and implementation planning, which closely resembles the decision-making process in medical procedures. The CPS model is well suited to the characteristics of students with higher levels of autonomous learning. Students with high levels of autonomous learning tend to have high achievement motivation. Based on the results of research using the CPS model conducted on students in the field of citizenship, there is a difference in citizenship problem-solving abilities between students with high achievement motivation and students with low achievement motivation (8). The results of the study show that the competence of groups taught with Problem-Based Learning (average = 88.72) is better than the competence of groups taught with direct learning methods (average = 73.33)(9).

These findings align with previous research that found that students exposed to innovative problem-solving frameworks demonstrated improved understanding and implementation of procedures in technical topics (3). Improved procedural understanding and implementation can also be supported by problem-based learning(10). This research has applications: to foster deeper understanding and retention of processes, educational institutions may consider incorporating CPS-based activities into hands-on clinical courses.

5.2 Impact of CPS on Communication Skills

Integrating creativity, critical thinking, collaboration, and communication skills into learning is currently an important goal in education (12). In line with its dialogic and collaborative ethos, CPS also significantly improves communication skills. Students must participate in structured brainstorming, group assessment, and solution justification during CPS sessions, activities that naturally foster communication skills. This is consistent with research showing that reflective and interactive teaching methods increase students' confidence in communicating ideas and working with others(4) and(6). Furthermore, developments in information and communication technology (ICT) present both opportunities and challenges for educational ideas and practices, requiring consideration in communicating ideas and working in teams(13). Appropriate learning strategies provide benefits in full mastery of learning, enabling students to collaborate and interact in implementing and creating learning projects (11).

By strengthening the interpersonal skills needed in high-risk situations, CPS can be used as a preventative approach in educational efforts, as communication failure is a major cause of unfavorable patient outcomes.

5.3 The Role of Learning Autonomy

Learning autonomy was found to have a significant, beneficial impact on communication skills, but not on procedural skills. This suggests that students with greater autonomy are better at reflecting and self-regulating, which helps them communicate more successfully in situations involving teams or patients. This finding supports the claim that self-regulated learners are more competent and confident in social situations(5).

Based on the NLC's hypothesis for online learning service users, this may contribute to the development of skilled and confident use of personalized learning platforms.

The nature of procedural skills, which often require more expert feedback and repeated practice than autonomous inquiry, may explain the lack of impact. However, encouraging student autonomy remains crucial for producing self-aware and motivated professionals.

5.4 Absence of Interaction Effect

Interestingly, the lack of a substantial interaction effect suggests that the superiority of the CPS approach does not depend on the level of autonomy demonstrated by students. From an instructional design perspective, this is positive because it implies that CPS can be implemented broadly across diverse student populations without requiring significant individualization. To ensure that children with low

autonomy can fully participate in the CPS process, teachers may still need to provide scaffolding in their learning.

5.5 Educational Implications

The findings of this study highlight the need for a paradigm shift in health education, shifting from passive knowledge acquisition to active knowledge construction. Technological, social, and environmental changes occurring globally will also impact human life (11). The digitalization of society, changes in educational structures, and the rapid availability of resources have accelerated the development of learning environments (14). CPS is a useful model that combines critical thinking, creativity, and teamwork, making it ideal for simultaneously developing procedural and communication skills. Furthermore, fostering learning autonomy should be an ongoing goal, particularly in preparing students for lifelong learning in dynamic clinical environments.

Institutions should consider incorporating CPS modules into their core courses, educating staff in facilitative teaching techniques, and creating support networks that encourage independence. Simulation-based exercises and blended learning approaches could enhance the findings of this study.

6. CONCLUSIONS AND IMPLICATIONS

The use of Creative Problem Solving (CPS) as a successful teaching method in patient safety education is empirically supported by this study. Healthcare students' procedural and communication skills were shown to improve significantly with CPS, demonstrating its potential as a holistic instructional approach. Given the clear correlation between these competencies and patient outcomes in clinical education, these findings are highly relevant.

This study also emphasizes how learning autonomy contributes to the development of communication skills, highlighting the need to encourage self-directed learning practices in healthcare professions education. Although autonomy does not have a direct effect on procedural skills, it does encourage further efforts to develop autonomous and reflective learners by fostering communication skills.

The lack of interaction effects suggests that CPS works well for students with varying levels of autonomy, making it a flexible approach that can be used with a variety of learner profiles. To maximize the benefits of CPS, the data also suggest that more support may be helpful for students with lower levels of autonomy.

Recommendations for Practice:

- Integrate CPS modules into standard curricula, particularly in courses focused on clinical reasoning, communication, and procedural training.
- Provide professional development for educators in implementing CPS and autonomy-supportive teaching.
- Encourage interdisciplinary learning environments where communication skills are practiced collaboratively.
- Support the development of learner autonomy through personalized learning plans, reflective journals, and coaching.
- Use blended learning and clinical simulations to further contextualize CPS and reinforce procedural practice.

Recommendations for Future Research

Future studies should examine how CPS interacts with technology-enhanced learning environments and how this impacts clinical performance and long-term skill retention. Qualitative research could also examine students' perceptions of CPS and autonomy growth to gain a more in-depth understanding of their learning experiences. Furthermore, studies conducted in diverse educational settings could assess the generalizability of these findings.

In summary, this study contributes to the growing body of evidence supporting innovative, student-centered approaches to healthcare education. Combined, CPS and autonomy promotion offer a powerful way to equip aspiring medical professionals with the knowledge and skills needed for effective and safe practice.

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