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Adaptive Learning Models for Gifted and Talented Students: Global Perspectives and Implementation Challenges

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Abstract: This study examines adaptive learning models designed to optimize the potential of gifted and talented students from a global perspective. Using a systematic literature review (SLR) methodology, 21 articles from high-ranking journals (Q1 and Q2) and relevant academic books published between 2021 and 2024 were analyzed. The analysis identifies three primary models: the Enrichment Triad Model (ETM), the Differentiated Instruction Model (DIM), and the Autonomous Learner Model (ALM). Each model emphasizes critical elements such as deep learning experiences, curriculum flexibility, mentoring, and technology integration to foster creativity, critical thinking, and independent learning. The findings highlight the importance of adaptive educational paradigms that address not only the academic needs but also the social and emotional development of gifted students. The study also identifies significant challenges in implementing these models, particularly in developing countries like Indonesia, where resources and institutional support are often limited. The results provide practical insights into tailoring educational policies to meet the unique needs of gifted students, emphasizing the need for a balanced integration of global frameworks with local contexts. Future research is encouraged to explore adaptive learning implementations in diverse sociocultural settings to ensure equitable and inclusive education for gifted learners worldwide.

INTRODUCTION

Gifted and talented students have become a significant focus in the field of education due to their exceptional abilities and potential for achieving outstanding accomplishments. These students exhibit unique characteristics, such as a positive self-concept, perfectionism, high levels of physical energy and enthusiasm, creative and productive thinking, leadership abilities, and advanced psychomotor and cognitive skills. They are also characterized by remarkable curiosity, a passion for challenges, and heightened responsiveness to information. Additionally, they demonstrate superior memorization capabilities, rapid reading speed, and exceptional critical thinking skills. Research shows that gifted and talented students process information more efficiently, often focusing on advanced conceptual content compared to their peers (VanTassel-Baska et al., 1992).

The optimization and management of the learning process for gifted and talented students require tailored approaches to meet their specific needs (Scholz & Tietje, 2012; Baxter & Jack, 2008). A thorough understanding and creative teaching methods are essential for developing innovations that align with

the needs of this group of students (Bastani et al., 2018; Moen & Middelthon, 2015; Esterberg, 2014; James, 2013; Bowen, 2009; Fossey et al., 2002). Addressing these needs presents a challenge for education systems to design approaches that maximize the potential of individuals with above-average abilities and learning speeds (Campbell & Eyre, 2020; King, 2022; Peters, 2022).

Educational programs for gifted and talented students should adopt a specialized approach that fosters the balanced development of their intellectual, social, and emotional capacities. This involves not only accommodating their academic needs but also providing opportunities for in-depth exploration in their areas of interest (Santos & Natividad, 2023; Saputri et al., 2024). However, many educational institutions in Indonesia still rely on standard teaching methods that are less responsive to the unique needs of gifted students, which often results in suboptimal growth and development (Coleman et al., 2022; Peters, 2022; Riedl Cross et al., 2024).

In Indonesia, similar to other countries, the education of gifted students faces various challenges, including curriculum limitations that fail to address their needs and a lack of resources and professional support for effective instruction (Callahan & Azano, 2021; Latifah et al., 2024; Saputri et al., 2024; VanTassel-Baska & Hubbard, 2019). Standardized approaches in formal education often fall short of stimulating the abilities of these students, highlighting the necessity for more challenging and differentiated teaching methods (Coleman et al., 2022; Ishak, 2024; Peters, 2022).

Additionally, the disparity in access and opportunities for gifted and talented students in developing countries exacerbates the educational inequality for this group, potentially hindering their overall development (Cohen, 2022; Crawford et al., 2020; Makel, 2022; Plucker & Peters, 2020; Robertson, 2024). To address this issue, it is crucial for educational institutions and governments to implement inclusive policies and supportive learning environments tailored to the needs of gifted and talented students.

Previous studies, as identified through international reviews using the keyword "learning of gifted students," highlight the necessity of addressing these challenges, as depicted in Figure 1.

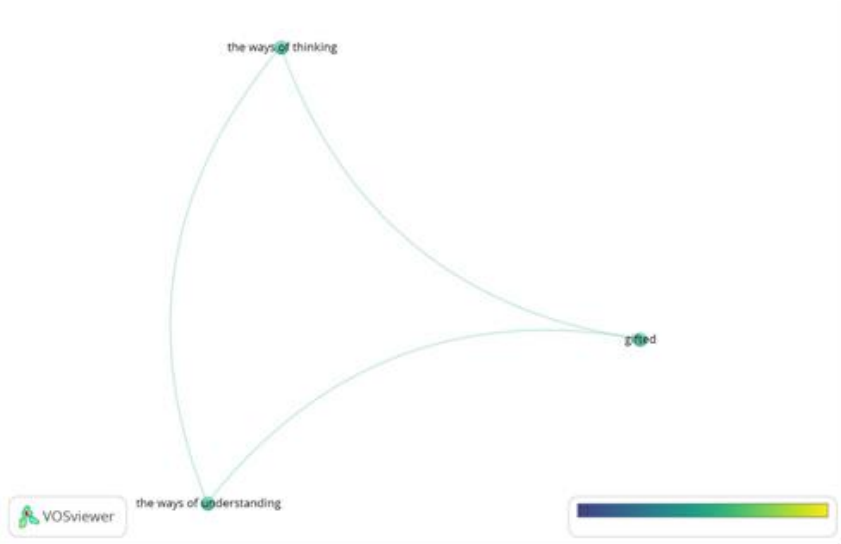

Figure 1. "Learning of Gifted Students" by Keyword.

Based on Scopus data analyzed on November 6, 2024, research on the "learning of gifted students" remains limited. This is reflected by the fact that only eight studies have employed the keyword "learning of gifted students," originating from countries such as Iran, Norway, Turkey, Serbia, the United States, and South Korea. These studies explore various themes, including mathematics education for gifted students (Azimi et al., 2023, 2024; SUBAŞI & Esra, 2020), methods for identifying potential learning (Pajchel & Ramton, 2021), didactic strategies and competencies for gifted students in the global era (Gojkov et al., 2015), global connections in the transformation of gifted education (Eriksson, 2010), independent learning approaches (Yoon, 2009), and learning strategies for gifted students (Scruggs et al., 1985). Notably, no studies have been identified in Indonesia that specifically address the "learning of gifted students," as illustrated in Figure 2.

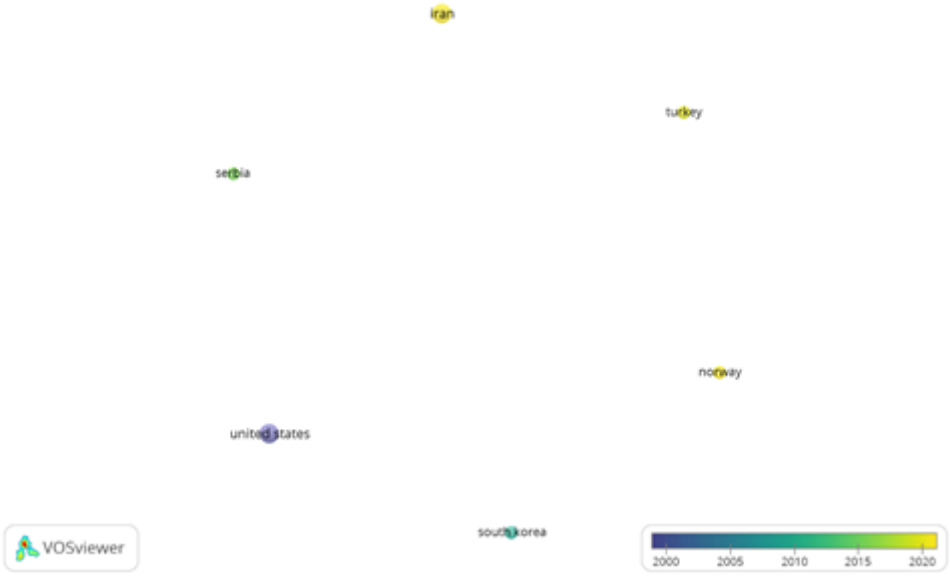

Figure 2. "Learning of Gifted Students" Research by Country.

Recent literature reveals a lack of specific research on the "learning of gifted students" in Indonesia. The limited global studies on this topic, combined with the absence of similar research in Indonesia, underscores a critical research gap. Addressing this gap is essential for gaining a deeper understanding of effective learning strategies tailored to the unique needs of gifted students in the Indonesian context. This study aims to provide new insights into the learning needs of gifted students at the local level, which can serve as a basis for developing more responsive educational policies. Additionally, this research has the potential to contribute to theoretical frameworks and policy discussions at the global level by proposing adaptive learning models suitable for gifted students, which may also be applicable to other countries facing similar educational challenges.

The significance of this research is further supported by an analysis of the Scopus database, which indicates that studies on the "learning of gifted students" are predominantly conducted in countries such as Iran, Norway, Turkey, Serbia, the United States, and South Korea. This study, therefore, seeks to identify and analyze adaptive learning

models relevant to gifted students by leveraging the perspectives of international experts. The findings aim to support the development of more inclusive and adaptive educational policies that cater to the extraordinary potential of gifted and talented students.

METHOD

The research method employed in this study is the Systematic Literature Review (SLR), a structured approach designed to filter, evaluate, and synthesize various relevant research sources on expert perspectives regarding the education of gifted and talented students across different countries (Allsop et al., 2022; Kitchenham et al., 2009). This method involves selecting articles published in high-ranking journals (Q1 and Q2) and books relevant to the topic of learning for gifted and talented students in both global and local contexts.

The SLR process consists of several steps: identifying keywords, screening the literature based on inclusion and exclusion criteria, and mapping data from the selected articles (Cabrera & Cabrera, 2023). In this study, the qualitative data collected were analyzed using NVivo 12 Pro, a software tool that facilitates the coding process and thematic categorization. This approach enables systematic organization of information and provides a comprehensive overview of expert perspectives on the education of gifted and talented students across different countries (Belotto, 2018; Hashimov, 2015; Rahayu & Syafril, 2018).

The data coded in NVivo 12 Pro were further analyzed using the interactive analysis approach proposed by Miles and Huberman, which includes three main stages: data reduction, data presentation, and conclusion drawing (Hashimov, 2015; Onwuegbuzie & Weinbaum, 2016). During the data reduction stage, irrelevant or repetitive information was excluded to ensure that the analysis focused solely on insights that contribute to understanding the education of gifted and talented students. The data presentation stage involved organizing the findings thematically, highlighting general patterns and unique perspectives from each country. Finally, the conclusion-drawing stage aimed to identify key themes and implications derived from the research findings (Rahayu & Syafril, 2018). This methodological approach enables researchers to explore diverse expert perspectives on the education of gifted and talented students globally. The insights generated from this study are expected to inform the development of educational policies that are more inclusive and responsive to the unique needs of gifted and talented students worldwide.

Table 1. Documents Used as Data Sources for this Study.

No	Author's Name	Journal Quality	Country Name
1	Maria Caridad Garcia Cepero	Q1	Colombia
2	Joseph S. Renzulli and Sally M. Reis	Q2	United States of America
3	Carla B. Brigandi, Cindy M. Gilson, and Myriah Mille	Q2	United States of America
4	Carla B. Brigandi	Q2	United States of America
5	Paul S. George	Q1	United States of America
6	Dorothy Sisk	Q1	United States of America
7	Belle Wallace, Alessio Bernardelli, and Clare Molyneux and Clare Farrell	Q2	United Kingdom London
8	Sally M. Reis, D. Betsy McCoach, Catherine A. Little, Lisa M. Muller, and R. Burcu Kaniskan	Q1	United States of America
9	Joseph S. Renzulli	Q1	United States of America
10	George Betts	Q1	United States of America
11	Dhara Baiden	Q2	United States of America

No	Author's Name	Journal Quality	Country Name
12	Michael S. Carriger	Q1	United States of America
13	Elaine H.J. Yew and Karen Goh	Q2	Singapore
14	John Leddo, Laila Jafri, dan Hameed Jafri	Q2	United States of America
15	Thomas Howard Morris	Q1	English
16	Allen Thurston, Maria Cockerill, and Tien-Hui Chiang	Q2	United Kingdom
17	Nadire Emel Akhan, Samet Çiçek, and Gülten Kocaağa	Q1	Turkiye
18	C Owen Lo and Li-Chuan Feng	Q2	Canada
19	Heinz Neber, Monika Finsterwald, and Nicola Urban	Q2	Jerman
20	Huss, J. A.	Q2	Czech Republic
21	Tessa H.S. Eysinka, Loes Gersena, and Hannie Gijlersa	Q2	Belanda

In addition to the high-ranking journal articles mentioned earlier, several books were utilized as data sources for this study. The selected books were chosen based on the quality of their content and their relevance to the research topic. These references provided valuable insights and a broader perspective on the education of gifted and talented students. The list of books used as data sources is presented in Table 2.

Table 2. Books Used as Data Sources in this Study.

No	Author's Name	Source	Country Name
1	Joseph S. Renzulli	Reflections on Gifted Education: Critical Works by Joseph S. Renzulli and Colleagues, pp. 193–210	New York
2	Joyce VanTassel-Baska, Gail Fischer Hubbard, and Janice I. Robbins	Springer International Handbooks of Education, Part F1630, pp. 945–979	United States
3	Betts, George T., and Jolene J. Kercher	Systems and Models for Developing Programs for the Gifted and Talented, Second Edition, pp. 1–728	United States
4	Sally M. Reis, Joseph S. Renzulli	Systems and Models for Developing Programs for the Gifted and Talented, Second Edition, pp. 323–352	United States

Table 2 provides an overview of the data sources used in this study, focusing on key books authored by prominent scholars in the field of gifted education. These books offer foundational insights into the design and implementation of programs and models tailored to gifted and talented students. Each source is accompanied by information on the country of publication, underscoring the international breadth and diversity of research in this area.

RESULT AND DISCUSSION

Based on the analysis conducted, this study identifies three adaptive learning models for gifted and talented students as suggested by experts worldwide: the Enrichment Triad Model, the Differentiation Instruction Model, and the Autonomous Learner Model. These models represent diverse approaches to addressing the unique educational needs of gifted and talented students. A summary of these models and their key features is presented in Table 3.

Table 3. Learning Models Suitable for Optimizing the Potential of Gifted and Talented Students.

Learning Model	Description	Method/Enrichment	Description
Enrichment Triad Model (ETM)	The learning model of providing varied and in-depth learning experien-ces through Explo-ration, Skill Deve-lopment, and Independent Study.	1. Type I Enrichment (Exposure to New Topics and Ideas)	Interactive Discussions, Project-Based Learning, Field Trips, or Guest Lectures.
		2. Type II Enrichment (Skill Development and Process Training)	Problem-Based Learning (PBL), Creativity Workshop, Simulation, and Role-Playing.
		3. Type III Enrichment (Self-Directed Research and Application)	Independent Study, Mentorship Programs, and Creative Product Development.
Differen-tiation Instruction Model (DIM)	Student-centered le-arning to meet the unique needs of gifted and talented students by adjusting the content, process, products, and learning environment accor-ding to their abilities, interests, and learning styles.	1. Content Differentiation	Providing complex and integrated content designed to encourage in-depth analysis and higher-level thinking.
		2. Process Differentiation	Problem-solving through critical and creative thinking via Project-Based Learning, Problem-Based Learning, and intellectual debates.
		3. Product Differentiation	Provide the freedom to create according to interests and talents, and encourage innovation through technology projects that have a real impact on local issues.
		4. Learning Environment Differentiation	Create a learning environment that supports exploration and collaboration. Provide access to mentors or experts.
		5. Tiered Assignments	Offer challenges appropriate to the level of ability through different task levels and complexities, as well as time flexibility.
		6. Compact Curriculum	Provide a compact curriculum for accelerated learning exploration by eliminating material that has already been mastered.
		7. Use of Technology	Offer broader global access through various interactive learning platforms for exploration in specific fields of interest.
Autonomous Learner Model (ALM)	Learning through the empowerment of individuals to become independent, creative, and responsible learners, with a balance between teacher support and student freedom.	1. Independent Learning	Facilitate autonomy for gifted and talented students in decision-making through deep interest exploration, independent projects, and the development of research, analysis, and reflection skills.
		2. Enrichment Activities	Providing innovative learning experiences that encourage creativity and critical thinking through special programs, competitions, and interdisciplinary collaboration.
		3. Group Investigations	Enhancing the learning experience through collaborative projects in small groups to develop

Learning Model	Description	Method/Enrichment	Description
			communication skills, social interaction, teamwork, and cognitive abilities.
		4. Mentorship Programs	Stimulating the aspirations of gifted and talented students through mentoring by professional mentors aligned with their interests to bridge theory and practice.
		5. Personalized Curriculum Development	Optimizing the intellectual capacity of gifted and talented students through a differentiated curriculum, such as acceleration or specialized materials, without causing boredom or pressure.
		6. Creative Problem Solving (CPS)	Improving divergent, convergent, and creative thinking skills through design thinking to help gifted and talented students find innovative solutions.
		7. Development of Life Skills	The development of life skills such as time management, leadership, and decision-making supports gifted and talented students in becoming well-rounded individuals

The Enrichment Triad Model (ETM), as outlined by Renzulli (2021; Renzulli & Reis, 2012), represents a flexible and adaptive educational approach tailored to the diverse needs of gifted and talented students. This model incorporates three core components: Type I (Exploration), which provides students with exposure to various topics and fields to stimulate curiosity; Type II (Skill Development), which focuses on the enhancement of cognitive, affective, and research-related skills; and Type III (Individual and Group Investigations), enabling students to apply their interests and skills to solve real-world problems or create innovative projects.

The ETM places emphasis on fostering meaningful engagement by aligning learning opportunities with students' personal interests and intrinsic motivation. By addressing their intellectual and creative needs, this model promotes not only academic achievement but also the development of independence and problem-solving skills. High-fidelity implementation, as noted by Garcia-Cepero (2008), has shown positive outcomes in fostering engagement, creative thinking, and independent learning. Furthermore, the success of this model depends on well-structured programs, teacher competency in implementing authentic learning processes, and the integration of advanced tools such as formative assessment, technological resources, and metacognitive strategies.

The ETM also provides a robust framework for evidence-based educational practices. Practical applications include methods such as Interactive Discussions and Project-Based Learning (Almazroui, 2023; Kokotsaki et al., 2016; Reis et al., 2021; Webber et al., 2020), Field Trips (Olszewski-Kubilius et al., 2021; Renzulli, 2021), and Problem-Based Learning (PBL) (Alt & Raichel, 2022; Carriger, 2015; Yew & Goh, 2016). These methods, alongside Creativity Workshops (Aksoy et al., 2023), Simulations and Role-Playing (Newell, 2021), and Mentorship Programs (Sergeyeva et al., 2021; Sharma et al., 2024), provide a comprehensive platform for enhancing students' abilities. Additionally, activities like

Independent Study and Creative Product Creation (Brigandi, 2019; Brigandi et al., 2019) help refine students' innovative and analytical skills, preparing them for complex real-world challenges.

The Differentiated Instruction Model (DIM) is another effective approach, designed to meet the diverse needs of gifted and talented students. As explained by George (2005), Krause (1987), Tomlinson (2001), and Wallace et al. (2012), the DIM focuses on offering deep, enriched, and complex content that matches students' abilities and interests. Gifted students, as highlighted by Sisk (2009) and VanTassel-Baska (2021), thrive in environments that provide advanced materials and challenging tasks to stimulate critical thinking. The use of Project-Based and Problem-Based Learning strategies (Almazroui, 2023; Kokotsaki et al., 2016; Sergeyeva et al., 2021) is particularly effective in fostering creativity and originality.

DIM not only emphasizes content depth but also supports personalized learning through tiered assignments and compact curricula (Reis & Renzulli, 1992, 1995). These methods ensure that learning remains challenging yet achievable, allowing students to progress at their own pace. Furthermore, the integration of interactive technologies (Chen et al., 2013; Irina et al., 2019) plays a vital role in expanding global access to information and encouraging interaction with diverse ideas. This global exposure broadens students' perspectives, empowering them to produce innovative and original work. A key component of DIM is its focus on mentorship, which, as noted by Vygotsky (1978), facilitates meaningful learning experiences and guides students toward achieving their potential.

The Autonomous Learner Model (ALM), developed by Betts (1985, 2004; Betts et al., 2016; Betts & Kercher, 2023), takes a holistic approach to gifted education by fostering independence and self-directed learning. It emphasizes a blend of enrichment activities, group investigations, and in-depth mentorship programs to nurture intellectual, emotional, and social growth. By focusing on personal interests and cross-disciplinary activities, the ALM encourages students to tackle real-world challenges with creative and collaborative thinking.

Curriculum customization in the ALM allows students to accelerate their intellectual development while simultaneously cultivating life skills such as time management, leadership, and effective communication. Mentorship plays a pivotal role, connecting students with professionals who inspire and guide them in their fields of interest. Activities such as design thinking sessions and real-world problem-solving further enhance their innovative capacities. The ALM's holistic focus ensures that students are well-prepared for future challenges, making it an indispensable model for developing well-rounded individuals.

Implications for the Indonesian Context

Applying these learning models in Indonesia presents unique opportunities and challenges. The Enrichment Triad Model (ETM) offers a practical framework for fostering independent exploration through extracurricular activities, research projects, and experiments. This approach can be integrated into programs designed to provide gifted students with opportunities to pursue their interests deeply. However, implementing such models requires structural support, including teacher training, curriculum adjustments, and access to appropriate resources.

In the context of Differentiated Instruction, Indonesian educators can leverage the model to design tiered lessons and compact curricula that

challenge gifted students without overwhelming them. Incorporating interactive technology and mentorship programs will further enhance their learning experiences, aligning with global standards while addressing local challenges.

The Autonomous Learner Model offers a transformative approach by empowering students to take ownership of their learning. Its emphasis on mentorship, enrichment activities, and the development of life skills is particularly relevant for preparing Indonesian students to compete on a global scale. However, successful implementation requires a concerted effort from educators, policymakers, and institutions to provide the necessary infrastructure and training.

These models, when adapted effectively, have the potential to transform gifted education in Indonesia, fostering the intellectual, social, and emotional growth of students while addressing their unique needs and challenges.

CONCLUSION

This study concludes that the development of gifted and talented students' potential requires adaptive learning models that integrate academic, social, and emotional dimensions, emphasizing creativity, critical thinking, and independent learning. The identified models Enrichment Triad Model (ETM), Differentiated Instruction Model (DIM), and Autonomous Learner Model (ALM), highlight essential components such as deep learning experiences, curriculum flexibility, mentorship, and technological integration. These models demonstrate the importance of balancing global educational frameworks with local contexts to foster innovative and socially responsible individuals. However, challenges such as resource limitations and institutional support, particularly in developing countries like Indonesia, remain significant barriers to implementation. Despite these challenges, the findings offer practical insights for tailoring educational policies to address the unique needs of gifted students holistically. Future research should explore the application of these models in diverse sociocultural settings and investigate how educational policies can ensure equitable and inclusive education for gifted learners worldwide.

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