

# The Paradox of Social-Emotional Learning (SEL) and Generative Artificial Intelligence (GAI) in Design and Technology: High School Context

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## ABSTRACT

The study is on The Paradox of Social-Emotional Learning (SEL) and Generative Artificial Intelligence (GAI) in Design and Technology (D&T): High School Context. This study is guided by the rational framework, anchored on the constructivism paradigm whose mother is the interpretivist paradigm of philosophy. Hinged on this philosophy, the study adopted a qualitative approach, following a systematic review of the available related literature, newsletters, podcasts and webinars on GAI in education and AI in instruction, best practices in D&T, case studies and interviews with the selected thirty-five D&T professionals drawn from; 5 D&T high school teachers, with an equal spread of 5year difference interval teaching D&T, 5 D&T examiners, 5 subject moderators, 5 D&T consultants and 5 Tertiary D&T teacher trainers and 10 from private high schools currently applying SEL in their curriculum. The commonality among the interviewees was their strong focus on CAD/CAM in design and manufacturing. The literature gathered using key research words and interview results was cross-reviewed and thematically analysed. It surfaced that the D&T professional community feel that GAI has immense potential to foster creativity in problem-solving, by allowing simulations of possible ideas in Virtual Reality (VR) environments and speeding up the design processes; research and ideation stages. Efficient leveraging of the capabilities of GAI; blended with the Social Emotional Learning (SEL) skills can influence students to explore and experiment with design concepts more efficiently, freeing up time for higher-order thinking and collaborative problem-solving. Having a clear and precise understanding of the impacts of GAI in D&T is significant because D&T competencies help students engage in real-world issues. Fusing GAI to D&T is a risky yet potential path because of the possible shortcomings and benefits it could have in actual- or authentic-problem solving within the classroom and society. The study recommends and provides insights for policymakers and researchers in the field of education with particular thrust on D&T to foster ethical considerations and data privacy, embrace and invest in Virtual Instruction (VI) tools specifically tailored for personalised learning, promote Professional Development (PD) and Capacity Building, embark on a rigorous curriculum review and alignment with GAI and SEL infusion in curriculum redesign.

**Keywords:** Social Emotional Learning (SEL), Generative Artificial Intelligence (GAI), Design and Technology, Authentic Learning, Teaching

## INTRODUCTION

Social emotional learning (SEL) is the process through which children, youth, and even adults can discriminate and understand their emotions, manage them effectively individually, achieve personal and collective goals, establish and maintain positive relationships, and demonstrate empathy for others' feelings. The secondary and high school frameworks worldwide are intensifying their mandate towards preparing young people for global societal challenges. Biewen et al. (2020), underscore that students need "real" learning objectives and opportunities to become independent and initiate a problem, search for suitable group members, and negotiate competition and specialisation that collaboratively exhibit a reduced sense of accomplishment. Gaining new abilities and skills enhances an individual's self-efficacy and competence to succeed in life's problems and adversity which can be presented in Design and Technology (D&T) classrooms. D&T constitutes a significant learning area that augments social and emotional capabilities. According to Hank et al. (2022), this learning area

includes the safe use of materials, modelling, visual representation, prototyping, technologies, systems use, reflection, evaluation, analysis, and design. Authentic design and implementation of solutions incorporate authentic contexts such that learners strive to understand the problem before offering solutions (Hank et al., 2022).

Garry et al. (2020) affirm that the term Artificial Intelligence (AI) denotes a computer executing actions and thoughts to solve problems characteristically processed by humans. Crevani et al. (2024) noted that the advancement and spread of big data, the Internet, and the Internet of Things (IoT) are driving many developments in algorithmic automation and machine learning that inspire AI empirical research and economic growth. Ethics, nevertheless, is pivotal when considering augmenting human social intelligence capabilities (Froschauer et al., 2021), especially given the potential of AI to replace human roles and relationships with affective and intelligent machines. Generative artificial intelligence (GAI) is a new concept integrated by Selvam & Danapalasingam (2019) that is part of a new dawn in big data analytics (Tyugu, 2023). According to Liu et al. (2020), GAIs are AI programs that envision emerging issues. GAI constitutes a derivative act of artificial intelligence where computer software tasks mimic cognitive and emotional processes including sustainable problem-to-solution mapping in applications without human intervention.

## BACKGROUND OF THE STUDY

The field of education has witnessed a significant shift in recent years, with the emergence of innovative approaches that aim to address the multifaceted needs of students. Two such approaches, Social emotional learning (SEL) and Generative Artificial Intelligence (GAI), have gained considerable attention in the context of Design and Technology (D&T) education at the high school level. Social-Emotional Learning (SEL) is a framework that focuses on developing students' abilities to manage their emotions, build positive relationships, and make responsible decisions (Weissberg et al., 2015). In the D&T classroom, SEL can be integrated to enhance students' self-awareness, empathy, and collaborative skills, which are crucial for successful design and problem-solving (Grieve & Haggerty, 2021). Studies have shown that the interplay of SEL in D&T learning can lead to improved academic performance, reduced behavioural issues, and increased engagement (Jones & Bouffard, 2012). GAI, on the other hand, is a rapidly evolving field that can potentially transform how students learn and create in the D&T classroom. GAI systems, such as ChatGPT, Stable Diffusion, Midjourney, Adobe Firefly, Maya and DALL-E, can assist students in generating ideas, prototyping designs, and solving complex problems (Bartlett and Camba 2024). Gero and Kannengiesser, (2019) hint that through efficient leveraging of the capabilities of GAI, students can explore and experiment with design concepts more efficiently, freeing up time for higher-order thinking and collaborative problem-solving. Zhou and Lee (2024 p6, para 4) echo that the rapid adoption of GAI technologies poses exceptional benefits and risks. In their research, they underscore that students when assisted by GAI, can significantly increase productivity in coding (Peng 2023), ideation (Noy & Zhang, 2023), and written assignments (Dell'Acqua, *et al.* 2023). However, they observe that there are raising concerns regarding potential disinformation (Spitale, *et al.* 2023) and stagnation of knowledge (design) creation (Burtch *et al.* 2023). From this, the study hypothesises that the intersection of SEL and GAI in D&T learning can create a holistic and enriching educational experience for high school students. Through a deliberate and systemic cultivation of students' social-emotional skills, such as empathy, collaboration, and self-regulation, the D&T classrooms can become a more inclusive and supportive environment. Additionally, the integration of GAI can enhance students' creativity, problem-solving abilities, and critical thinking skills, which are essential for success in the 21st-century design and technology landscape.

### Research Paradigm

The research is anchored on the premise that:

1. GAI can develop social and emotional learning of high school D&T students when implementing a socially intelligent paradigm of automation system, design collaboration, and empathy training, thus broadening their problem-solving skills, including the capacity to integrate novel reasoning, tools, and sharing personal viewpoints with others.
2. Secondly, GAI expands the capacity to scale social and emotional skills for D&T students and can lead

the route in bestowing SEL competencies on all high school students. With the paradoxical approach of GAI in the subject automation and the subsequent reduction in the capacity of AI, and student's self-regulation skills, D&T teachers should deploy SEL materials to help address such a gap.

### **Purpose of this Paper**

The paper will address how significant it is to include SEL skills and GAI in the D&T curriculum. It is important to teach students how to manage their emotions and express their opinions and thoughts with others positively, a skill fundamental in design problem-solving. It will address the importance of promoting SEL in high school D&T to help learners resolve contemporary design problems with a human-centred approach (Kim et al., 2020). The study will address the importance of social and emotional intelligence in learners to enhance their academic performance and positive approach to D&T classroom activities effectively. The research will evaluate the need to incorporate SEL competency in high school education that addresses the GAI impact on automated tasks and classroom activities (Kim et al., 2020). Similarly, the study aims to review the possible effects of overreliance on GAI in product design. To this end, the research will be guided by the following twofold research questions (RQs):

### **Research Questions (RQs)**

**RQ1.** How does the GAI affect humans' creative design and production?

**RQ2.** To what extent do GAI and SEL enable D&T students to produce more creative products?

### **Theoretical Framework**

The rational framework asserts that lifelong learning is integral to keeping pace with the fast-changing learning landscape irrespective of the kind of subject one focuses on. In contrast, the lifelong learning paradigm holds that learning design and enabling technologies increasingly augment learning experiences, whether in the human resources development gateway, the physical workshop with human teachers, or the emergence of online classrooms (Lehman, *et al.* 2023). This study is guided by the rational framework, anchored on the constructivism paradigm whose mother is the interpretivist paradigm of philosophy. The idea behind generative AI can be traced back to creativity and imagination which are fundamental human traits that cannot occur in a vacuum. To achieve optimum creativity and imagination, the fusion of GAI technologies and SEL skills must be put into play. In the same vein, Chigora and Manokore (2024) opine that the constructivist approach allows learners to take ownership of their learning, fostering a sense of agency and empowerment. This ensures that the learning process in the design process is built upon their prior knowledge and experiences, creating a personalised and meaningful learning journey which can be augmented by GAI.

## **LITERATURE REVIEW**

### **The Intersection of SEL and GAI in D&T Learning**

The interplay between SEL and GAI can also contribute to responsible and ethical design practices, as students learn to navigate the complexities of technology and its impact on society (Gero & Kannengiesser, 2019). This holistic approach to D&T education can better prepare high school students for the challenges and opportunities they will face in their future academic and professional pursuits. Currently, GAI, also known as augmented intelligence, is augmenting the capacity to create new designs, including improving the generation of new items, for example, vehicles with new applications of AI interfaces (Lehman, *et al.* 2023). Another notable advancement in GAI in design and engineering is augmenting the capacity to reconfigure or customise existing artefact designs to align well with user needs and preferences. Lastly, the GAI increasingly augments the capability to design artefacts across different types of design spaces, including improving the capacity of the technology platform to provide a sophisticated design solution in any shape, form, or size (Lehman, *et al.* 2023). This augmented potentiality means the incoming stream of powerful approaches and design tools not only enhances moving toward a new phase of problem-solving capability but also the upcoming impending struggle along this pathway.

Gero & Kannengiesser, (2019) submit that at present, AI-based technological tools, products, and innovations should demonstrate their capability to mitigate the potential cognitive biases that could undermine effective SEL outcomes. Given this, a question remains "Does the software product specifically augment the valid emotion, reasoning, or memory processes of the user or creator?"

Elucidating further, Buchanan et al., (2021) underscore that the integration of GAI can enhance the delivery and personalisation of SEL-based curricula, tailoring the content and activities to individual student needs. This is so because GAI systems can analyse student data and create customised learning experiences that address their unique social-emotional needs, fostering a more targeted and effective approach to SEL implementation. Conversely, it must be noted that the reliance on AI-generated content and interactions may raise concerns about the authenticity and depth of human-to-human connections, which are essential for effective SEL implementation (Garner et al., 2014). There is a risk that the overreliance on technology could diminish the quality of interpersonal relationships and the emotional resonance of SEL-focused activities in D&T classrooms.

### **Educators' Perspectives**

Educators play a crucial role in navigating the integration of SEL and GAI in high school classrooms. They may view AI-powered tools as an opportunity to enhance their teaching practices and provide more personalised support for students' social-emotional development (Buchanan et al., 2021). However, some educators may also express concerns about the potential loss of human touch and the challenges of maintaining authentic relationships in a technology-driven environment (Garner et al., 2014). Educators must strike a delicate balance between leveraging the benefits of GAI and preserving the human connection that is essential for effective SEL.

### **Students' Perspectives**

Buchanan et al., (2021) echo that high school students, as the primary beneficiaries of this integration, may perceive GAI in SEL-focused activities as a way to engage more effectively with the content and receive tailored support. The personalisation and interactive nature of AI-powered tools may resonate with students, fostering a sense of engagement and ownership in their social-emotional development. However, students may also have reservations about the impact of AI on their interpersonal skills and the overall quality of their social-emotional experiences. They may worry that the reliance on technology could hinder their ability to develop genuine connections and empathy which is key in D&T problem solving.

### **Policymakers' and Administrators' Perspectives**

Policymakers and school administrators play a crucial role in shaping the integration of SEL and GAI in high school classrooms. They may view the incorporation of AI-powered tools as a way to optimise resource allocation, enhance educational outcomes, and address the diverse needs of students (Buchanan et al., 2021). However, they must also consider the ethical implications, data privacy concerns, and the need for comprehensive professional development to ensure the effective and responsible implementation of these technologies (Garner et al., 2014). Policymakers and administrators must carefully examine the potential benefits of GAI and the need to uphold the integrity of SEL-focused educational practices.

### **The Impact of GAI on D&T Pedagogy**

The relationship of GAI in the D&T classroom can potentially transform the way students learn and create products. GAI can assist students in generating ideas, prototyping designs, and solving complex problems, freeing up time for higher-order thinking and collaborative problem-solving (Saunders & Gero, 2001). This shift in pedagogy can lead to the growth of critical thinking, creativity, and problem-solving skills, essential for success in the 21st-century. However, Bartlett and Camba (2024) caution that the interplay of GAI also presents challenges, such as the need to address ethical considerations, ensure responsible use of technology, and maintain a balance between human and machine-generated contributions. D&T teachers will need to adapt their teaching strategies to effectively leverage the capabilities of GAI while promoting the development of students' social-emotional skills and design-thinking abilities (Gero & Kannengiesser, 2019).

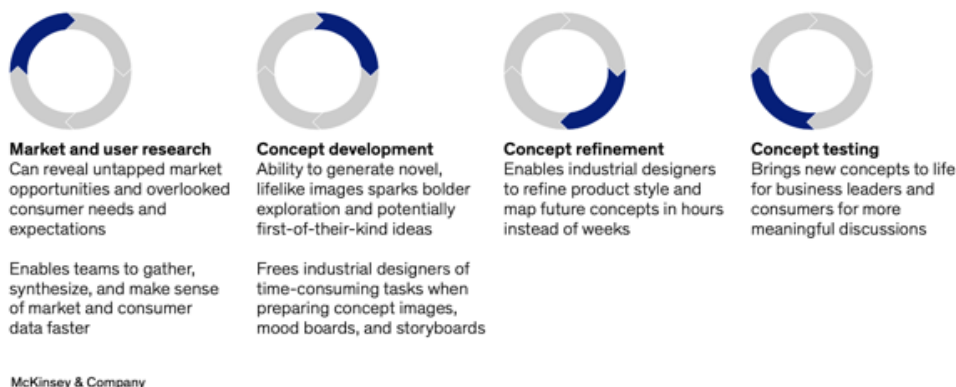
Booth et al. (2024) also emphasise that while GAI tools can bring extraordinary outputs, they cannot replace

human expertise. The field of design and manufacture will continue to face dynamicity, just as the industry saw with the arrival of computer-aided design (CAD) and later advancements such as 3-D printing and augmented and virtual reality. While the methods for designing physical products may change, D&T teachers and industry experts must ensure the meaningful use of the GAI technology and delivery of integrity design items. Cai, et al., (2019) underscore that GAI is relevant in D&T high schools, particularly as an educational technology intervention tool. Such technology encompasses educational software implemented to support learning, guide the students, and improve their creativity, decision-making skills, design perspectives, and divergent thinking within the D&T. However, it is crucial to underscore ethical problems when integrating AI into technological applications because of the potential to replace social relationships and cognitive activities with a machine that produces intelligent behaviours in high school. Machine learning can augment the potential to establish AI-based cognitive devices that will boost the practical knowledge in D&T decision-making to achieve lifelong learning via dynamically collecting experiences (Cai, et al., 2019). Such devices might recognise the models or contexts of various problems, leading to personal preferences, as well as adversarial cases that prove the gadgets are different from resisting the results of teachers and learners.

### Significance of SEL and GAI in D&T Learning

The integration of SEL and GAI in D&T learning at the high school level holds significant promise. Grieve and Haggerty (2021) opine that cultivating students' social-emotional skills, such as empathy, collaboration, and self-regulation, ensures that D&T classrooms become a more inclusive and enriching environment. Additionally, the integration of GAI and SEL can enhance students' creativity, problem-solving abilities, and critical thinking skills, which are essential for success in the 21st-century design and technology landscape. Elucidating further, according to Hensman *et al.* (2019), D&T dynamicity, mainly in the temporal awareness of authentic creativity and problem-solving, is under-studied. Developing a construct of realistic problems that are dynamic and change over time requires the research team to adapt the D&T cycle (Make, Evaluate, Improve and Investigate). According to the research done by Booth et al. (2024) under McKinsey and Company (2024) the GAI stands out to be bringing a new era of creativity and productivity to D&T. Below is a summary of their findings:

#### Generative AI ushers in a new era of creativity and productivity across the product design life cycle.



Source: Booth *et al.* (2024)

### Comparing and contrasting the significance of SEL and GAI

Research is conflicting on the efficacy of social and emotional skill training programs at the high school level. According to Ohrablo et al. (2019), project-based learning (PBL) has a significant influence on SEL ethics, habits of achievement, and motivation to learn. Another aspect to consider in the high school D&T class is virtual reality (VR) (Ohrablo et al. 2019). VR or any high-quality learning platform allows students to interact in a simulated world using devices such as tablets, smartphones, and sensors to control images and sounds to create a new dimension. Also, the D&T teachers should integrate the Paul Liskaser design thinking process which is anchored on the beliefs and insights of the designer into utile materials and media and not highly over-reliant on GAI.

Selvam, (2019) suggests progressive and skilled teaching of D&T, ensuring there are design and creation projects from the pre-design and research phase to shaping and balancing a range of making encounters, incorporating ability and concept building, learner-led insights, "spin-off," and confidence in exploring, transforming, and applying a range of ideas. Since, the subject content is dynamic, giving design-and-make projects and likely solutions in various materials and processes (e.g., computer-assisted design and manufacturing [CAD-CAM]) can foster authenticity. From each difficult design-and-make project, pupils should note and record the limitations and benefits of various tools and resources. Authentic design-and-make experiences enhance learners' thought development (Selvam, 2019).

### **Case studies on AI in advancing Education**

The World Economic Forum (WEF) (2024) submitted several case studies on how AI is fast advancing education 4.0. The case study by UNICEF (2024) on using Accessible Digital Textbooks (ADT) holds significant value. It can contribute immensely to students who are dyslexic or have visual impairment as it has text-to-audio features. The availability of audio descriptions of images, sign language videos and other customised features will enhance motivation and classroom participation. This will ensure more personalised learning which is inclusive.

Another case study by Kabakoo Academies in WEF (2024) shows the potential of GAI in transforming the education landscape and disparities among communities. It brings the aspect of Skill-building with Virtual Mentors which supplement human mentorship. This is a positive development, D&T can adopt to ensure high academic and skills acquisition. The use of these gamified virtual tokens has the potential to perpetuate dynamic and robust D&T classrooms with virtual worlds tailored to improve learner's perspectives in product design creation. These virtual avatars can also be leveraged to mimic a reality not often physically experienced by D&T students.

Finally, a case study by the Ministry of Education of the United Arab Emirates (UAE) (2024) on the AI Tutor Project has the potential to promote self-paced learning, enhance the learning experience, and eliminate time and geographical barriers. It also has the potential to involve parents in the academic journey by supporting and providing real-time feedback to the students.

### **Future Trends in D&T Learning**

As the field of education continues to evolve, the interplay between SEL and GAI in D&T learning is likely to become increasingly prominent. Emerging technologies, such as advanced natural language processing and generative design tools, will continue to shape the D&T classroom, requiring educators to adapt their pedagogical approaches (WEF, 2024). Bartlett and Camba (2024) opine that product design and D&T teachers should not naively cling to traditional techniques and methods but must remain open to the possibility that certain hand skills in design may decrease in importance in the future. In their submission, they hint that it is without a doubt that educators in the past were afraid to introduce CAD, 3D rendering, and digital sketching for fear that students would lose hand sculpting and hand rendering skills. Therefore, the emergence of GAI technology in the industry and SEL practice in education continue to shape the designer's perspective and clients' expectations in product design.

Saffo (1994) cited in Bartlett and Camba (2024) argued that originality was increasingly rare, and originality would eventually cease to be the true litmus test of creativity and innovation. In line with this, one can still evoke debate on the designer's role in the GAI revolution. The designer's creativity blended with human-centred needs is still critical to transforming the outputs of GAI into a viable final product design solution. Bartlett and Camba's (2024) findings indicate that GAI, at present, is not outputting a manufacturable final product without human input and testing for fitness of purpose. D&T students are still required to curate the best solution, considering the user needs, market appropriateness, and the product needs for the product. The D&T students and teachers can leverage GAI to help get to the final viable outcome, by quickly mapping the situation across databases for similar existing design problems. This bonds well with Bartlett and Camba's (2024, pg9, para 3) observation that "Trend research, user research, understanding of branding and brand identity, and manufacturability knowledge may become increasingly valuable skills in the age of generative AI." In doing so, D&T students ensure that the GAI augments (supplements) human skills which are still of critical importance in producing

user-centred and in some cases custom designs.

Future trends may include the integration of SEL and GAI in personalised learning experiences, the development of collaborative design platforms that leverage the strengths of both human and machine intelligence, and the exploration of ethical considerations surrounding the use of GAI in the design process (Gero & Kannengiesser, 2019). Additionally, the role of the teacher may evolve, shifting from a traditional instructor to a facilitator who guides students in navigating the complex interplay between technology, design, and social-emotional learning.

This literature review indicates that many researchers see the value in applying GAI to design and manufacture. While researchers are increasingly investigating applications of AI to the design process, there is a need for more work that focuses specifically on design education. Other reviews have focused on classifying and categorising GAI.

## METHODOLOGY

The study adopted a qualitative approach, following a systematic review of the available related literature, newsletters, podcasts and webinars on GAI in education and AI in instruction, best practices in D&T, case studies and interviews with the purposely selected thirty-five D&T professionals. These were drawn from; 5 D&T high school teachers, with an equal spread of 5year difference interval (5,10, 25years) teaching experience, 5 D&T examiners, 5 subject moderators, 5 D&T consultants and 5 Tertiary D&T teacher trainers and 10 Technology teachers from private high schools currently applying SEL in their curriculum. The commonality among the interviewees was their strong focus on CAD/CAM in design and manufacturing. The interviews were face-to-face and online for the regional and international participant. Four case studies on the effects of GAI in education were cross-reviewed. Although the emphasis was on an AI perspective in teaching and learning, the case studies were an eye-opener to the potential implications of generative AI in D&T classrooms. The literature was gathered using key research words and interview results were cross-reviewed and thematically coded. The key terms used for the literature research were; generative AI, product design, Social Emotional Learning in D&T, and technical vocational education.

## DISCUSSION OF FINDINGS

The available literature findings, webinars, podcasts, case studies, and newsletters on GAI in education and instruction, were thoroughly reviewed and triangulated against the qualitative responses from the interviews with the selected D&T professionals. The research questions were drawn upon to guide the discussion and curate reliable outcomes aligned with the study.

**RQ1.** How does the GAI affect humans’ creative design and production?

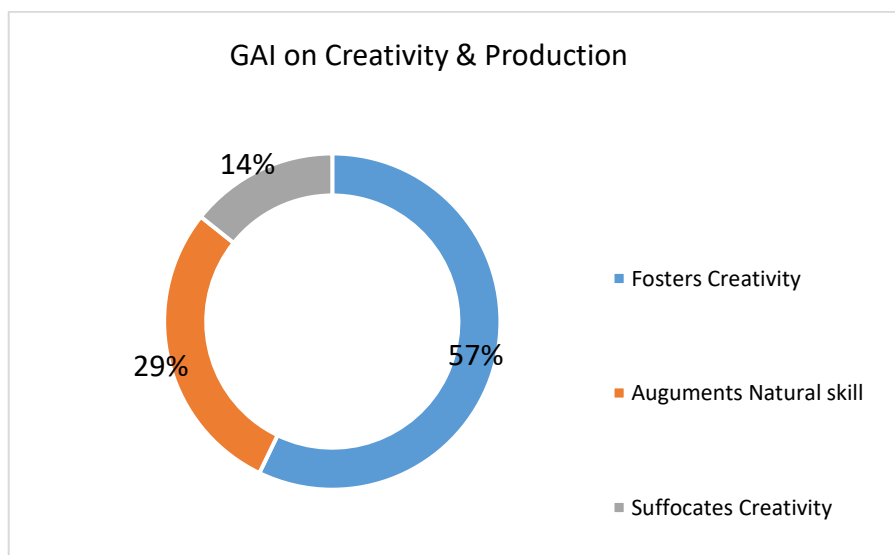


Fig. 1. D&T Professionals’ opinion

The first question registered a mixed feeling amongst the D&T professional learning community. From the interviews, 57% of D&T professionals opine that GAI fosters creativity by opening opportunities to tap into otherwise untapped user needs. This is through the triangulation and indexing of data from the design problem across trillions of information or similar design scenarios. The designer will work as the curator and process the outcome of GAI, speeding up the ideation process. This aligns with the findings of Bartlett and Camba (2024), who hint that GAI can increase the ideation speed by utilising quick search and feedback raw data for the designer to process. The designer has to gather inspiration and tailor the outcome to their needs. This should avoid plagiarism, as the AI-generated images at present mirror the work of a hidden individual (Bartlett and Camba 2024). 29% view GAI as having the potential to augment the natural skills in design. They agree that GAI blended with SEL can foster authenticity in user-centred designs. They agree that GAI blended with SEL can foster authenticity in user-centred designs. They also emphasise that instead of overtaking human natural skills in problem-solving, GAI can enhance student skills by exposing them to a wide range of inspirational ideas and material. On the contrary, 14% of the D&T professionals indicate that GAI has the potential to suffocate creativity and is bound to perpetuate generalised design outcomes which may appear futuristic, but lack in function, aesthetics, ergonomics and sometimes safety. Over-reliance on GAI can create problems of products that do not mirror the human needs. This submission aligns with Burtch *et al.* (2023) observation that GAI can result in a lack of creative design with the human touch.

### **Significance of using GAI and SEL skills in High school D&T**

From the interviews, it surfaced that high academic achievement in D&T requires fusing SEL competency with AI. GAI significantly helps D&T students develop novel reasoning and employ their viewpoints using creative art and design. This includes computer-aided designs (CAD) for complex problem-solving, and design collaboration exercises, such as sharing the same screen during video conferencing to allow both parties to manipulate the picture and optimising SEL skills (Kim *et al.*, 2024). When after improving SEL skills, the D&T student reasoning neural networks a problem and deploys GAI's adaptation capability, problem-solving model (SRS-335), and image-to-image translation systems model (Inui *et al.*, 2022). The case studies done in a high school Japanese class of senior students shed light on the significance of GAI in helping students navigate unfamiliar language in design and manufacturing. The GAI can work as a companion providing real-time feedback and information through dedicated applications. The D&T professionals echo that considering diversity in D&T classrooms, some students need personalised scaffolding interventions from GAI systems. For example, students who are dyslexic or who suffer from Autism spectrum disorder (ASD) can benefit from GAI systems to develop their SEL skills. Li *et al* (2024) submit that student support through GAI models for ASD students is a significant improvement in technology. D&T classrooms would benefit from this development.

### **Impact of GAI and SEL on D&T Pedagogy**

The majority of the D&T professionals share the view that GAI and SEL have immense potential to transform teaching and learning in this AI age. They echo that considering GAI's increasingly critical role in D&T, the teachers to leverage this technology to improve autonomous problem-solving, novel reasoning, and emotional skills like social intelligence, and curiosity. Si *et al.* (2019) developed an augmented reality (AR)-enabled simulated learning environment designed based on Anderson's training needs and Chyung's modified approach. The study findings established that the AR technologies significantly impacted students' effectiveness and competencies. The exploitation of Virtual Reality (VR) can also be utilised to model and simulate environments especially, in product design or in architectural designs. In the D&T classroom set-up, students can be grouped to work on a Topic involving solving a problem of paediatric learners at primary school. While the research on this topic requires, a thorough understanding of the challenges faced by the client (paediatric learners), social interaction skills must be applied to get the context of the problem. GAI can assist in providing a quick brainstorming, while the in-depth inquiry is done by the students. This will ensure a user-centred design outcome.

Elucidating further, the theories of GAI (Ingold, 2023) assert that it identifies and creates diverse feelings with other regulation technologies to establish learner-developed interactions. The D&T professional community feel that there is a need to incorporate GAI features in science, math, and technology appliances worldwide despite their authenticity in enhancing the social and emotional intelligence of the student. The rationale behind this



submission is that student one-on-one experience in SEL skills development encompasses the emotional awareness phase enhancing recognition and inspiration (Gour *et al.*, 2022). The learner's creative skills must always be recognised to ensure the maximum impact of SEL-focused learning. While GAI can assist in providing spaces that resemble an otherwise remote design scenario through VR and AR models, students can leverage this in designing customised products.

Furthermore, incorporating the GAI training environment into the Creative Systems Theory (CST) experience is increasingly crucial to improving SEL competencies because it is fundamental in cultivating self-awareness, autonomy, purpose, and innovative reasoning to ensure students can succeed in modern technology-triggered fields (Kim *et al.*, 2020). However, the fusion of GAI training capabilities must ensure that social interaction opportunities are not omitted, thus emotionally recognising and encouraging individual-centred tasks considering different perspectives (Gonda & Novikova, 2023). This approach is anchored on the fact that professional CST is increasingly centred on autonomy. It is important to augment the GAI ethical specifications to develop an algorithmic sense of uniqueness.

## CONCLUSION

The study explored the paradox of Social-emotional Learning (SEL) and Generative Artificial Intelligence (GAI). The findings from this study indicate a reinvention of D&T, but SEL has to go first. Authentic, inspirational, hands-on learning experiences centring student's inventive minds and intrinsic passion mark students as unique SEL designers and ultimately the community. The D&T professional community shared some informative perspectives on the topic. The key highlights are GAI's potential to foster creativity in problem-solving, by allowing simulations of possible ideas in Virtual Reality (VR) environments and speeding up the design processes; research and ideation stages. Through efficient leveraging of the capabilities of GAI, students can explore and experiment with design concepts more efficiently, freeing up time for higher-order thinking and collaborative problem-solving. Having a clear and precise understanding of the impacts of GAI into D&T is significant because D&T competencies help students engage in real-world issues. Fusing GAI and SEL skills to D&T is a risky yet potential path because of the possible shortcomings and benefits it could have in actual- or authentic-problem solving within the classroom and society. GAI systems, such as ChatGPT, Stable Diffusion, Midjourney, Adobe Firefly, Maya and DALL-E, can assist students in generating ideas, prototyping designs, and solving complex problems.

## RECOMMENDATIONS

This paper has examined the available literature on AI in instruction to align and contribute to the growing body of research on the interplay of SEL and GAI in D&T education at the high school level. The following recommendations were made:

### 1. Ethical Considerations and Data Privacy

Educators, policymakers, and administrators must collaborate to establish clear guidelines and policies that prioritise the ethical and secure implementation of GAI in SEL-focused D&T classrooms.

### 2. Professional Development and Capacity Building

Effective integration of SEL and GAI in high school classrooms requires comprehensive professional development for educators. Teachers must be equipped with the knowledge, skills, and resources to navigate the nuances of this intersection, fostering a balance between the benefits of AI-powered tools and the importance of human-to-human connections in SEL.

### 3. Personalised Learning and Skill Development

The interplay of GAI in SEL-focused D&T classrooms can foster personalised learning experiences that cater to individual student's social-emotional needs and learning styles.

#### 4. Virtual Instruction (VI) tools:

Schools must discover the early adoption of realistic AI to foster early exposure and design thinking, and supplement, and develop co-curricular teachers to stay updated on the GAI in D&T.

#### 5. Curriculum review and alignment:

It is also apparent that SEL and GAI have become increasingly more significant with the advent of Volatility, Uncertainty, Complexity and Ambiguity (VUCA); questioning should be restructured from many perspectives and not merely from the educators.

#### 6. GAI infusion in curriculum redesign:

This will augment the past curriculum to current guidelines based on the learners' methods of connecting, reasoning, and how they are affected by the information to implement the reasoning to handle some issues (Wilkins *et al.*, 2023).

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