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How Gifted Students Harness AI: Opportunities, Challenges, and Future Prospects

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Abstract

In this study, we delve into the opportunities, challenges and prospects of gifted students in middle and secondary school in tapping artificial intelligence (AI). The first part introduces AI and its role in education and discusses how school students need to understand and use AI effectively. The second part examines the concept of giftedness and the characteristics of gifted students. The research employs a mixed-methods approach, administering questionnaires to two groups: It provides gifted students and peers with average IQs. Results show that gifted students often use AI tools (ChatGPT primarily) as tools to advance their learning and to self-explore, whereas, for non-gifted students (average IQ), AI is predominantly used for completing their homework. While all groups can see the value of AI in increasing engagement and motivation, they all also struggle with difficulties, like technical problems and privacy problems. The implications are that personalized feedback and effective inclusion of AI tools within an educational curriculum are both critical. The findings conclude that AI tools should be integrated into school curricula to boost students' ability in personalizing learning, boost learning by means of creativity, and augment technological competence of students. For AI to be effectively integrated, professional development of educators becomes very important. Finally, the study supports for learning environment, which is both collaborative and innovative and uses AI to support students' diverse needs.

Introduction

Regarding technological advances in artificial intelligence (AI), stakeholders in the educational field use the AI increasingly more and more (Stolpe & Hallström, 2024). This new technology is used by teachers, students and parents alike, to get access to more information and handle other things. As argued by Gil de Zúñiga, H., Goyanes, M., & Durotoye, T. (2023), Artificial intelligence (AI) is defined as the actual ability of non-human machines or artificial entities of doing the things (tasks, solving problems, communicating, interacting, acting logically) that we associate with biological humans. AI's functionality can be conceptualized along two dimensions: performance level (decision making / prediction) and autonomy level (varying level of human input, interaction, or supervision involved). The authors Triguero, I., Molina, D., Poyatos, J., Del Ser, J., Herrera, F. (2024), think that most of the Artificial intelligence applications that are built are made to fulfill specific tasks. Yet there are many scenarios

that demand a more wide-ranging of AI to perform tasks of a wide range, referred to as a General-Purpose Artificial Intelligence System (GPAIS). The authors see GPAIS as an aspiration, a fiction and a potential risk to our society. Stolpe, K., & Hallström, J. (2024) consider that all citizens should learn about AI for two reasons: First, every student should know and understand what AI is and how he can use it and second all of them should be inspired to become designers of AI applications in the future.

Park, W. & Kwon, H (2024) studied in their implementation of an educational program within South Korea's middle school free semester system by using AI. These results suggest the importance of developing AI centered educational programs for use in schools. To begin with, the AI program identifies information pertaining to career exploration, giving students exposure to different technology career opportunities and positive attitude towards these fields. Second, the application of the AI program enhances the AI competencies through technology-based projects. Third, the study shows that technology education can improve AI skills and attitudes toward technology.

Our work in this study seeks to shed light on how gifted students in middle and secondary schools utilize AI, the opportunities, the challenges and the prospects. Additionally, we will look at what we should be teaching our students and the ways we should be doing it in classrooms to progressively expand their technical skills, knowledge, and socio-ethical understanding. The first part will define gifted students by their characteristics and abilities. The methodology section includes a questionnaire administration on 20 gifted students (middle and secondary schools) and another 20 students with a normal range of IQ. We will compare the results of these groups to see how gifted students use AI and how those with average IQs are utilizing it to reach an enhanced standing.

Definition of Giftedness

Defining the concept of giftedness is complicated and challenging. According to Kaufman and Sternberg (2008), giftedness is a label that can be applied with different criteria, variously perceived as general, spanning the numerous domains, or as specific pertaining to certain areas. Giftedness is historically transient with some culturally specific connotations. Initial efforts to define giftedness dates to Terman and Hollingworth (1926) who concentrated mainly on IQ tests (Ivarssom, 2023). Passow theory who defined intelligence as the tool for success in the social valued areas, is emphasized upon by Turkman (2020), but not all fields are mentioned as the social valued areas, but instead are limited to only some of them, such as languages, social sciences, natural sciences, and mathematics. On the other hand, for example, according to Witty's theory (1958), remarkable potential can be figured out on the grounds that it is perceived in any field by accomplishing or showing capacities (Turkman, 2020). Turkman (2020) characterizes gifted students as those who have demonstrated high ability in areas like general intellectual ability, specific academic aptitude, creative thinking, leadership, visual and performing arts; and psychomotor ability (Further, in 1972, the US Office of Education defined gifted as students demonstrating high ability in one or more areas including general intellectual ability, specific academic aptitude, creative thinking, leadership, visual and performing arts and psychomotor ability). In 1978, Joseph Renzulli proposed the Three-Ring Conception of Giftedness, suggesting that high potential arises from the interaction of three clusters of traits: have above average abilities, high task commitment, and have creativity (Renzulli, 2006). General abilities include abstract thinking, sophisticated reasoning, keen spatial relations and verbal fluency, Renzulli said.

These general traits are supported by specific abilities that allow for knowledge to be applied for problem solving. Renzulli points out that task commitment combines interest, motivation, perseverance, openness to criticism and self-confidence. The third cluster centered on creativity — a key indicator of potential — which was measured by fluency, flexibility, originality, curiosity and openness to new experiences. Identifying giftedness requires interaction among these three clusters, according to Renzulli. In Sweden, the term giftedness was defined in 1997 by Persson as the ability to consistently surprise others with knowledge in one or more each behavior (Ivarsson 2023). On the other hand, in 1999 Gagné introduced a different perspective by putting a difference between innate potential (giftedness) and developed ability (talent) (Ivarsson, 2023). This development he stressed intrapersonal and environment factors and supposed that about 10% of the population could be called gifted. Gagné identified levels of giftedness ranging from basic to exceptional and proposed a multidimensional model of intelligence involving six factors: Developmental processes, intrapersonal factors, environmental factors, natural aptitudes, systematically developed skills, and chance (Ivarsson, 2023). Gifts become talents through learning and practice, as explained by him, as part of a 'complex choreography' (Lautrey, 2003). Gagné offered invaluable glimpses into how high potential development can be understood through distinguishing gifts from talents. The gifted students in the United States are defined by the National Association for Gifted Children (NAGC) as those students that demonstrate outstanding aptitude or competence in one or more areas, with an exceptional ability to reason and learn or have a documented performance that is among the top 10% or rare in one or more domains (Turkman, 2020). Worrell, Subotnik, Olszewski-Kubilius, and Dixson (2019) further explain that Gagné's Differentiating Model of Giftedness and Talent (DMGT) (2018) describes how natural abilities (gifts) combine with environmental and personal factors to lead to outstanding skills (talents) and separate gifted individuals from their potential and talented individuals from their high-level achievements. In addition, Ivarsson (2023) expresses the view of Borland (2005) concerning the necessity to tailor education to pupils who are ahead of their development. However, Subotnik et al. (2011) considers giftedness to be a developmental process characterized as potential, achievement and eminence in which cognitive and psychosocial variables are of paramount importance in its evolution. Regarding these different concepts and models, this study will use a multiple dimension approach that brings Gagné’s concept into Renzulli’s model of Three-Ring Conception of Giftedness, focusing on how giftedness is a combination of innate abilities, environmental influencing factors and personal pledge in identifying and developing gifted and talented students.

Research Question

How do gifted students harness AI differently than their peers with average IQs in middle and secondary school, and what implications does this have for their learning outcomes?

Methodology

Participants

The study will involve two groups of participants: 20 gifted and 20 averagely intelligent middle and secondary school students. A wide diversity of experiences and backgrounds will be represented by selecting the participants from a variety of educational institutions.

Research Design

The approach of this research will therefore be one of mixed methods, with emphasis on quantitative analysis. A structured questionnaire will be administered to two groups: Gifted students and average IQ students. It seeks to uncover data on how these two groups use AI tools while learning and compare how they use these tools and how they affect their learning outcome. The usage of AI will be further tested on performance and motivation, with qualitative insights gleaned from open ended questions complementing the quantitative data.

Questionnaire Development

The questionnaire will be designed to explore various dimensions of AI usage, including:

- Artificial intelligence in learning
- The impact of AI on learning
- The challenges and concerns
- The future use and recommendations

Data Collection

The questionnaire will be administered online to ensure ease of access and completion. Participants will be informed about the purpose of the study and assured that their responses will remain confidential and used solely for research purposes. Anonymity will be maintained throughout the study.

Data Analysis

Upon collecting the data it will be assessed, statistically, to test for the differences in responses between gifted students and average IQ students.

Ethical Considerations

The study will follow ethical principles, participants guardians' detail informed consent and permission. All participants will maintain strict confidentiality, and individual identities will not be reported but in aggregate.

Limitations

This study has sample sizes of 20 students with an IQ above 120 and 20 students with average IQs. However, this permits for a targeted contrast between the two organs, yet the small sample size tends to make the outcomes tentative. The population of gifted or average IQ students may not be well represented by the results because an individual variation and varied educational context might not be taken into account. Further, the results may not generalize to other age groups, other geographic regions, or students who might learn under different

environments, which may determine the way AI would be used to manage the learning outcomes as well.

Results

In the following, we will show the results in different dimensions. For each dimension, we will highlight different aspects of both gifted students and students of average IQs usage of AI, their experiences, and learning outcomes. We will organize the findings around such issues as AI usage frequency, types of used tools, impact on academic performance and challenges the two groups face. The objective of this multi-dimensional analysis is to give further insights into the ramifications of AI in the learning process of these unique groups of students.

Demographic Information

Three key questions were asked in order to gather all necessary demographic data about the participants. Results show that 80 percent of people are in 14–15 age group and 20 percent of them are in 16+ age group. Additionally, 80 percent of these applicants are male. Of those 60% are in ninth grade, 20% are in tenth grade, and 20% are in eleventh grade. These numbers give a visible picture of the age, gender and educational level of the participants. Moreover, the results indicate that 60% of the participants are engaged in special programs for gifted students and use coding languages including Python, HTML, JavaScript, and CSS for the program, and Gifted and Talented program.

AI Usage in Learning

The results indicate that among those who had used AI tools in the learning process, 80 percent among gifted students said they use the tools a few times a week and 20 percent a few times a month. Eighty percent of gifted respondents reiterated the use of, for instance, ChatGPT, educational apps, content creation tools, coding platforms or voice assistants, to name but a few.

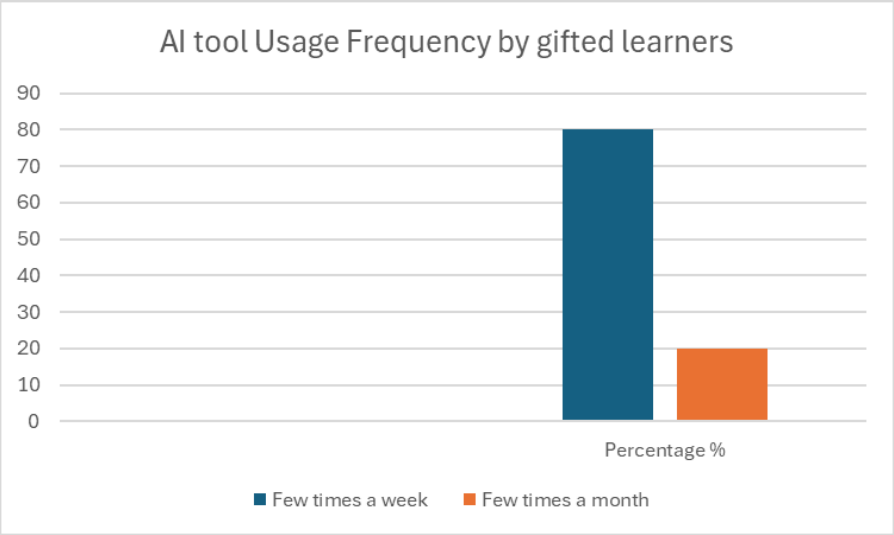

Figure 1 AI Usage Frequency for Gifted Learners

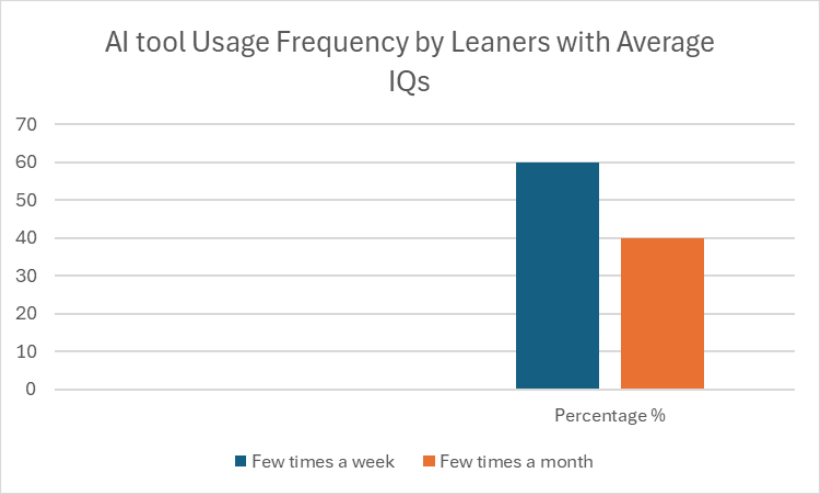

Figure 2. AI Usage Frequency by Students with Average IQs

When asked about the purpose, 80% said that they mostly use AI for research and information gathering as well as for creative projects; only 20% use it to learn a new language. In comparison with students who have average IQs, 60% of them use AI tools a few times a week and 40% use it a few times a month. Moreover, 60 percent of them also said they use ChatGPT to complete their assignments and check them at homework.

Impact of AI on Learning

It turns out 80% of gifted participants reported AI tools help them explore advanced topics and learn at their own pace, and 20% stated that AI hasn't influenced their learning experience. With that, 80% of participants with average IQs said that AI enhances their learning experience by making it more fun and engaging while 20% mentioned that AI has helped them with their grades. The groups came to a unanimous agreement that AI tools would be of most benefit to those in computer science/technology, languages, and arts. Furthermore, 80% of the participants in both groups were of the view that AI tools are more engaging and help in motivating the students but 20% were slightly motivated by AI tools.

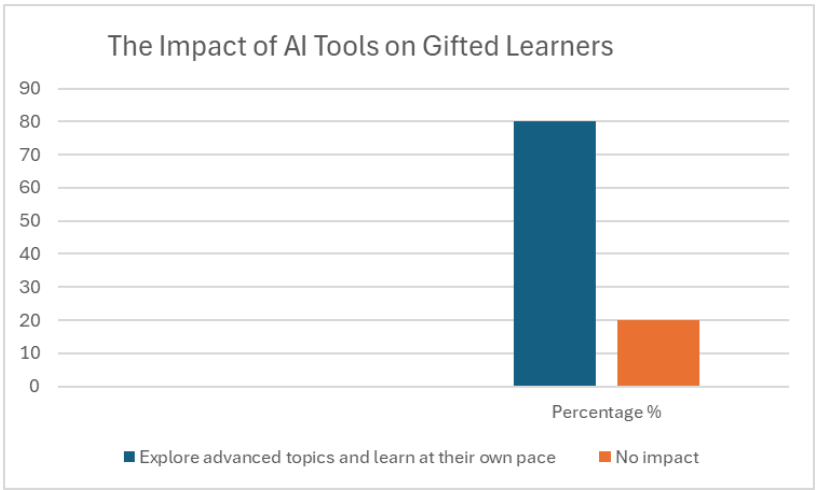

Figure 3. The Impact of AI Tools on Gifted Learners

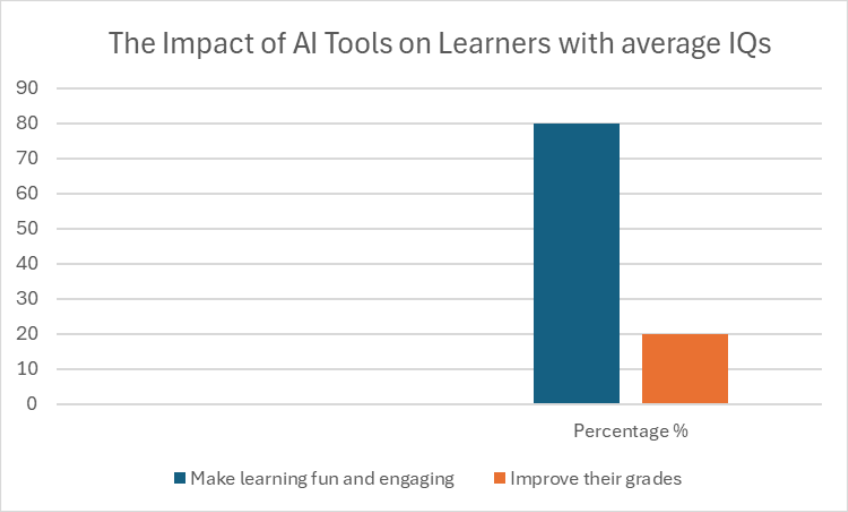

Figure 4. The Impact of AI Tools on Learners with Average IQs

Challenges and Concerns

The results indicate that both kinds of participants confronted issues when using AI tools, such as technical problems and their own learning objectives being derailed. Furthermore, 40 percent of participants have concerns about using AI tools in learning (40 percent) have no concerns about such risks. In particular, 50% of respondents still see privacy concerns as a risk of AI tools.

Future Use and Applications, Their Limitations, and Recommended Modifications

The results show that 20% of participants from both groups weren't sure and 80% would like to use AI tools more frequently in their learning. Participants also expressed a desire for various features of AI tools to improve their educational experience such as more personalized feedback, greater integration with the school curriculum, highlighting gamification elements, more user-friendly interface, more interactive content, better privacy and security of personal information. They also say that AI tools should be easy to use and ensure that, for instance, if a user doesn't ask ChatGPT some specific and well formulated question, they won't get the answer they were looking for. Additionally, participants preferred AI to have more human-like interactions.

Discussion

This study's findings also reveal revelations about gifted students' use of the AI tools vis a vis their average IQ peers. Analysis shows that there are differences between the way the AIs are used, as well as perceived impact on learning outcomes.

Demographic Overview

A typical demographic profile is shown for participants aged 14–15 (males predominated; significant representation in ninth grade). However, with 60% of participants identifying as gifted receiving advanced

educational resources through participation in specialized programs, this group is in a strong position to take maximum advantage of AI tools to enhance the learning experience. This demographic detail not only is essential to paint the picture of what educational environment these students are in but also how they utilize technology.

Frequency and Nature of AI Usage

We also address the frequency and nature of AI usage—defined as AI use that can be attributed largely to AI. The findings indicate that 80% of gifted participants use AI tools sometimes a week while 60% of those with average IQs. If gifted students more frequently incorporate AI into their daily learning routines, this higher frequency suggests. Their primary tools included ChatGPT, educational apps, and coding platforms — tools that take on a problem that offers a solution at which they can achieve problem solving expression, expressing creativity, and learning in depth. Beyond helping with homework, these tools may also help gifted children learn independently and explore subjects beyond any assigned curriculum.

Impact on Learning Experience

AI tools help gifted students explore these more advanced topics as these gifts allow them to learn at their own pace, which points to AI tools' role as tools for self-directed learning. The students with average IQs for instance find that AI tools are fun and entertaining. The difference indicates that gifted students more likely utilize AI tools in mastery and challenge mode as a way of stretching their knowledge or ability. What this means, however, is that gifted learners need more means to become resilient and autonomous learners, which AI can facilitate to a greater extent than teachers can, which may also lead to more motivation and engagement.

Challenges and Risks

Although there are advantages for each group, challenges abound—Technical problems and distractions from learning goals. Interestingly, 40 percent of participants identified risks associated with AI, but privacy issues were especially prominent at 50 percent. This awareness can make gifted students more wary and skeptical about their use of AI tools, and more inclined to find solutions that work on prevention of these risks and acquire full benefits they bring to learning. From this, educational institutions would need to be clear on guidelines and give training on safe usage of AI.

Future Recommendations

Both groups wish there were more effective AI tools that are, for example, more personalized and integrated with the school curriculum, or include gamification components. In particular, gifted participants emphasized that with user friendly interfaces and systems of AI that care enough to show nuance we can dive deeper into content. They are suggestions that enable them to create tools that do more than help them with academic tasks, units that support critical thinking and creativity.

Conclusion

Results from this study show that gifted students use AI tools for their advanced learning experiences in novel ways that greatly improve their performance. By using these technologies, they can study topics outside the traditional curriculum and can pursue self-directed study. Unlike their counterpart's average in IQ, the difference is stark in terms of education needs and motivations regarding different learning profiles. The identified challenges and risks described in the study, along with the proposed enhancements, could reduce the risks of the learning experiences for all students. To maximize AI's impact on education, schools should embed the AI tools into the curriculum so that learning can be personalized, and this can happen better. Including AI in lesson plans enables educators to create a more differentiated approach to teaching them to best serve the diverse needs of each student, encouraging them to learn at his/her own pace and review topics that he/she enjoys. Not only will this support gifted learners but will also help average students become more engaged and motivated.

This is not possible without professional development for educators. Teachers need to be trained on the tools that will help them use AI in training students. When teachers are comfortable in their ability to implement AI technologies in teaching, they can help students create their use of similar tools more effectively and innovatively. Additionally, schools should foster creativity and innovation by offering students experiences in project-based learning with AI integrated within. It could be coding, digital art or interactive storytelling — all of which will give students an outlet to work creatively and acquire vital skills in the process. However, by encouraging collaboration, AI can help make group projects into more effective vehicles for teamwork and the exchange of different points of view and thus equip students with critical thinking and problem-solving skills.

Technological competence should be developed in school curricula. Teaching students how to use AI tools well can be a great way to help students acquire crucial digital literacy skills that will apply both in school and in their career. Additionally, by establishing a positive learning environment conducive to experimentation with AI tools, it lets students feel comfortable experimenting with these tools and know where to reach out when they need to, and have the confidence to try some of these tools out.

Monitoring and evaluation of AI tools regarding their effectiveness in boosting student learning outcomes is ongoing. Feedback can be ongoing from students, teachers, and parents, helping guide future ways to improve, making sure the way AI is integrated will help reach educational goals. Addressing ethics concern of AI use is important as well.

Educators should guide their students in understanding how to live with AI in their lives responsible for the use of technology and digital citizenship. This analysis concludes with the potential of AI in education to transform how gifted learners learn, and the important requirement to consider amid such transformation. Thus, if schools accept AI as a way to differentiate, to be creative and to develop new skills, all students can use technology in an effective way, as they will be ready to confront a future in which AI will be present in almost all the domains.

References

Ayasrah, S., & Hanandeh, A. (2024). Exploring effective methods for identifying gifted and talented students. *International Journal of Instruction*, *17*(1), 115-132.

Beljan, P., Gardner, J. M., & Homaijani, D. (2024). Processing Speed in Gifted Children: A Clinical Neuropsychological Perspective. *Roeper Review*, *46*(2), 131–139. https://doi.org/10.1080/02783193.2024.2309396

Gagné, F. (2020). *Differentiating giftedness from talent: The DMGT perspective on talent development*. Routledge.

Gil de Zúñiga, H., Goyanes, M., & Durotoye, T. (2023). A Scholarly Definition of Artificial Intelligence (AI): Advancing AI as a Conceptual Framework in Communication Research. *Political Communication*, *41*(2), 317–334. https://doi.org/10.1080/10584609.2023.2290497

Ivarsson, L. (2023). Principals' perceptions of gifted students and their education. Social Sciences &Humanities Open, 7(1), Article 100400. https://doi.org/10.1016/j.ssaho.2023.100400

Johnsen, S. K. (Ed.). (2021). *Identifying gifted students: A practical guide*. Taylor & Francis.

Kaufman, S. B., & Sternberg, R. J. (2008). Conceptions of giftedness. In S. I. Pfeiffer (Ed.), *Handbook of giftedness in children: Psychoeducational theory, research, and best practices* (pp. 71–91). Springer Science Business Media. https://doi.org/10.1007/978-0-387-74401-8_5

Lautrey, J. (2003). *L'état de la recherche sur les enfants dits "surdoués"*, Laboratoire Cognition & Développement, Université Paris V.

Mcclain, M. C., & Pfeiffer, S. (2012). Identification of Gifted Students in the United States Today: A Look at State Definitions, Policies, and Practices. *Journal of Applied School Psychology*, *28*(1), 59–88. https://doi.org/10.1080/15377903.2012.643757

Park, W., & Kwon, H. (2024). Implementing artificial intelligence education for middle school technology education in Republic of Korea. *International journal of technology and design education*, *34*(1), 109-135.

Raoof, K., Shokri, O., Fathabadi, J., & Panaghi, L. (2024). Unpacking the underachievement of gifted students: A systematic review of internal and external factors. Heliyon, 10 (1), Article e36908.

Renzulli, J. (2006) *Qu'est-ce que le haut potentiel et comment peut-on le développer chez l'enfant et l'adolescent ?* (Numéro 485), p. 463-468. DOI 10.3917/bupsy.485.0463, Bulletin de psychologie.

Reynen-Woodward, K., Round, P., & Subban, P. (2023). Gifted, disadvantaged, unseen: A scoping study of giftedness, disadvantage and cultural difference in young adult learners. *Social Sciences & Humanities Open, 7*(1), Article 100477. https://doi.org/10.1016/j.ssaho.2023.100477

Robert J. Sternberg, Joseph S. Renzulli & Don Ambrose (2024) The Field of Giftedness—Past, Present, and Prospects: Insights From Joseph S. Renzulli and Robert J. Sternberg, Roeper Review, 46:3, 233-245, DOI: 10.1080/02783193.2024.2357379

Stolpe, K., & Hallström, J. (2024). Artificial intelligence literacy for technology education. *Computers and Education Open*, *6*, 100159.

Triguero, I., Molina, D., Poyatos, J., Del Ser, J., & Herrera, F. (2024). General Purpose Artificial Intelligence Systems (GPAIS): Properties, definition, taxonomy, societal implications and responsible

governance. *Information Fusion*, *103*, 102135.

Türkman, B. (2020). The evolution of the term of giftedness & theories to explain giftecharacteristics. Journal of Gifted Education and Creativity, 7(1), 17-24.

Worrell, F. C., Subotnik, R. F., Olszewski-Kubilius, P., & Dixson, D. D. (2019). Gifted students. *Annual review of psychology*, *70*(1), 551-576.

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