Advancing Students' Creativity and Self-Learning in Scientific Research in University: Designing an Interpersonal Learning Model

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Abstract: This project investigates methods to improve students' creativity and self-directed learning in scientific research by developing an interpersonal learning model. Conducted at Universitas Negeri Padang, the research aims to address the growing demand for innovative and independent learners capable of engaging in meaningful scientific exploration. The suggested approach prioritizes peer relationships, mentorship, and active engagement in research activities by integrating collaborative learning methodologies and enhancing interpersonal communication. The research used a mixed-methods approach, integrating qualitative insights from focus group talks with quantitative data derived from experimental applications of the model. Results indicate a significant improvement in students' creative thinking, problem-solving skills, and motivation for independent research. The findings underscore the capacity of interpersonal learning to revolutionize conventional educational methodologies, establishing higher education as a venue for cultivating critical thinkers and inventive contributors to the scientific community. This model is presented as a reproducible framework for other colleges aiming to achieve comparable results.

1 INTRODUCTION

In the swiftly changing realm of education, promoting creativity and autonomous learning has emerged as a fundamental principle of contemporary higher education (Holmes,2023). Universities play a critical role in equipping students with the skills necessary to thrive in an era defined by innovation, collaboration, and independent thinking. The capacity to conduct scientific inquiry not only fosters intellectual advancement but also aids societal progress by tackling intricate issues with evidence-based answers. Nevertheless, conventional educational methods frequently inadequately foster the creativity and independence essential for successful scientific investigation. (López et. al., 2024).

Universitas Negeri Padang urgently needs to transform its teaching approaches to meet these demands. A possible strategy is incorporating interpersonal learning models that prioritize cooperation, mentorship, and active participation.

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These methods promote peer learning, foster critical thinking abilities, and instill a sense of responsibility for one's educational path (Creswell, 2012). Universities can improve students' creative thinking and independent inquiry capacity by cultivating an environment that promotes interpersonal interactions and collaborative learning experiences

2 MATERIALS AND METHODS

This study employed a mixed-methods approach to develop and evaluate an interpersonal learning model to enhance creativity and self-directed learning in scientific research among students at Universitas Negeri Padang. The methodology included qualitative and quantitative approaches.

2.1 Research Design

The qualitative approach to understand the needs and challenges of students in scientific research, focus group discussions (FGDs), and in-depth interviews were conducted with students and faculty members (Silajdzic, 2018). A quantitative approach pre-experimental design with pre-test and post-test measures was used to assess the effectiveness of the interpersonal learning model in improving creativity and self-learning capabilities.

2.2 Participants

The participants in this study included 120 undergraduate students from various departments at Universitas Negeri Padang, chosen through purposive sampling to ensure a diverse representation of academic disciplines. Faculty members, including academic advisors and research supervisors, participated in the study. Their involvement was crucial for offering insights into the mentorship and collaborative dynamics of the proposed interpersonal learning model. The students and faculty contributed to a comprehensive understanding of the model's effectiveness in fostering creativity and self-directed learning in scientific research.

2.3 Data Collection

The study employed qualitative and quantitative data collection methods to thoroughly explore and assess the effectiveness of the interpersonal learning model. Qualitative focus group discussions (FGDs) were done with student groups to identify barriers to creativity and self-directed learning in scientific research. Moreover, comprehensive interviews with faculty members yielded significant insights into effective techniques for fostering interpersonal learning and improving research mentorship procedures. The researchers employed two main instruments for quantitative analysis: the Creativity Self-Assessment Scale and the Self-Directed Learning Readiness Scale (SDLRS). These were administered to students before and after the intervention to measure changes in creativity and self-directed learning capabilities. Additionally, statistics regarding research performance were gathered by assessing students' research proposals and presentations, providing a concrete metric of the model's influence on their scientific research abilities.

2.4 Intervention: Interpersonal Learning Model

A model for interpersonal learning was developed in the study, incorporating essential elements to enhance creativity and self-directed learning in scientific research. The model included collaborative learning sessions in which students engaged in small group discussions, and problem-solving activities focused on research subjects. These workshops promoted collaboration and analytical reasoning while tackling particular obstacles in scientific investigation.

A peer mentorship program was established, matching students with peers possessing past research expertise (Jeffery & Bauer, 2020). This mentoring sought to offer direction and support during the learning process, fostering reciprocal learning and confidence. Faculty mentorship formed another essential model element, offering structured guidance from academic advisors. Regular progress evaluations gave students constant feedback and guidance as they progressed in their research pursuits. The paradigm underscored active involvement in research, with students participating directly in research projects (McNair et al., 2022). This experiential method enabled them to implement theoretical knowledge in realistic scenarios, closing the divide between education and real-world application. The concept aimed to improve the collaborative and individual dimensions of students' scientific research skills through these interconnected components.

2.5 Data Analysis

The research utilized qualitative and quantitative methodologies to assess the gathered data, guaranteeing a thorough evaluation of the

interpersonal learning model's effects. Thematic analysis was performed on transcripts from the focus group discussions (FGDs) and interviews for the qualitative data. This technique entailed the identification of repeating themes and patterns, explicitly concerning obstacles, requirements, and methodologies for augmenting creativity and self-directed learning in scientific research—the analysis enhanced comprehension of the participants' experiences and viewpoints, aiding in refining the learning model.

The quantitative data were evaluated using paired sample t-tests to compare the pre-test and post-test creativity and self-directed learning scores. This statistical method was selected to evaluate the significance of any enhancements after the intervention. Furthermore, descriptive statistics were utilized to assess alterations in research performance, as indicated by students' evaluations of research proposals and presentations. These evaluations provided qualitative insights and quantitative data regarding the model's efficacy.

3 RESULTS AND DISCUSSION

3.1 Result

This study's findings provided qualitative and quantitative insights into the efficacy of the interpersonal learning model in improving students' creativity, self-directed learning, and research performance. The focus group talks identified significant problems encountered by students in scientific research from a qualitative standpoint. These limitations included a lack of trust in their research talents, restricted possibilities for collaborative learning, and insufficient mentorship assistance. Students articulated a pronounced need for organized engagements with peers and teachers to improve their research proficiency. Multiple prominent themes emerged from the analysis. Peer collaboration was recognized as vital in enhancing problem-solving abilities, whereas faculty mentorship was crucial in delivering ongoing advice and constructive criticism. Furthermore, active engagement in research projects positively influenced students' creative thinking, enabling them to integrate theoretical knowledge with practical application.

The data quantitatively demonstrated measurable evidence of the model's efficacy. The Creativity Self-Assessment Scale demonstrated a notable improvement in scores, with an average pre-test score of 65.2, escalating to 78.5 post-intervention. The statistical study validated this enhancement as highly significant ($p < 0.01$), demonstrating that the model efficiently promoted creativity. The Self-Directed Learning Readiness Scale (SDLRS) results indicated a significant enhancement in self-directed learning ability, with average scores rising from 62.8 to 76.9. This improvement was statistically significant ($p < 0.01$), corroborating the model's efficacy. The research performance of students was evaluated based on their study proposals and presentations. Faculty mentors observed a 40% enhancement in the quality of research proposals, notably in clarity, creativity, and problem formulation. Post-intervention presentations demonstrated improved articulation, logical organization, and creative methodologies relative to the pre-intervention baseline.

Responses from students and professors highlighted the model's efficacy. Students predominantly acknowledged the significance of peer mentoring sessions, with 85% asserting that these sessions were crucial in enhancing their comprehension of research themes. Moreover, 78% of students valued the organized mentorship offered by academics, identifying it as crucial in enhancing their confidence and research abilities. Faculty members observed that the model positively influenced students by promoting collaboration and accountability. This collaborative environment led to improved participation and excitement for research efforts. The findings underscore the efficacy of the interpersonal learning paradigm in overcoming obstacles and markedly improving students' creativity, self-directed learning, and research proficiency in scientific inquiry.

3.2 Discussion

This study's findings offer strong evidence for the efficacy of the interpersonal learning paradigm in enhancing creativity, self-directed learning, and student research performance. This section analyzes the data comprehensively, elucidating their ramifications, emphasizing probable mechanisms, and correlating them with previous literature. The qualitative findings identified significant obstacles encountered by students, such as diminished confidence in their research skills, restricted collaborative learning opportunities, and insufficient mentorship (Liedtka, 2015). These constraints correlate with prior research highlighting the challenges students often experience when shifting from theoretical education to autonomous scientific inquiry (Magolda,2024). Addressing these

limitations, the interpersonal learning approach immediately responds to students' needs through structured peer and faculty mentorship and hands-on research engagement (Richards et al., 2020).

The identified themes—peer collaboration, faculty mentorship, and active participation— highlight essential mechanisms by which the model attained its objectives (Gutierez, 2021). Collaborative engagement among peers cultivated mutual support and enhanced problem-solving abilities, enabling kids to explore and refine ideas within a nurturing setting. Faculty mentorship offered expert direction and constructive criticism, enabling students to navigate intricate research processes adeptly. These findings align with previous research highlighting the significance of mentorship and collaborative learning in higher education. The quantitative findings indicated statistically substantial enhancements in creativity and self-directed learning readiness (Tang, 2020). The increase in creativity ratings implies that the model successfully provided an environment where students could think innovatively and approach challenges with uniqueness. This corresponds with collaborative learning theories, which assert that exposure to many perspectives in group environments fosters innovative thinking (Rasku-Puttonen et al., 2002). The enhancements in self-directed learning readiness suggest that students were more assured and proficient in overseeing their learning processes. This advancement may arise from the integration of organized support and independence afforded by the model. Although academic mentorship provided direction, peer mentoring and active research involvement enabled students to assume responsibility for their educational experience (Muñoz et al., 2022). These findings align with self-determination theory, which posits that autonomy, competence, and relatedness are crucial for cultivating intrinsic motivation and self-directed learning.

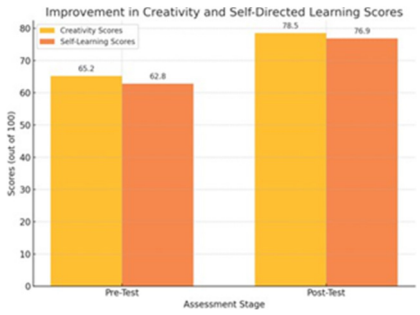

Figure 1: Improvement in creativity and self-directed learning scores.

The assessment of research performance revealed substantial improvements in the caliber of students' research proposals and presentations. These enhancements indicate that the approach advanced theoretical comprehension and facilitated practical skills. The structured mentorship and active participation elements undoubtedly contributed significantly to this outcome. Students received continuous feedback on their work, facilitating iterative enhancements in clarity, creativity, and issue formulation. Furthermore, the noted enhancements in presentation skills—articulation, logical organization, and creative methodologies—underscore the model's capacity to equip students for authentic academic and professional problems. These competencies are essential for academic achievement and correspond with the graduate traits employers desire, including critical thinking, communication, and innovation. The exceptionally favorable student and staff responses reinforce the model's efficacy. Students regarded the peer mentorship sessions as essential for enhancing their comprehension of research themes. This discovery indicates that peer interactions enhanced learning and fostered a sense of community and collective responsibility. Faculty mentors noted increased collaboration and involvement among students, demonstrating the model's ability to enhance the research learning environment (Tang et al., 2022). These findings align with prior research that underscores the significance of structured mentorship and collaborative learning in enhancing engagement and motivation. That 85% of students saw peer mentoring as essential, and 78% attributed their confidence to teacher assistance illustrates the comprehensive influence of the concept.

4 CONCLUSION

The interpersonal learning paradigm effectively overcame critical obstacles to creativity and self-directed learning, significantly enhancing students' research skills and performance. The methodology included organized mentorship, collaborative learning, and active involvement, cultivating an environment conducive to invention, confidence, and practical skills. These findings highlight the significance of comprehensive methodologies in research education and provide a framework for cultivating creativity and independence in student learning across various educational settings (Nowell, 2022).

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