

Research Article

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The GENICS (Grouping, Exploring, Discussion, Individual Activity, Combining, Sharing) Learning Model: Instructional Design Model to Enhance Student Creative Thinking and Meta-Skills

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Abstract

Background/purpose. Innovative thinking and meta-skills are needed to solve difficult problems in the 21st century, but standard training techniques often fail. The fact that only 6% of pupils are innovative thinkers highlights a major educational gap. The GENICS learning approach (Grouping, Exploring, Discussion, Individual Activity, Combining, Sharing) is contrasted to Problem-Based Learning (PBL) in tailored instruction to improve these skills.

Materials/methods. A quasi-experimental approach with pretest-posttest control groups was used with 432 Grade X students from SMA Negeri 5 Jambi City. The experimental group (n=36) used GENICS while the control group (n=36) used PBL. Validated essay tests and observation sheets assessed creative thinking (fluency, flexibility, originality, elaboration) and meta-skills (self-management, social intelligence, invention). Methods included descriptive statistics, MANCOVA, and effect size estimations.

Results. The GENICS learning model improved creative thinking by 93.48% and meta-skills by 26.78%, outperforming PBL by 56.42% and 4.70%, respectively. Elaboration (153.49%), originality (116.77%), critical thinking (44.37%), and empathy (35.26%) improved. GENICS showed superior efficacy with a medium effect size ($\eta^2 = 0.097$, $p = 0.036$) in multivariate tests.

Conclusion. The GENICS model's structured yet flexible stages use differentiated learning ideas that exceed PBL for cognitive and non-cognitive skills. Complete 21st-century skill development is provided by the tiered system, especially the Combining and Sharing stages that encourage collaborative elaboration. Findings suggest curriculum designers should use differentiated models. Single-school and short interventions are drawbacks. Examine GENICS' effects on emotional intelligence, retention, and scalability in education. Study emphasizes systematic instructional design for mixed classes.



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1. Introduction

The 21st century is marked by significant technological developments, globalization, and growing social complexity. They require people who are knowledgeable, innovative, problem-solvers, and adaptable to new and unanticipated conditions. Creative thinking, critical thinking, cooperation, and adaptability are increasingly considered 21st-century talents required for personal and professional success (Umam, 2021). Creative thinking and meta-skills are essential for innovation, problem-solving, and adaptability (Lakilo et al., 2019; Prasittichok & Klaykaew, 2022).

Creative thinking involves blending different views and processing data in new ways to develop new ideas. It measures fluency, flexibility, originality, and elaboration (Munandar, 2012). Fluency lets people develop various ideas, flexibility lets them approach challenges from different angles, uniqueness lets them create distinctive solutions, and elaboration lets them detail ideas. These skills are needed to solve complicated problems and innovate. Research shows that pupils' creative thinking skills are undeveloped despite their importance (Chan & Yuen, 2014; Sundapa, 2022). Many pupils struggle to solve problems with originality, fluency, and elaboration, which limits their adaptability to complex and dynamic contexts. Traditional teaching techniques that emphasize rote memory and standardized testing over creativity and critical thinking worsen this issue. Thus, students are often unprepared for the current workforce, which prizes creativity and adaptability.

Students need innovative thinking and meta-skills to navigate the future. Meta-skills influence an individual's perspective and attitude, allowing them to learn, solve issues, and innovate in many activities (Prasittichok & Klaykaew, 2022). These qualities promote openness, flexibility, and a willingness to try new things, making them vital for lifelong learning. Meta-skills include inventiveness in problem-solving, resilience, and self-awareness. Problem-solving creativity involves understanding, brainstorming, and acting. Persistence, active coping, and overcoming obstacles are resilience. Self-awareness comprises self-esteem, self-evaluation, and emotional awareness. Yadollahi and Yazdani (2020) divide meta-skills into basic cognitive, higher-order thinking, and psychomotor domains. Remembering, comprehending, applying, analyzing, assessing, and inventing are cognitive meta-skills that underpin decision-making and problem-solving. Critical, creative, and introspective thinking helps people solve complicated challenges and make informed judgments. Skill-based activities, simulations, and demonstrations enhance psychomotor meta-skills for professional decision-making.

Creative thinking, the ability to generate novel and valuable ideas, is intricately linked with various meta-skills that enhance cognitive processes. These meta-skills include adaptability, problem-solving, and collaboration, which enable individuals to effectively apply their creative abilities in practical situations. For instance, during project-based learning, students showcase their creativity while also utilizing skills such as teamwork and effective communication, leading to better outcomes (Yusnaeni et al., 2020). Research indicates that when students engage in collaborative brainstorming, they achieve higher levels of creative thinking compared to working alone, illustrating the importance of these supportive skills in fostering innovation (Ermayanti et al., 2021). Overall, the integration of creative thinking with essential meta-skills is crucial for thriving in contemporary educational environments and addressing complex challenges.

Differentiated learning requires meta-skills to enable students to customize their learning to their styles, interests, and abilities. Meta-skills help students adapt, self-direct, and handle academic and professional problems. Differentiated learning is promising for boosting creative thinking and meta-skills. It encourages students to study in methods that meet their needs, interests, and talents. Teachers use differentiated learning to fulfill students' needs and expectations, according to Pitaloka and Arsanti (2022). It also involves identifying and teaching students' strengths and learning styles (Trynovita, 2023). Differentiated learning stresses adapting training to individual differences to make learning more engaging and successful.

Tomlinson (2018) listed three ways for differentiated learning. Differentiation of content maps students' learning requirements and groups them by readiness, ability, and interest to adapt instruction. This ensures students receive content that matches their knowledge and skills. Second, the differentiation of processes alters how students connect with and understand knowledge through tiered activities with differing levels of support, challenge, and complexity. Students can learn at their own pace and gain greater knowledge. Third, differentiation of product lets students show their learning through essays, presentations, videos, and other creative activities. This method promotes engagement and creativity by letting students express their learning in ways that suit them. Differentiated learning promotes engagement and addresses individual requirements, yet also has drawbacks. These include time and effort limits and difficulties assessing pupils with different levels of knowledge (Agustiana et al., 2023). Successful differentiated learning implementation demands meticulous planning.

To overcome these obstacles, the GENICS learning model was created. The GENICS paradigm promotes creativity and meta-skills through individualized learning and structured education. Each level of the GENICS paradigm promotes meta-skills like cooperation, communication, critical thinking, and leadership while developing creative thinking indicators like originality, fluency, flexibility, and elaboration (Mardiyanti & Siburian, 2023). GENICS comprises six teaching phases: grouping, exploring, discussion, solo action, merging, and sharing. The stages provide a planned yet flexible framework for effective learning experiences for students. The "Grouping" phase promotes teamwork and leadership, whereas the "Individual Activity" phase promotes creativity and self-learning. This systematic approach helps students build creative thinking and meta-skills while actively learning.

2. Literature Review

2.1. Creative Thinking Skills

Students need creative thinking to solve issues, produce new ideas, and adapt to changing environments. Creative thinking entails analyzing new information and combining unique ideas to solve problems, according to Lakilo et al. (2019) and Khofifah (2023). Creative thinking requires fluidity, flexibility, creativity, and elaboration, according to Munandar (2012). These indicators show the ability to develop many ideas (fluency), use different views (flexibility), solve problems creatively (originality), and elaborate on ideas. Students need creative thinking to innovate and solve problems in the 21st century (Savira et al., 2023). However, research suggests that pupils' creative thinking skills are generally lacking (Purwati & Alberida, 2022). A survey at SMA 5 Jambi City found that just 6% of students had very high creative thinking skills, while the rest were medium or low. Effective instructional strategies to boost creative thinking in schools are needed.

2.2. Differentiated Learning

Differentiated Instruction (DI) modifies curricula, teaching methods, resources, and learning activities to meet the requirements of individual students and small groups. DI, based on inclusive education, tailors instruction to students' readiness, interests, and learning profiles to maximize learning (Tomlinson & Jarvis, 2023). Modern classrooms require responsive teaching due to student disparities in ability and background (Dumont, 2019; Schleicher, 2016).

DI is based on Vygotsky's (1987) zone of proximal development, which stresses giving pupils tasks slightly above their present ability levels to stimulate cognitive progress (Sousa & Tomlinson, 2018). According to Tomlinson (2018), differentiation involves content (adapting materials to students' readiness through tiered assignments; Pozas & Schneider, 2019), process (using small-group work and project-based learning; Hastuti et al., 2024), and product. Meta-analyses reveal that DI improves student achievement little to moderately (Hattie, 2009; Smale-Jacobse et al., 2019). DI improves

outcomes across achievement levels, but implementation often favors struggling kids, leaving high achievers unchallenged (Brighton et al., 2015; Krannich, 2019; Deunk, 2018).

The effectiveness of DI is limited by several factors that are not sufficiently addressed in research. These include a lack of comprehensive frameworks for its implementation, variability in how different educators apply DI in their classrooms, and inadequate professional development that leaves teachers uncertain about best practices (Papanthymou & Δάρρα, 2022; Σακελλαρίου et al., 2018). Additionally, the socio-emotional aspects of teaching, crucial for student engagement and learning, are often overlooked; establishing supportive teacher-student relationships is vital for DI's success but may not always be prioritized (Mirawati et al., 2022; Calabazaron-Ocampo, 2023). To optimize DI, further research is needed to fill these gaps and ensure it is effectively applied to benefit all learners.

DI struggles in practice despite its theoretical potential. Time, resources, and training often hinder teachers (Roy et al., 2013; Mengistie, 2020). In Germany, where DI is mandated (KMK, 2015), classrooms generally prioritize remedial support for low achievers over enrichment for strong performers (Prast et al., 2015; Ziernwald, 2022). Teacher self-efficacy and enthusiasm have been shown to enhance the adoption of differentiated instruction (DI) (Kalinowski et al., 2024). Collaborative planning among educators to design tiered activities (Hartwig & Schwabe, 2018), along with structured frameworks like the GENICS model—which integrates DI with stages such as Grouping and Individual Activity to foster creativity and meta-skills—are essential for effective implementation.

Empirical research shows DI can improve critical thinking and involvement. Hastuti et al. (2024) showed that Problem-Based Learning (PBL) and DI increased students' critical thinking, while Smale-Jacobse et al. (2019) discovered that DI's flexible grouping tactics improved secondary students' academic performance. Traditional approaches like PBL lack the organized differentiation needed to serve multiple learning demands, highlighting the necessity for novel models like GENICS (Sinaga, 2024).

2.3. The GENICS Learning Model

Vygotsky's concept of the Zone of Proximal Development (ZPD) serves as an essential framework within educational theory, particularly emphasizing the role of social interactants in enhancing a learner's capabilities. The ZPD identifies the range of tasks that a learner cannot accomplish independently but can achieve with assistance from more knowledgeable peers or adults. This aligns closely with the GENICS learning model, which encompasses Grouping, Exploring, Discussing, Individual Activities, Combining, and Sharing. These components reflect the collaborative and social nature underpinning Vygotsky's theory, promoting a social constructivist approach to learning where peer interaction is paramount for developmental progress (Mattar, 2018; Brieger et al., 2020).

Furthermore, the GENICS model can be seen as operationalizing Vygotsky's concepts in practical settings. For instance, the grouping and discussing phases encourage learners to engage with one another, thereby functioning within the ZPD by fostering collaborative dialogue that extends knowledge acquisition. Mattar (2018) highlights how connectivism, influenced by Vygotskian principles, reflects a more flexible approach to learning, emphasizing that knowledge extends beyond individual learners into their networks and technological tools. This interconnected process fosters opportunities for guided interactions that align well with the GENICS model's collaborative components.

Connectivism itself, proposed by Siemens and Downes, posits that learning occurs within networks, whether they be social or technological, thereby extending the notion of ZPD to incorporate learning from diverse sources outside traditional interactions (Mattar, 2018). This is

particularly relevant in the digital age, where access to resources and learning communities can simultaneously enhance knowledge acquisition and provide social scaffolding that Vygotsky deemed critical. Jeny (2024) further suggests that incorporating connectivist principles into classroom practices involves leveraging digital platforms to create rich, interactive learning environments where learners can form meaningful connections, thereby reinforcing Vygotsky's ideal of socially mediated learning experiences.

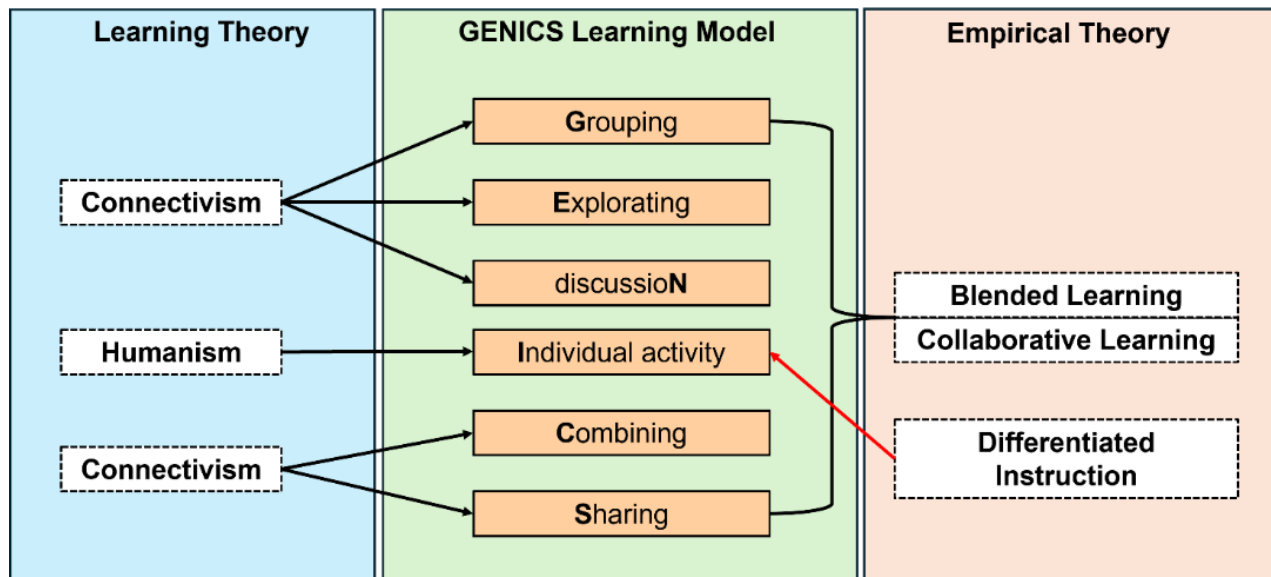


Figure 1. Theoretical Background of the GENICS Learning Model

Moreover, the humanistic aspect of educational paradigms supports individualized understandings that connect with both Vygotsky's and GENICS's frameworks. Humanism focuses on the development of the whole person and emphasizes the importance of personal agency in the learning process, which resonates with the individual activities and autonomy encouraged in the GENICS model (Chen & Chan, 2024). The possibility to explore personal interests within collective settings mirrors the humanistic approach by acknowledging that learning is a deeply personal journey that can thrive in supportive, collaborative environments.

The humanistic and connectivist philosophies behind GENICS describe its principles and uses. Everyone has the right to know themselves, according to humanistic thought. It emphasizes appreciating others regardless of race, ethnicity, or religion (Aiman et al., 2024). This perspective fosters an inclusive classroom atmosphere where all students are appreciated and free to communicate. Connectivism stresses learning through networks, technology, and cooperation. Students need relationships to communicate information (Downes, 2022). Today's educational environment requires teamwork and technology, making the GENICS paradigm relevant. GENICS encourages varied student participation to enhance active learning. Each model level assists different learning processes. Grouping promotes student-teacher and student-student collaboration. Students need this collaborative setting to learn from each other and grow in their talents (Maison & Syamsurizal, 2019). Working together teaches pupils future social skills, including communication and teamwork.

GENICS (Grouping, Exploring, Discussion, Individual Activity, Combining, Sharing) is a structured learning strategy that improves creativity and meta-skills. Table 1 shows how each GENICS stage correlates with creative thinking and meta-skills.

Table 1. Relationship Between GENICS Model Syntax, Creative Thinking Indicators, and Meta-Skills

GENICS Model Syntax	Creative Thinking Indicators	Meta-Skills Indicators
Grouping	Original thinking	Adaptation, collaboration, communication, leadership
Exploring	Fluent thinking	Curiosity, leadership, and reasoning
Discussion	Flexible thinking	Communication, critical thinking, collaboration, creativity, integrity, curiosity, reasoning
Individual Activity	Original and flexible thinking	Focus, initiative, creativity, empathy, integrity, reasoning
Combining	Elaboration skills	Initiative, collaboration
Sharing	Elaboration skills	Focus, communication, empathy, and critical thinking

Source: Mardiyanti & Siburian (2023); Munandar (2012); Spencer & Lucas (2021).

Students engage in originality, fluency, flexibility, and elaboration activities in the GENICS paradigm to cultivate creativity. Each phase of the model targets unique creative thinking skills. For instance, the Grouping phase promotes collaboration and leadership, which are necessary for creativity. The Exploring phase encourages curiosity and reasoning, letting pupils think clearly while researching. Students develop their ideas and offer varied opinions during Discussion, promoting flexible thinking. Students can explore and solve issues independently in the Individual Activity phase, encouraging creativity and adaptability. Combining and sharing improve elaboration abilities by combining individual contributions and presenting ideas together. The GENICS paradigm encourages creativity and meta-skills like communication, critical thinking, cooperation, and leadership. Lifelong learning and flexibility require meta-skills, making the GENICS approach effective in meeting diverse student requirements and preparing them for future difficulties.

The GENICS model is purposefully designed to stimulate students' creative thinking through structured yet flexible learning phases. In the Grouping phase, students begin practicing fluency and flexibility by exchanging diverse perspectives. The Exploring phase prompts curiosity and idea generation as learners engage with stimulating problems or resources. As students move into the Discussion phase, they refine their ideas and develop elaboration by organizing and reflecting on the information they've encountered. The Individual Activity phase allows learners to exercise originality, providing space for independent thinking and idea development. During the Combining phase, students synthesize their ideas with others', encouraging creative restructuring and deeper innovation. Lastly, the Sharing phase reinforces fluency and elaboration, as students articulate their ideas and adapt them through feedback and discussion.

In parallel, GENICS also intentionally cultivates key meta-skills that support lifelong learning and effective problem-solving. The Grouping phase enhances collaboration and communication, which are foundational for teamwork in academic and real-world settings. In Exploring, students activate problem-solving and adaptability as they navigate new information. The Discussion phase promotes metacognition and reflective thinking, which are crucial for self-regulated learning. Individual activity strengthens initiative, self-efficacy, and perseverance, which are important for working independently. Combining develops adaptability and systems thinking by requiring students to integrate and reconcile diverse ideas. Finally, the Sharing phase builds confidence, empathy, and

constructive communication as students present their work and respond to feedback. Altogether, GENICS not only encourages creative output but also embeds the development of essential meta-skills throughout its instructional design.

2.4. Problem-Based Learning (PBL) Model

Another creative thinking and meta-skills-focused educational methodology is Problem-Based Learning (PBL). Students solve real-world problems via inquiry and teamwork in PBL. Table 2 shows how PBL model syntax, creative thinking indicators, and meta-skills relate.

Table 2. Relationship Between PBL Model Syntax, Creative Thinking Indicators, and Meta-Skills

PBL Model Syntax	Creative Thinking Indicators	Meta-Skills Indicators
Orienting students to the problem	Fluent thinking	Focus, adaptation, empathy, and curiosity
Organizing students for learning	Fluent and flexible thinking	Integrity, adaptation, leadership, curiosity, reasoning
Guiding individual and group inquiry	Original thinking	Integrity, communication, collaboration, leadership, curiosity, reasoning, critical thinking
Developing and presenting results	Flexible thinking	Initiative, collaboration, creativity, and reasoning
Analyzing and evaluating the process	Elaboration skills	Critical thinking

Source: Junaidi (2020); Munandar (2012); Spencer & Lucas (2021).

While the PBL paradigm promotes creative thinking and meta-skills, it struggles to meet students' different requirements. The structured yet flexible GENICS model integrates differentiated learning principles and emphasizes individual and group activities for a more holistic solution.

PBL serves as an effective framework for enhancing students' creative thinking by embedding various thinking processes into each phase of its model syntax. In the first phase, orienting students to the problem, students are exposed to an open-ended issue that demands broad idea generation. This situation stimulates fluent thinking as learners brainstorm multiple possible interpretations and solutions, encouraging ideational flow without immediate judgment. Moving into organizing students for learning, the process becomes more collaborative and exploratory, prompting both fluent and flexible thinking. Here, students learn how to look at problems from different angles, adjust their approaches, and shift between strategies, which sharpens their cognitive flexibility. During guiding individual and group inquiry, students are challenged to construct their own knowledge through research and critical dialogue, promoting original thinking as they develop novel ideas or innovative perspectives. In the developing and presenting results stage, students must synthesize and express their learning in creative ways, demanding a return to flexible thinking to adapt their findings into coherent, often multi-modal presentations. Finally, the analyzing and evaluating the process phase strengthens elaboration skills, as students refine their ideas, add depth, and critically reflect on their learning journey. This systematic integration of creative thinking skills throughout the PBL cycle allows students to think more divergently and creatively in authentic, problem-solving contexts.

In addition to creative thinking, PBL also facilitates the development of crucial meta-skills by immersing students in complex tasks that require self-regulation, collaboration, and critical reflection. During the orienting to the problem phase, students engage with unfamiliar and often

ambiguous issues, helping them cultivate focus, adaptability, empathy, and curiosity—skills necessary for dealing with uncertainty and understanding others' perspectives. In organizing for learning, the need to set learning goals, assign roles, and access resources fosters integrity, leadership, and reasoning, while also maintaining curiosity as students uncover new knowledge. As students progress to guiding inquiry, they are placed in situations that require communication, collaboration, integrity, and critical thinking, especially when they must negotiate meaning and validate evidence in a team setting. These challenges promote not only academic skills but also interpersonal maturity and ethical reasoning. In the developing and presenting results stage, students exhibit initiative and creativity as they take responsibility for their output, often customizing presentations for different audiences, while continued teamwork reinforces collaboration and reasoning. Finally, analyzing and evaluating the process involves deep critical thinking, as learners reflect on their decisions, assess their performance, and identify areas for growth. Through these structured yet dynamic activities, PBL equips students with the meta-cognitive and social-emotional tools needed for lifelong learning and success in rapidly changing environments.

3. Methodology

These quasi-experimental studies used non-randomized control group pretest-posttest designs. Design was chosen to compare the GENICS learning approach to PBL in enhancing students' creativity. An experimental group taught using GENICS and a control group taught using PBL were studied. Both groups' creative thinking was assessed before and after the intervention. The study included 432 Grade X students from SMA Negeri 5 Jambi City. Purposive sampling selected the 36-student experimental class (X-6) taught using the GENICS paradigm and the control class (X-11) taught using PBL. The choice of purposive sampling in this study was based on the need to ensure that the experimental and control groups had equivalent conditions, so that any differences found in students' creativity could be directly attributed to the learning methods implemented, GENICS and PBL, rather than other factors. This method was selected because it allows the researcher to choose students with similar academic abilities and demographic characteristics, ensuring a valid comparison between the two groups.

Research validity and reliability were ensured by selecting courses with similar academic performance and demographics. The same teacher taught both groups to control for variability in teaching styles and ensure consistency in instruction. Additionally, the students' prior learning experiences were ensured to be comparable, as neither group had previous exposure to the GENICS or PBL methods. The demographic characteristics of the participants, such as age, gender, and socio-economic background, were also considered to ensure the groups had similar conditions. Thus, purposive sampling ensures that variables that could affect the study's results are well controlled.

This instrument-based study assessed students' innovative thinking and learning model implementation. These included GENICS and PBL model-specific teaching modules, student workbooks (LKPD), syntactic consistency observation sheets, and essay exams. The four creative thinking indicators—fluency, flexibility, originality, and elaboration—were tested in nine essay questions. Pilot and expert testing confirmed essay test validity and reliability. Expert judgment was employed to evaluate whether each item appropriately reflects the intended theoretical construct to ensure construct validity. A panel of five experts with relevant backgrounds in education, psychology, and subject-specific content was involved in the validation process, strengthening the credibility and accuracy of the instrument within the study's context. The Cronbach's Alpha value of 0.73 indicates that the research instrument has good internal consistency and is considered reliable for use in this study.

Data collected via different methods. Before and after the intervention, experimental and control students' innovative thinking was examined. We made learning observations to implement

the GENICS and PBL model syntax consistently. Data analysis employed descriptive and inferential statistics. Descriptive data summarized pretest and posttest mean scores, standard deviations, and creative thinking skill percentage improvements. GENICS and PBL model syntax compatibility was assessed using multiple regression. One-way MANCOVA was used to test the hypothesis and control for students' initial creative thinking skills to appropriately compare the GENICS and PBL models. Partial eta-squared was used to evaluate the GENICS model's impact on students' creativity.

Four 90-minute experimental and control course meetings were held for the study. The Grouping phase, which involves students forming teams and setting up the collaborative environment, is allocated 10 minutes. This time is adequate to explain the group dynamics and assign tasks. Next, the Exploring phase, where students investigate and explore the learning material, is allocated 20 minutes. This is sufficient for guided inquiry, enabling students to engage with the content and begin developing creative ideas. The Discussion phase follows, with 20 minutes dedicated to group discussions. In this time, students share insights, critically analyze their findings, and refine their understanding through peer feedback, which is essential for promoting critical thinking and collaboration. The Individual Activity phase is allotted 25 minutes, providing ample time for students to independently work on synthesizing the information, applying the knowledge they've gained, and completing individual tasks that solidify their learning. Finally, the Combining and Sharing phases are allocated 15 minutes in total. These phases focus on the synthesis of ideas and sharing them with the class, which is vital for consolidating learning and fostering collective creativity.

Instructional modules, LKPD, and essay assessments for the GENICS and PBL models were created, and instructors were trained to maintain consistency. Students' first innovative thinking was examined in both groups. Experimental class learned the six-stage GENICS paradigm during intervention: Diversity in student groups promotes teamwork and leadership; Exploring involves pupils researching and brainstorming to spark curiosity and thought; Discussion, where groups shared their discoveries and knowledge, improved flexibility and collaboration; Individual Activity, where students addressed problems and developed ideas independently, emphasizing creativity and self-direction; Combining, where groups coordinated individual work to elaborate; Sharing discoveries with the class promoted communication and critical thinking. The control class was taught five times using PBL: Presenting the challenge to engage kids and ignite curiosity; planning students' problem-solving skills to foster flexibility and leadership; Guided individual and group inquiry, where students explored solutions independently and collaboratively, fostering originality and critical thinking; developed and presented results, where students shared their findings, promoting creativity and collaboration; and analyzed and evaluated the process, where students reflected on their problem-solving process, enhancing elaboration and critical thinking. Posttests in both groups examined students' creative thinking skills, and the GENICS and PBL model syntax was observed during the intervention to assess consistency.

One practical limitation to consider in this study is the readiness of the teachers, the need for appropriate teaching materials, and the class size. Teacher readiness is crucial for the successful implementation of the GENICS model within the 90-minute duration, as teachers who are unfamiliar with the model will require training to manage each phase effectively. Additionally, the need for suitable teaching materials is essential to support each phase of learning, such as materials that stimulate curiosity in the Exploring phase and resources that facilitate discussion in the Discussion phase. Another limitation is class size, as larger classes can make it difficult to manage time and ensure active participation from all students in each phase. Therefore, dividing students into smaller groups and employing effective classroom management strategies are necessary to ensure every student is actively involved. Thus, while the GENICS model holds potential for enhancing creativity, its successful implementation depends heavily on teacher preparedness, the provision of relevant teaching materials, and optimal class size management.

The study used ethical research standards to maintain research integrity. Parents and pupils gave informed consent, and confidentiality and anonymity were protected. All children were given equal opportunity to engage in the study, and the intervention was designed to not disturb learning.

4. Results

4.1. Creative Thinking Skills

The results of this study indicate that the GENICS learning model is more effective in enhancing students' creative thinking skills compared to the PBL model. Table 3 presents the pretest and posttest results for creative thinking skills in both the experimental (GENICS) and control (PBL) classes.

Table 3. Creative Thinking Skills in GENICS and PBL Classes

Class	Pretest Mean	Posttest Mean	Difference	Corrected Mean	Percentage Increase (%)
GENICS	41.07	79.46	38.39	79.37	93.48
PBL	48.44	75.77	27.33	75.86	56.42

The GENICS class demonstrated a higher percentage increase (93.48%) in creative thinking skills compared to the PBL class (56.42%). This significant improvement in the GENICS class can be attributed to the structured yet flexible stages of the GENICS model, which align with the indicators of creative thinking: fluency, flexibility, originality, and elaboration.

Table 4. Creative Thinking Indicators in GENICS and PBL Classes

Indicator	Model	Pretest Mean	Posttest Mean	Difference	Percentage Increase (%)
Fluency	GENICS	49.48	87.50	38.02	76.84
	PBL	53.13	79.11	25.98	48.91
Flexibility	GENICS	35.53	68.52	32.99	92.84
	PBL	41.20	66.67	25.46	61.80
Elaboration	GENICS	29.86	75.69	45.83	153.49
	PBL	46.52	76.39	29.87	64.18
Originality	GENICS	40.05	86.81	46.76	116.77
	PBL	58.34	90.97	32.63	55.93

The GENICS model showed superior performance across all creative thinking indicators, with the most significant improvements observed in elaboration (153.49%) and originality (116.77%). These results highlight the effectiveness of the GENICS model in fostering creative thinking by engaging students in activities that promote originality, fluency, flexibility, and elaboration.

4.2. Meta-Skills

The results also show that the GENICS model is more effective in improving students' meta-skills compared to the PBL model. Table 5 presents the pretest and posttest results for meta-skills in both classes.

Table 5. Meta-Skills in GENICS and PBL Classes

Class	Pretest Mean	Posttest Mean	Difference	Corrected Mean	Percentage Increase (%)
GENICS	64.37	81.60	17.24	81.78	26.78
PBL	67.54	70.71	3.17	70.54	4.70

The GENICS class achieved a significantly higher percentage increase (26.78%) in meta-skills compared to the PBL class (4.70%). This indicates that the GENICS model provides a more effective framework for developing students' meta-skills.

Table 6. Meta-Skills Indicators in GENICS and PBL Classes

Indicator	Model	Pretest Mean	Posttest Mean	Difference	Percentage Increase (%)
Self-Management					
Focus	GENICS	66.36	78.55	12.19	18.37
	PBL	70.22	73.61	3.39	4.83
Integrity	GENICS	68.29	84.03	15.74	23.05
	PBL	75.46	78.47	3.01	3.99
Adaptability	GENICS	66.67	81.17	14.51	21.76
	PBL	69.14	71.61	2.47	3.57
Initiative	GENICS	65.63	82.52	16.90	25.75
	PBL	66.55	70.95	4.40	6.61
Social Intelligence					
Communication	GENICS	63.43	78.47	15.05	23.72
	PBL	62.73	65.74	3.01	4.80
Empathy	GENICS	62.30	84.26	21.96	35.26
	PBL	64.82	62.04	-2.78	-4.29
Collaboration	GENICS	66.67	82.25	15.59	23.38
	PBL	73.46	74.85	1.39	1.89
Leadership	GENICS	67.82	85.41	17.59	25.93
	PBL	66.67	69.68	3.01	4.51
Innovation					
Curiosity	GENICS	68.75	83.33	14.58	21.21
	PBL	69.68	71.76	2.08	2.99
Creativity	GENICS	66.44	82.18	15.74	23.69
	PBL	69.21	75.23	6.02	8.70
Sense-Making	GENICS	63.58	82.10	18.52	29.13
	PBL	67.90	74.07	6.17	9.09
Critical Thinking	GENICS	55.93	80.74	24.81	44.37
	PBL	62.59	67.50	4.91	7.84

The GENICS model demonstrated superior performance across all meta-skills indicators, particularly in critical thinking (44.37%) and empathy (35.26%). In contrast, the PBL model showed limited improvement, with a slight decline in the empathy indicator (-4.29%).

4.3. Effectiveness of the GENICS Model

The results of the *Kolmogorov-Smirnov* test indicate that the residual data from the posttest of students' creative thinking skills [$D(72) = 0.103$, $p = 0.054$] and meta-skill abilities [$D(72) = 0.096$, $p = 0.098$] are normally distributed. The multivariate test results (Table 7) confirm the effectiveness of the GENICS model compared to the PBL model in enhancing both creative thinking skills and meta-skills.

Table 7. Multivariate Test Results

Test	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's Trace	0.097	3.487	2.000	65.000	0.036	0.097
Wilks' Lambda	0.903	3.487	2.000	65.000	0.036	0.097
Hotelling's Trace	0.107	3.487	2.000	65.000	0.036	0.097
Roy's Largest Root	0.107	3.487	2.000	65.000	0.036	0.097

The results indicate a medium effect size (0.097), demonstrating that the GENICS model is significantly more effective than the PBL model in improving both creative thinking skills and meta-skills.

5. Discussion

GENICS (Grouping, Exploring, Discussion, Individual Activity, Combining, Sharing) is a groundbreaking learning model that overcomes the limitations of traditional Problem-Based Learning (PBL) in fostering creative thinking and meta-skills, two crucial 21st-century skills (Umam, 2021; Prasittichok & Klaykaew, 2022). GENICS follows Indonesia's Kurikulum Merdeka framework, which emphasises personalised learning, by using differentiated instruction (Pitaloka & Arsanti, 2022; Sarnoto, 2024). GENICS scaffolds learning through six interrelated stages to improve cognitive flexibility, socio-emotional, and metacognitive skills, preparing students for complex, real-world situations.

5.1. Creative Thinking Skills

The GENICS learning model improved creative thinking by 93.48% compared to PBL's 56.42%, especially in elaboration (153.49%) and originality (116.77%). Munandar (2016) defines creative thinking as fluidity, flexibility, originality, and elaboration. These findings support this. The model's phases focus skill development. Grouping encourages students to work in varied teams and gain diverse viewpoints (Mardiyanti & Siburian, 2023). This phase helps kids think from diverse perspectives, a vital problem-solving ability. Exploring promotes individual exploration and curiosity-driven inquiry to help students create creative answers (Khofifah & Berliana, 2023). Self-directed exploration helps pupils think creatively. Discussion improves fluency through controlled idea exchange and peer criticism (Savira et al., 2023). This phase encourages students to communicate openly and enhance their ideas through constructive dialogue. Individual Activity supports freedom and creativity by having students solve challenges on their own (Munandar, 2016). This stage works well for introverted, introspective learners. Combining & Sharing synthesizes individual contributions into cohesive outputs and presents them to peers, mimicking real-world collaborative creativity

(Spencer & Lucas, 2021). This phase helps students generate, improve, and share ideas. PBL's less organized approach often fails to address individual learning variations, resulting in uneven skill development (Smale-Jacobse et al., 2019). PBL stresses problem-solving but lacks GENICS' explicit procedures to foster elaboration and innovation. PBL's open-ended nature may leave some students without enough scaffolding to build higher-order thinking skills, while GENICS gives stage-specific coaching.

5.2. Meta-Skills

With a 26.78% improvement in meta-skills—critical thinking, empathy, leadership, and adaptability—GENICS outperformed PBL. The model's organized phases improved several lifetime learning skills: Critical Thinking (44.37%). The Discussion phase's debate and peer review helped students analyze evidence and form rational arguments (Hastuti et al., 2024). This phase simulates real-world decision-making requiring critical examination. Empathy (35.26%): The Sharing stage, where students presented their work and received feedback, promoted perspective-taking and emotional intelligence, which PBL decreased (-4.29%) due to its limited social engagement (Yadollahi & Yazdani, 2020). Collective reflection at GENICS helps students respect multiple opinions, a talent required in worldwide workplaces.

Leadership & Collaboration (25.93% and 23.38%): The Grouping and Combining stages required students to negotiate positions, allocate duties, and settle disagreements, which PBL sometimes neglects (Sarnoto, 2024). These phases teach accountability and teamwork to prepare students for leadership. These results demonstrate GENICS' alignment with differentiated education, which adapts content, process, and product to varied learners (Tomlinson, 2018). Kinesthetic learners excelled in hands-on Individual Activity activities. Sharing presentations helped visual learners organize information graphically. Discussion helped auditory learners grasp (Pozas & Schneider, 2019).

5.3. Effectiveness of the GENICS Model and It's Practical Implication

Three educational ideas underpin the GENICS learning model, making it more effective in modern schooling. To ensure inclusion and engagement, it uses Differentiated Instruction (Tomlinson, 2018) to tailor tasks to students' learning profiles, such as tiered activities in the Exploring phase. This method adapts training to individual readiness, interests, and learning styles. Second, the model uses collaborative networks (e.g., Grouping and Discussion stages) to develop common knowledge, reflecting digital-age learning's interconnected, information-rich character (Downes, 2022). Third, it scaffolds learning through peer interactions (Combining) and instructor assistance to improve cognitive progress without overloading pupils, spanning the gap between independent and supervised practice (Sousa & Tomlinson, 2018). These theoretical foundations allow GENICS to meet the broad demands of 21st-century learners and follow worldwide educational trends that emphasize cooperation, critical thinking, and adaptation for lifelong learning and interpersonal development.

Despite its strengths, GENICS faces implementation challenges, including teacher preparedness—requiring professional development to transition from traditional methods to its flexible, student-centered approach (Kalinowski et al., 2024)—and resource intensity, as designing tiered activities requires significant planning time (Mengistie, 2020), difficult for under-resourced schools. Future research should examine scalability across fields (e.g., STEM vs. humanities; Sinaga, 2024) and skill retention longitudinally (Hattie, 2009), while policymakers must prioritize teacher training and budget allocation to reduce hurdles.

GENICS integrates creative thinking and meta-skills through customized training, redefining pedagogy. Its student-centered, phased design fixes traditional PBL's flaws and promotes invention,

collaboration, and flexibility. GENICS transforms modern education by aligning with theoretical concepts and empirical data to prepare students for 21st-century challenges.

6. Conclusion

Students' creative thinking abilities and meta-skills can be significantly improved through exposure to the GENICS learning model, which is an instructional strategy that is very effective. Because of its organized yet flexible stages, it offers a thorough framework for encouraging higher-order thinking and adaptability, which makes it an invaluable tool for differentiated learning. It is possible for educators to build a learning environment that is more inclusive and successful by adopting the GENICS model. This environment will prepare students for the problems that they will face in the 21st century.

7. Suggestion

It is important to emphasize that this study has a number of limitations, despite the fact that its findings are encouraging. The first limitation of the study is that it was carried out at a single school with a relatively small sample size, which may restrict the extent to which the findings may be generalized. Second, because the intervention was only for a brief period of time, it is possible that the long-term impacts of the GENICS model on creative thinking skills and meta-skills were not captured. For the purpose of establishing whether or not the GENICS model is beneficial, it is recommended that future study investigate its implementation in a variety of educational contexts and durations. Additionally, in order to provide a more thorough knowledge of the possibilities of the GENICS model, research might be conducted to study the impact that the model has on other skills, such as metacognition and emotional intelligence.

Declarations

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