Strengthening Social-Emotional Skills in Children with Autism using Serious Game

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ABSTRACT

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterised by persistent deficits in social interaction, communication difficulties, restricted, repetitive patterns of behaviour and interests as outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). These impairments can significantly hinder children's ability to empathise, engage in peer relationships, and manage appropriate social behaviours. In Malaysia, the prevalence of ASD is estimated at approximately 1 in 600 children, reflecting a growing need for effective and inclusive intervention strategies. This study examines the effectiveness of a serious game on the social-emotional skills of children with autism. The study involved eight children aged 5 to 10 years with varying levels of autism severity and was implemented in a classroom setting, supported by three special education teachers. Data collection was conducted through direct classroom observation, interviews with 3 special education teachers, and facial expression recognition to detect emotional responses exhibited by the children with autism during gameplay. The analysis focused on observable changes in emotional expression, engagement levels, and interaction with peers. Findings suggest that the serious game positively influenced the children's ability to recognise and express emotions, with several instances of improved peer interaction noted during and after gameplay. Teacher feedback further supported these observations, highlighting increased classroom engagement and social participation. The use of facial expression recognition provided objective insights into emotional responses, reinforcing the qualitative findings. Overall, the results demonstrate that game-based intervention, combined with technological tools and educator support, can enhance social-emotional development among children with autism and promote a more inclusive classroom environment.

Keywords: Autism Spectrum Disorder, Serious Game, Social-Emotional Competence, Game Design

INTRODUCTION

Autism Spectrum Disorder is commonly referred to as a "spectrum disorder" due to the wide variability in both the types and severity of symptoms experienced by individuals with autism (Hodges et al., 2020; Volkmar, 2021). According to the Diagnostic and Manual of Mental Disorders (DSM-IV), autism spectrum disorder is classified as a lifelong condition which is associated with difficulties in social communication, interaction alongside restricted and repetitive behaviour (American Psychiatric, 2013).

In 2022, it is estimated that 1 in 600 children in Malaysia is affected by ASD (Yaacob et al., 2022) and there is a statistic from the Social Welfare Department (JKM) indicating there are 15,484 registered cases of children and adults diagnosed with autism spectrum disorder (Khan et al., 2019). The rising number of autism diagnoses has led to a 30% increase in individuals seeking services from the National Autism Society of Malaysia (NASOM) across all age groups (Eow et al., 2020; Mohd Roslan & Mohidem, 2025). This trend underscores the necessity of providing early support for children with autism to enhance their development in key areas such as skill acquisition, education, and healthcare. Given that children with autism exhibit persistent deficits in social communication and interaction across various contexts, these challenges significantly impact their socialemotional reciprocity, affecting their ability to develop, maintain and understand relationships (American Psychiatric, 2013; Fuentes et al., 2012).

Although emotional and behavioural difficulties are not core symptoms of autism spectrum disorder (ASD), they are frequently observed as part of its clinical profile (Day et al., 2022). Challenges in perspective-taking and an impaired ability to understand others' emotions and intentions contribute to the social difficulties faced by children with autism (Baron-Cohen et al., 2009). Additionally, Papoutsi et al., (2018) highlight that children with autism often struggle to interpret emotional and social cues from facial expressions. This study explores the potential of serious games in fostering social-emotional skill development among children with autism. Over the past decade, digital games have increasingly been utilized beyond entertainment, serving as tools for therapeutic interventions and skill acquisition (Bernardini et al., 2014). Serious games have been widely adopted to complement traditional approaches in enhancing social-emotional development in children with autism (Kellidou et al., 2020). Therefore, this study investigates the short-term effects of serious game intervention in supporting social-emotional skills among children with autism.

Related Works

Emotions are intricate human experiences that play a fundamental role in daily life, significantly shaping communication and social interactions. Emotions once perceived by the ancient Greeks as negative forces leading to irrational behaviour but now it is widely recognised as adaptive and essential to survival (Sharma et al., 2019). Children with autism often exhibit challenges in social interaction, including limited social contact, emotional sharing and imitation (Chaidi & Drigas, 2020), which hinder their ability to communicate, socialise and build relationships. Core characteristics of ASD, such as inflexibility, a strong preference for routine and difficulties in interpreting social cues, recognising emotions in others, and adopting different perspectives, contribute to impairments in social-emotional development (Conner et al., 2020). These children are associated with difficulties in emotion recognition and there are also variances in the accuracy of emotion recognition among children with autism. Since, children with autism exhibited a poor perception of facial features and lack of interest in focusing on the eyes (Dantas & Nascimento, 2022; Syeda et al., 2017).

Children with autism usually experience challenges in perceiving others as intentional agents, which affects their ability to interpret and respond to social cues. The underdevelopment of social-emotional in children with autism significantly impacts their ability to establish and maintain relationships, as they struggle to adjust their speech and behaviour to suit the context of a given interaction. Additionally, children with autism exhibit difficulties in imitation, empathy, and social imagination due to limited eye contact, deficits in joint attention, and a reduced sensitivity to others' distress (Goldsmith & Kelley, 2018). Consequently, children with autism will continue to display deviation and social interaction across numerous contexts due to difficulties in social-emotional skills (Stathopoulou et al., 2020). Thus, individuals with autism demonstrate substantial difficulties in recognise a broad range of emotional expressions, with these difficulties becoming more pronounced as they age(Wagener et al., 2021).

Hence, a variety of technology-based interventions including interactive computer systems, virtual and augmented reality platforms, robotics and serious game have been developed to facilitate children with autism in their learning and development process. Prior research has consistently shown that the integration of information and communication technologies (ICTs) can enhance engagement and motivation among children with autism, particularly by providing structured and immersive virtual environments that replicate real-life social situations in a controlled and predictable manner (Dapogny et al., 2018). According to Khan et al.,(2019) and Pedreschi et al., (2019), these technological interventions are particularly effective due to their repetitive nature, reduced social complexity, incorporation of multimedia elements, and the ability to monitor and track learning progress efficiently.

Furthermore, Carreno-Leon et al., (2021) assert that serious game not only sustain attention and engagement but also contribute positively to the development of cognitive and motor skills in children with autism by fostering a sense of achievement through interactive gameplay. Kokol et al., (2020) also argue that serious game can play a vital role in helping individuals with special needs acquire essential skills across academic, communication, vocational, and recreational domains. Dizicheh et al., (2021) highlight that children with autism tend to spend a considerable portion of their time engaging with screen-based media, particularly video games, which reflects their affinity for digital environments. Supporting this, Kellidou et al., (2020) report that children with autism experience similar levels of enjoyment from gaming as their typically developing peers.

A review of existing literature suggests the potential for a serious game that utilise different interaction devices to stimuli social-emotional skills among children with autism. Whitley (2016) identified core social-emotional domains including self-awareness, self-regulation, social skills, empathy and motivation as areas of difficulty for children with autism. In response to these challenges, the study integrates facial expression recognition using Vision AI technology to detect subtle emotional shifts in children during their interaction with the game environment. Parenting a child with autism often involves complex challenges, compounded by widespread societal misconceptions regarding the condition. This study addresses two key concerns: (i) the insufficient development of social-emotional competencies in children with autism, and (ii) the limited availability of effective educational tools and strategies in the context of autism-specific instruction. To address these gaps, this study introduces MyFeeling, a serious game specifically designed to foster social-emotional learning outcomes for children with autism, while also serving as a complementary resource for educators.

METHODOLOGY

The study protocol received approval from the Human Research Ethics Committee of Universiti Teknikal Malaysia Melaka (UTeM) and prior to the trial, a written consent was obtained from all participants. This study adopted a qualitative research approach to explore the effectiveness of serious game approaches in supporting social-emotional competence among children with autism. Qualitative methods were selected to gain in-depth insights into the participants' behaviour, experience and interactions within a classroom setting. Data collection was conducted through classroom observations and interview sessions with special education teachers. The usability testing spanned a month period involving eight (8) children with autism aged between 5 and 10 years old. Participant selection was conducted by the special education teacher, ensuring representation across a range of autism spectrum levels and severity for inclusion in the usability testing.

The children engaged with the serious game, MyFeeling using two different interaction modalities. In the first session, each participant was given 15 minutes to play the serious game using conventional input which PC Control (keyboard and mouse). In the subsequent session, they play the game using motion sensor, Kinect Xbox 360 for another 15 minutes. Throughout the session participants' behaviour and responses were closely observed and recorded for further analysis. In addition, facial expression recognition using Vision AI was employed to capture and analyse subtle emotional expressions displayed by the children while playing the serious game. Vision AI able identifies a range of emotional parameters however this study focused on five key emotional indicators as outline in Table 1.

Table 1: Emotion Indicators by Vision AI

Emotion Indicators	Description
Joy	Characterised by upturned mouth corners, raised cheeks, and often crinkled eyes.
Sorrow	Indicated by lowered eyebrows, furrowed brows and downturned mouth corners.
Anger	Often associated with clenched jaws, furrowed brows and narrowed eyes.
Surprise	Recognised by widened eyes, raised eyebrows and an open mouth.
Neutral	Characterised by a relaxed facial expression with no prominent emotional cues.

DEVELOPMENT METHODOLOGY

This study employed an iterative design methodology to develop My Feeling, a serious game intended to enhance social-emotional competence among children with autism. The development process was structured into three phases: requirement elicitation, feasibility testing, and final implementation as shown in Figure 1.

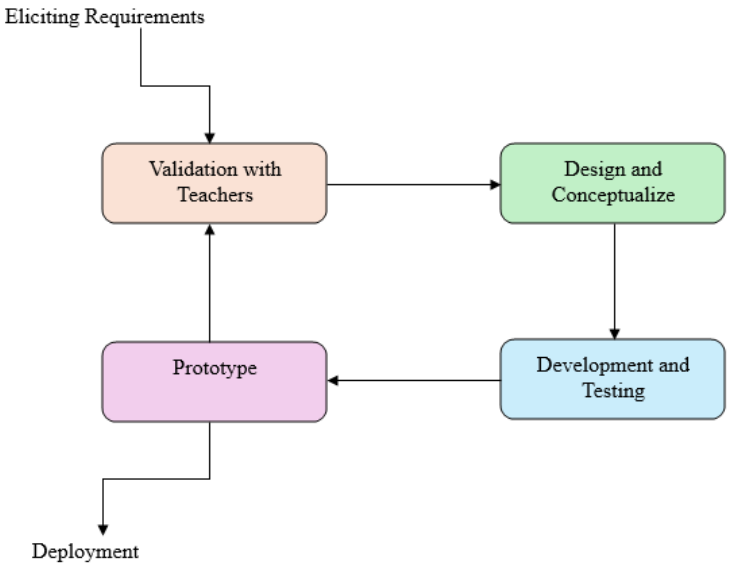

Figure 1. Iterative Cycle of MyFeeling Development Phase 1: Requirement Elicitation and Preliminary Design

The initial phase involved a comprehensive literature review and interviews with special education teachers from the National Autism Society of Malaysia (NASOM). These activities identified five core emotions—joy, sadness, anger, fear, and disgust—as the primary learning targets. Based on these findings, a low-fidelity paper prototype was created to illustrate the game's mechanics, interface, and learning objectives. Design principles emphasized simplicity, visual clarity, minimal auditory stimulation, and positive reinforcement. Teachers recommended incorporating three difficulty levels, puzzle-based tasks, and textual rewards aligned with classroom practices.

Phase 2: Feasibility Testing and Prototype Refinement

A preliminary prototype was evaluated with one special education teacher and two children with autism to assess usability, sensory sensitivity, and engagement. Activities included emotion-matching and puzzle-solving tasks. Feedback from this phase informed several refinements, including simplified audio cues, structured level progression, and the integration of positive textual feedback as a reward mechanism.

Phase 3: Final Development and Interaction Modalities

The final version of My Feeling was developed using Unity and implemented in two interaction modalities:

1. **PC Control**: Players used a keyboard and mouse to navigate mini games such as puzzles and "Fall and Catch," with positive textual feedback provided upon task completion.

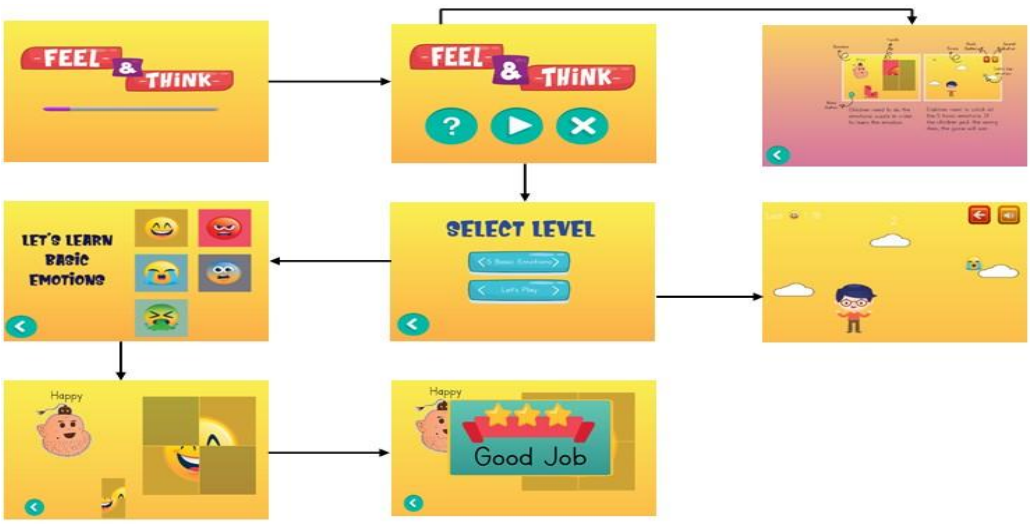

Figure 2. My Feeling using PC Control

2. **Kinect Xbox 360**: Motion-based interaction was introduced through gesture recognition, enabling players to engage in activities such as swiping to explore emotions and full-body movement in the "Fall and Catch" game. This modality aimed to support kinaesthetic learning and motor coordination alongside emotional recognition.

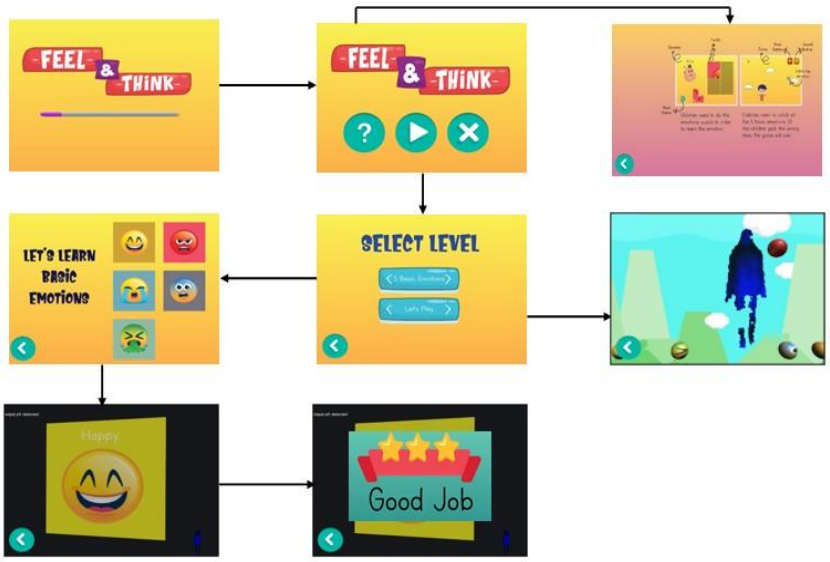

Figure 3. MyFeeling using Kinect Xbox 360

RESULT AND DISCUSSION

The study found that participants generally spent more time playing the game using Kinect Xbox 360 instead of PC control. This indicates that incorporating gestures and movements facilitates a more seamless and engaging interaction compared to conventional input, PC control. According to Wu & Zheng (2019), motion detecting technologies can deliver 3D virtual reality scenarios that enhance engagement among children with autism, as reflected in their stronger preference for gameplay and heightened attention. Similarly, (Khor et al., 2025) emphasize that extended reality (XR) technologies provide immersive, adaptable and precisely controlled environments. The findings indicated that variations in ASD severity were associated with differences in participants' comprehension and the level of success they achieved in the game.

Table 2. Participant's Profile and Total Duration Spent on MyFeeling

Participant	Age	Duration spent (minutes)		Total duration spent (minutes)
		Test 1 (PC control)	Test 2 (Kinect Xbox 360)	
1	6	11	9	20
2	9	16	20	36
3	5	10	9	19
4	5	17	15	32
5	7	6	8	14
6	5	13	9	22
7	6	5	7	12
8	7	9	7	16

As illustrated in Table 2, the findings indicate that children with high-functioning autism engaged with the game for a longer duration compared to other participants, largely due to their heightened interest in replaying the game. differences in cognitive abilities and comprehension of game instructions among the children with autism

were found to influence their overall gameplay performance. Participants with mild to moderate autism experienced more difficulties completing the game tasks and required frequent guidance from special education teachers, whereas those identified as high functioning exhibited greater independence and task persistence.

In addition, the results obtained from Vision AI have been analysed and are presented in Table 3 below. The results reveal that four participants displayed signs of happiness upon completing the game, suggesting positive emotional engagement. Two participants exhibited expressions of surprise when the in-game reward system was triggered after completing the first level. Conversely, the remaining two participants maintained a neutral emotional state and showed limited interest in continuing with the game, indicating a lower level of engagement.

Table 3. Emotion Displayed by Participants

Participants	Emotion Capture by Vision AI
1	Happy
2	Happy
3	Surprised
4	Happy
5	Neutral
6	Happy
7	Surprised
8	Neutral

Children with high-functioning autism demonstrated prolonged engagement by repeatedly playing the game, indicating both a strong interest and an enhanced capacity to navigate the game successfully. Findings suggest that these participants perceived the game levels as relatively easy, requiring minimal time to comprehend instructions and complete the given tasks. In contrast, children with moderate autism showed the shortest duration of gameplay, which may be attributed to limited interest or difficulties in understanding the game mechanics. Furthermore, these participants were only able to complete the tasks with direct support and guidance from the special education teacher. Based on these observations and the collected qualitative data, three key themes emerged, highlighting the effectiveness of serious game in supporting the social-emotional competence of children with autism

Theme 1: Serious Game Support Social-Emotional Interactivity among Children with Autism in Classroom Settings

Children with autism often facing challenges in conventional learning environment due to their difficulties to figure out classroom instructions, along with subtle vocal and facial cues from teachers and peers. Therefore, this study revealed that the use of serious game able to support development of social-emotional among children with autism as well as other skill development including communication and promotes social interaction skills. The incorporation of multimedia elements such as animation, sound effects, graphics, and user interfaces in serious game can enhance engagement and motivation among children with autism while also improving their social interaction, communication and literacy skills (Lee et al., 2018; Mohan et al., 2019).

This study reinforces this notion, as the use of MyFeeling within the teaching and learning process yielded positive results. Participants demonstrated the ability to react to emotional expressions and identify individual emotions. This study contributes to the growing body of research supporting serious game as an auxiliary educational tool due to the potential in enhancing classroom interaction and increase student participation.

Two participants were observed successfully reading emotion descriptions aloud and acting out the corresponding emotions. Additionally, the participants were able to accurately identify each emotion character when prompted by their teacher as illustrated in Figure 4. These observations suggest the serious game approach effective in promoting social-emotional development which are emotion recognition and understanding the emotion. The special education teacher’s comments further support this notion.

The teachers noted that:

"Participant 2 and Participant 4 are children with high functioning autism, demonstrating strong comprehension skills and communication abilities. This allowed them to understand the displayed emotions and read the corresponding descriptions accurately compared to other participants. Indeed, neither participant required teacher intervention, and both demonstrated an ability to engage independently with the game."

a) The participant manages to identify each emotion character.

b) The participant manages to avoid obstacles and collect all the emotions.

Figure 4. Participants with High Functioning Autism Able to Identify Emotions.

Beyond its potential for social-emotional development, MyFeeling holds promise as an educational tool for children with autism. This is exemplified by the data captured through Vision AI, which detected a happy emotion expressed by one participant as shown in Figure 5. This emotional response likely stemmed from the motivational reward message displayed upon game level completion. The in-game reward system, including messages and animations, appears to serve as an effective incentive for continued play, potentially boosting the participant's emotional state. Up to now, several studies has confirmed the effectiveness of feedback and reward systems in the game to sustain and increase the motivation of children with autism to continue play the game as well as produce better results in achieving the required goals (Daud et al., 2023; Hassan et al., 2021; Tsikinas & Xinogalos, 2019). The observations align with the special education teacher's comments regarding Participant 1 and Participant 3.

The teacher noted:

"Participant 1 who typically experiences increased motivation in completing his task when receiving compliments from teachers and peers. The in-game reward system helps to boost his confidence and motivation to keep playing the game. Moreover, the Participant 2 initial surprise at the reward animation displayed when completing the game level, followed by a positive response to the encouraging message to keep continue playing the game."

a) A participant expresses happy emotion when reward animation appeared after puzzle game

b) A participant expresses surprise due to the rewarding animation.

Figure 5. Data Analyse by Vision AI

Theme 2: Enhancement of Social Interaction Among Peers for Children with Autism can be Triggered Through Social-Emotional Activities

According to de Mooij et al., (2020), many psychological interventions for social-emotional management are based on behavioural and social learning theories are collectively known as Social Skills Training (SST), which aims to develop interpersonal, emotional and cognitive-emotional skills. Usually, the special education teachers will employ techniques such as role-playing, storytelling and situation enactment to foster comprehension among children with autism. As highlighted Kokkalia et al., (2017), games are increasingly recognised as valuable education tools, enable teachers to create a more playful and creative learning environment by implement social stories in the game. This study suggests that serious game can effectively promote sustained social interaction in children with autism due to the game's ability to provide progressively consistent structured experiences, maintaining engagement through consistent appeal.

The MyFeeling appears to be more engaging, interactive and motivating compared to traditional classroom instruction. Observations revealed that participants actively played alongside their peers, and data captured by Vision AI detected expressions of happiness during gameplay, as illustrated in Figure 6. These findings suggest that the game has the potential to enhance social interactions not only among peers but also between students and teachers involved in the gameplay.

The special education teacher further noted that:

"Children with mild or high functioning autism may exhibit social interaction behaviours within the game environment. For instance, during Test 2 was conducted, Participant 4 verbally acknowledged their body tracking displayed on the screen stating, 'I am the green one and teacher is yellow'".

a) Participant joke around with his peers

b) Participants play together with his peers

Figure 6. Participants Interact with Peers

Moreover, the use of body-tracking technology influenced the children's interest and attention. The special education teacher observed a marked improvement in children's engagement when utilising Kinect Xbox 360 compared to traditional mouse-based controllers. Children with autism demonstrated greater enjoyment and freedom of movement with the Kinect technology due to the ability to foster a sense of immersion, enhance excitement and sustain the social interactions with peers as shown in Figure 7. These findings align with previous research which reported that incorporating gestures and movement into the learning process creates a more natural learning environment for children with autism (Khor et al., 2025; Martínez-González et al., 2022).

a) Participant joke around with his peers

b) Participants play together with his peers

Figure 7. Participants Reaction to Their Body Tracker

Theme 2: Enhancement of Social Interaction Among Peers for Children with Autism can be Triggered Through Social-Emotional Activities

Emotion regulation (ER) is a critical component of children's social and emotional development, involving the intentional modification of emotional responses in terms of onset, form, intensity, and duration through cognitive processes (Martínez-González et al., 2022; Reyes et al., 2020). Children with autism often experience challenges in social interaction, emotional sharing, and imitation, which can impact their ability to regulate emotions effectively. This study suggests that integrating serious game can support the development of social-emotional skills by enhancing children's adaptability to emotion regulation (ER) strategies, such as attentional control and self-soothing. During the observation, one participant demonstrated self-soothing behaviour by willingly handing over the mouse to a peer. Additionally, the participant exhibited cooperative behaviour by assisting peers in completing a game level and patiently waiting for their turn, as illustrated in Figure 8.

The special education teacher further noted that:

"Participant 2 is a high functioning autism demonstrated self-regulation by calming themselves and patiently waiting for their peers to complete the game. They also exhibited cooperative behaviours by assisting their peers with specific tasks and respecting their turn."

Figure 8. Participant 2 Exhibit Self-Soothing Behaviour

Additionally, facial analysis (Vision AI) revealed a surprise emotion in one participant while interacting with the Kinect Xbox 360, as depicted in Figure 9. Participant 7 exhibited confusion upon observing their body tracker on the screen and navigating the game interface. Initial assistance from teachers was required, but the participant subsequently demonstrated increased engagement and interest in the game.

The teacher commented that:

"Participant 7 exhibited a propensity for environmental adaptation, often displaying initial reluctance to engage in tasks. However, with clear instructions and stimulating game content, they demonstrated increased willingness to complete the activity."

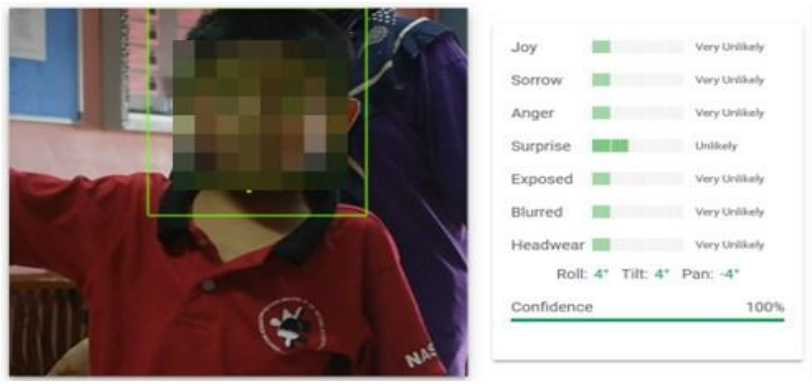

Figure 9. Vision AI detect surprise emotion on Participant 7

This study highlights the growing popularity of serious game as an entertainment medium, leading to increased scholarly interest in their potential to enhance individual well-being. Previous research suggests that video games can evoke positive emotions, improve mood, reduce stress, promote emotional stability, and support self-actualization (Gómez-León, 2025; Villani et al., 2018). Although video games may not fully capture the complexity of human emotions, specific game features present promising opportunities for developing emotion regulation skills (Baharom et al., 2014).

CONCLUSION

Serious game offer promising opportunities to enhance social-emotional and interpersonal skills in the classroom. The technology demonstrates potential to increase the children's engagement, interest and intrinsic motivation. While children with autism may struggle with complex cognitive tasks or reflective discourse, their active participation within the gaming environment meaningfully contributes to interactions. These actions provide valuable insights into their needs and preferences. The findings offer valuable insights for educators and autism specialists seeking to leverage technology for improved social-emotional and interpersonal outcomes among children with autism. This study also concludes that Human Computer Interaction (HCI) can effectively facilitate the skills development of children with autism by employing technology to support their educational attainment, aligning with Sustainable Development Goal 4 (SDG 4) which is quality education.

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