

A Review of the Use of ICT Techniques for Teaching Gifted Students

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Abstract

The issue examined in this systematic review was the current status of research on the use of ICT techniques in the education of gifted children. After defining gifted children, the need for separate consideration of educating them and the appropriate method of educating them led to considering ICT as a promising method to teach them. The review found that some recent research has reported models of appropriate education using ICT. However, mere models are not going to achieve anything. Facilitation of ICT at the school level and training of teachers to teach gifted children using ICT is also important. As with any other case, factors and challenges determine the success of ICT use in educating gifted children. Early identification of gifted children, self-regulation and self-efficacy of gifted children to focus on the relevant topics, individualised programmes and lastly, the impact of the current Covid-19 pandemic have been discussed by the other papers that were reviewed. Overall, it can be deduced that ICT is indeed a useful avenue to teach gifted students, but it needs to be used in conjunction with other educational interventions/programs to ensure its effectiveness. These findings have practical implications for improving the education of gifted students.

Key-words: Gifted Education, ICT, Teaching, Pedagogy.

1. Introduction

National Association for Gifted Children, USA defines gifted students as those, “with gifts and talents perform—or have the capability to perform—at higher levels compared to others of the same age, experience, and environment in one or more domains.” (NAGC, 2021). Gifted children may belong to any ethnicity, race, gender, culture or socio-economic status. Gifted children need special educational tools and methods to achieve their full potential. In the absence of sufficient opportunity to develop and express their talents, they may develop psychological problems. Since

many of them are introverts, they may need specific guidance and support to develop sociological abilities. Differently gifted children may have giftedness in different areas. Identifying giftedness itself and the area in which they are gifted is the starting point of using special educational tools and methods for them. NAGC has described some practices of identifying gifted children at district levels of the USA. The process consists of nominations by self. Peers, teachers, parents or others based on their perceptions. In the classrooms, teachers observe them using rating scales to assess different characteristics of giftedness. Performance of work portfolio in the class works is also included. How fast and how well these are done may be assessed. Detailed case studies of each selected student to confirm giftedness is the final process. A similar process exists in other countries and organisations also. However, it has also been pointed out that separate programmes for gifted children defy the principle of equity in education, which governs inclusive education.

The need to use ICT for the effective teaching of gifted children was highlighted by Mustafayeva (2020). The need to recognise children gifted in using ICT as a unique talent like in other fields and designing appropriate teaching and assessment methods at schools was stressed by Ahmad, Badusah, Mansor, and Karim (2014).

The aim of this systematic review is to assess the current status of using ICT techniques for teaching gifted children.

2. Methodology

The available literature from 2010 to 2021 were collected using the Google Scholar search engine. The keywords used were 'ICT techniques for teaching gifted students'. The first 200 papers were shortlisted by relevance, and out of these, 29 papers were shortlisted for a review. The shortlisted papers were selected based on their relevance to the aim of this research.

3. Results and Discussion

Method of Identification of Gifted Children

The education of gifted children is an important challenge since they need to be treated at a higher level than the general students. Some issues related to this aspect were highlighted by Worrell, Subotnik, Olszewski-Kubilius, and Dixson (2019). Elite higher educational institutions select only talented students with good academic scores and thus educate gifted children in their late adolescence stage only. These students contribute to the national GDP disproportionately. Giftedness is identified

by talent search in most countries. The authors discuss several models of giftedness. On the one hand, innovation and inventiveness are often considered as hallmarks of giftedness, while they have rights for free and appropriate education for them.

Appropriate Education of Gifted Children and Role of ICT in it

Thus, appropriate education is an important issue in the case of gifted children. One of the effective ways to provide appropriate education to gifted children may be the use of ICT tools and techniques. Any such method needs to consider the characteristics of gifted children, which were enumerated by Kontostavlou and Drigas (2019) as curiosity, initiative, imagination, originality, creativity, dedication to what they do and love for learning. Mobile learning, digital classrooms and online discussions are some avenues examined in this respect. However, ICT can be used only by those gifted students who have talent in using the technology. There may be gifted students in other areas for whom ICT may not be an appropriate education tool. One advantage of using ICT for teaching gifted children is that it provides opportunities for them to develop and practise higher-level thinking skills. As gifted students are spread throughout the world, ICT enables communications among them to satisfy the differential needs of differently gifted children through networking (Kaur & Meenu, 2013). A general discussion on the role of ICT in teaching gifted students is available in Khalikova and Khalikov (2020).

Models of Appropriate Education to Gifted Children Using ICT

When using ICT as a method for appropriate education for gifted children, methods to integrate with the whole system of education, including their factors, need to be considered. An effective model of using ICT for teaching gifted students was discussed by Bakar (2016). The concept of a digital classroom was used. This is an innovative method in which using integration of information and communication technology (ICT) was integrated. The method was tested at the "laboratory school" of the National Gifted Centre, Universiti Kebangsaan, Malaysia, as a teaching and learning strategy for gifted local students. Different tools of ICT such as electronic mail, social media applications and online learning portals were integrated as platforms for teaching gifted students. This technique has the advantage of creating a borderless classroom, where the gifted students can freely explore knowledge without limit or boundary. At least in the preschool stage, the integration needs to consider interaction with their less gifted counterparts, parents and others as a

factor of underachievement. To address this problem, an approach consisting of educational, ICT and learning guidelines might be helpful, according to Dutch research findings by Mooij (2013).

The use of robotics may be an excellent approach to promote creativity among gifted children. This possibility was demonstrated by Jagust, Cvetkovic-Lay, Sovic Krzic, and Sersic (2017) in a number of extra-curricular enrichment workshops using robotics like Lego Mindstorms EV3 and ICT for gifted primary students of grades 2 to 4. The gifted students did not have any difficulty in learning the tough lessons in computer programming, mechanics, algorithmic thinking, robotics, problem solving and creativity. The gifted children were professionally identified as intellectually gifted, at least two mental years above average. These efforts proved that gifted children are creatively productive, focused, task-oriented speed learners, more motivated and independent learners and like collaborations with other gifted children with the same interests and skills.

The usefulness of distance (online) education for gifted children in some specific challenging circumstances was discussed by Olszewski-Kubilius and Corwith (2011). The use of ICT was found especially suitable for gifted children located in inaccessible rural areas or when their schools do not have adequate advanced programmes or those who cannot fit with the ordinary school style of education or homebound students. Rural schools are a case in point as a large percentage of the population in developing countries are located in such areas. Distance education has the advantage of providing appropriate courses to gifted children without having to segment them from their peers or regular school environment. Desire to fast-track their education and to learn for extra credit on courses not offered in their institution may act as motivational points. Online learning is more facilitated by mobile learning (m-learning). A good example of combining m-learning with a lesson plan and gamification was given by del Carmen Trillo-Luque, Quintero-Ordoñez, Fuentes-Gómez, and Dauder (2020). They used Lesson Plan by Symbaloo EDU, gamification, and m-learning with Escape Room as a teaching alternative to teaching English as a second language to gifted children matching their faster pace of learning.

Education of gifted children need not be and should not be confined to highly technical maths, science or computer engineering subjects. Gifted children are part of society. So, they need to interact socially for various purposes. Social interactions are also part of gifted education. Blachnitzky (2009) developed and tested an online gaming application, Typozilla, based on the characteristics of the most popular gaming websites. The tests with gifted children revealed that they were very enthusiastic to see the avatars of other players in the multiplayer areas and competing against each other. They enjoyed learning the new skill of touch-typing by playing the game and engaging in creative tasks. All gifted children perceived the application to be highly appealing.

Another instructional design developed by Avcu and Er (2020) was effective on the computational thinking and creative thinking skills of gifted students but not on their programming self-efficacy. The instruction also helped the students learn and practise the computational concepts and their applications and develop their perspectives about computational practices, their design thinking skills up to a certain level. The students enjoyed the design thinking process, learned the course content but experienced some difficulties (Avcu & Er, 2020). The authors used the Instructional Design model of Morrison, Ross, Kemp, and Kalman (2010) for this work.

The ICT-related teaching methods used for gifted children in the studies of Karpova, Shtefan, Kovalska, Ionova, and Luparenko (2020) consisted of facilitating online distance education and the use of computers and software for networking and application of new ICT tools for learning applications. Organisational support was provided for all these and projects to use new ICTs and the internet and assessment of the effectiveness of using them. Thus, organisational support is important to achieve the desired success with the use of ICT to educate gifted children.

In an experimental study, Önal and Önal (2021) observed that Augmented Reality (AR)-supported astronomy teaching activities positively affected astronomy achievement and interest in astronomy of gifted students. The students had positive perceptions about the technical, cognitive and affective aspects of AR applications and wanted the use of AR applications in the delivery of other science subjects and other courses. AR and Virtual Reality (VR) seem to be very promising ICT methods to educate gifted children. However, no work on using VR was obtained in the literature search for this review.

Project-based learning also enhanced the capabilities of gifted children as well as other children. In ESL classes of gifted students, ICT was used for a project given to them to prepare a travel guide as a practical component of a 'Travel with Us' programme. ICT resources were used in the classroom for better engagement of students, dynamic interactions among them and development of ICT skills and problem-based learning (Sánchez, del Carmen, & Álvarez, 2020).

Facilitation of ICT Techniques to Teach Gifted Children

In the context of a developing country aiming to achieve the UN Millennium Development Goals of eliminating poverty, ensuring sustainable growth and social equity, education of gifted female children leads to reduction of child marriages, improvement in the rates of successful pregnancy and childbirth, family planning, self-reliance and empowerment of women, social sustainability and more jobs for women (Garba & Bisallah, 2016).

For successful use of ICT for teaching gifted children in schools, the ICT facilities should be available, as the availability and use of ICT tools were shown to be correlated when teaching gifted primary school children by Ahmed and Bakhiet (2021). Therefore, providing all the required ICT facilities at the school is of paramount importance. The need for organisational support was also highlighted earlier. The authors have examined the availability and use of an almost exhaustive list of ICT tools in the survey.

Teachers' Training for Teaching Gifted Children

To use ICT methods for teaching, the teachers of gifted children need to have the required expertise. It is, therefore, highly important to equip the teachers to use effective interventions for gifted children even in their general classrooms. This was stressed by NAGC. Training of teachers, especially in the required ICT competencies, was stressed by Turalbayeva, et al. (2017). The need to include the dimension of standards for teaching gifted children as an elaboration of the Australian Professional Standards for Teachers (APST) was highlighted by Henderson and Jarvis (2016). The authors have listed the items to be included in these standards by adaptation of the current list itself.

Considering separate expertise required for teachers in separate subjects, the need for training science teachers to teach science subjects to gifted students was emphasised by Trnova, Trna, and Skrabankova (2013). Based on analyses of existing curricula and professional development programmes for teachers and the curricula of students, Bochkareva, Akhmetshin, Osadchy, Romanov, and Konovalova (2018) developed and tested a model for training teachers to teach gifted students in mathematics and computer sciences. Another similar programme for teaching English communication to gifted children was developed by Kuznetsova (2018). The content, form of conducting lessons and facilitation by ICT were considered in the programme. The details of the programme with examples have been described by the author. Teaching skills in separate subjects are appropriate to deal with the differential abilities of gifted children.

The possibility of using mobile phones facilitated ICT use for accessing gifted children located in rural and other remote areas were discussed above. In continuation with this, a support system to revitalise on the job training and in-school training of teachers through effective use of video conferencing technology was proposed for teaching gifted children in remotely located schools (Kobayashi, Nagai, & Higuchi, 2020).

Some Factors and Challenges

Although separate ICT-enabled methods to teach gifted students to their full potential of capabilities may seem advantageous, there are many factors and challenges affecting its success. Some of them are discussed below.

It will be more advantageous if giftedness is identified in early childhood itself. According to Miftah, Raharjo, Utomo, and Rifai RC (2020) use of ICT-based learning media can bring out giftedness in early childhood through the improvement of their creative talent.

One issue is the extra time available to gifted children as they learn lessons faster. They may spend the extra time playing video games, becoming addicted to online technologies. This addiction was found to be negatively related to their quality of life, according to the findings of a survey by Yalcin, Guvener, and Kasa (2020).

Self-regulation and self-efficacy will help gifted children to separate what is relevant to their learning from the non-relevant ones. The essentiality of self-regulation and self-efficacy for mathematically gifted students when they use online learning was demonstrated by Fung, Yuen, and Yuen (2021). Course design, support from teachers, parents and peers was important in self-efficacy-mediated self-regulated online learning by gifted students.

It is always ideal for developing individualised learning programmes for each gifted student according to the nature of giftedness. In a study on this aspect, action research was used by Pangrčič, Seničar, and Gabrijelčič (2020) to evaluate individualised participatory learning programmes for gifted students, in which ICT was a component. The success of these programmes created greater awareness of the programme in the school, attracted more gifted students to the programme, enhanced the performance of participant students. Some challenges with respect to teacher-readiness and their training, ensuring active participation of gifted students in designing and implementing the programmes meant for them, and school-level facilitation was also discussed.

During the current Covid-19 pandemic, more technological opportunities were identified to facilitate the learning of gifted students in Poland. The pandemic seriously affected the identification and education of gifted students. These students acquired the ability to recognise and work with a new teaching and learning process through distance learning facilitated by ICT (Erdem, 2021).

4. Conclusion

The results of this review can be best concluded using the findings of Koh (2020) a review. The research trends in the use of ICT in teaching gifted children consisted of diversification and enrichment of experiences, leveraging it for online learning to expand academic options and the experiences and advantages in the use of various forms of ICT-based technologies for social and emotional development. There was a significant interaction of curriculum, technology and motivation through the reviewed papers.

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