

Usability of Hand Skate for Cognitive Play: An Autistic Case Study

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Abstract

Introduction: Human-Computer Interaction attached a Hand skate called 'Phukphon' has been attempted for an autistic case study by observing in a ten-day occupational therapy program.

Case Report: A nine years old girl improved sustained attention and positive emotion by playing the first and the third cognitive games with a consecutive five days. The 'Phukphon' showed excellent usability of dependability and stimulation.

Conclusion: This hand skate for cognitive play shows positive implication for sustained attention, but emotional intolerance should be caution in regard with inappropriate stereotyped behaviors.

Keywords: Cognitive Play; Interactive Game; Behavioral Observation

Introduction

High incidence of Autistic Spectrum Disorder (ASD) shows a discontinuing care, an unmet need of individual development plan, and an inadequate number of healthcare workforce [1]. Children with autism have three deficits due to a disconnection between autonomic nervous system and cognitive planning for his or her social emotional learning: 1) communication difficulties to clarify preoccupied interests, 2) lack of flexibility to change movement patterns, and 3) special needs to achieve life skills related social engagement [1]. Needs assessment was conducted in Thai parents with autistic children (n = 270), then basic life skills and psychosocial skills were found to be focused in those relevant specialists together with positive parents [1]. To prevent conduct disorders from those autistic children, a transformative learning before adolescent ages enables productive leisure engagement in order to gain self-achievement among supportive and edutainment playfulness [2]. However, most autistic children with ADHD will be depressive anxiety if they feel fatigued on repetitive movement exercises [3-5]. In regards with finding a practical solution, cognitive play may be used to improve joyful interaction as well as creativity [4] without game addiction [6]. Those children need cognitive play to improve fine motor coordination [5], visual perception [7-8], cognitive play [9], and attention [10]. 'Phukphon' hand skate attached Human-Computer Interaction (HCI) has newly been designed to control joint stick (Figure 1) during a few gameplays. This one single case study was under supervision of one occupational therapist

(OT) in a ten-day consecutive program following an ethical approval at COA. MURA2020/315. Applied Behavioral Analysis (ABA) was recorded using a time interval of 10 minutes (on task) and a few minutes break (off task). Three coding behaviors were observed including stereotyped behaviors, sustained attention, and positive/negative emotions. Its usability was also reported using the User Experience Questionnaire or UEQ which is retrieved from <https://www.ueq-online.org/>



Figure 1: Hand skate or 'Phukphon' designed to control joystick for gameplays.

From the figure 2, three cognitive games were asked for the case study to select as free play prior to start a session. The OT was trained to play those games before the case study's approach as follows: -



Figure 2: Sliding bucket game, squeeze sauce game, and pick-up game.

The first sliding bucket game

1. Use three positions: a left blue, a right green, and a middle white

2. Move a trash to where some objects were dropped by using the Hand Skate’s controller
3. Continue playing toward the timer stopped, and collecting any red ball was not allowed.

The second squeeze sauce game

1. Use three positions: a left blue, the right green, and the middle white by using a squeezer attached to the Hand Skate controller or clicking on the screen at ‘automatic squeeze’ option
2. See which sauce was ordered by a customer (mayonnaise as yellow and ketchup as red)
3. Move the controller to the left blue when the customer ordered the mayonnaise or to the right green for the ketchup, and slide it to the middle white for releasing the squeeze. Continue playing toward the timer stopped.

The third pick-up game

1. Put left or right-hand dominant on the Hand Skate. Use a top left purple, a top right yellow, a top centered red, and a middle white
2. See an item emerged from the left, centered, or right direction. Move the Hand Skate to match the correct direction of the item.
3. Continue playing toward the timer stopped, and collecting any red box was not allowed.

Case Report

A girl with nine years of age (BOD 2011 Jan, 23 has been medically diagnosed as ASD or Autistic Spectrum Disorder without any physical disabilities. She was able to control her emotion by following a simple command and doing well on eye-hand coordination tasks. As shown in table 1, ten days were consecutively recorded based on the ABA method. As seen in table 1 her stereotyped behaviors went down from Day 1 to Day 5 indicating a long period of sustained attention in parallel to maintain positive emotions at Day 3 - 5, higher times than negative emotions.

Game Number# (Day, Occupied Minutes)	Stereotyped Behaviors (Times)	Sustained Attention (Times)	Positive/Negative Emotions (Times)
#1-3 (Day 1, 8 min.)	18	4	2/5
#1, 3 (Day 2, 8 min.)	12	6	1/3
#1, 3 (Day 3, 8 min.)	8	9	2/1
#1, 3 (Day 4, 8 min.)	4	3	3/2
#1, 3 (Day 5, 8 min.)	3	11	4/3
#1, 3 (Day 6, 5 min.)	19	3	1/10
#1, 3 (Day 7, 8 min.)	13	9	1/4
#1, 2 (Day 8, 8 min.)	13	3	1/3
#1-3 (Day 9, 9 min.)	9	2	1/1
#1-3 (Day 10, 9 min.)	3	0	0/1

Table 1: Applied Behavioral Analysis Observed Usability of Hand Skate for Cognitive Play.

Interestingly, this case study enabled an emotional tolerance no later than 5 days especially for spending 8 minutes to complete two cognitive plays including 2-min break. She started getting more times of stereotyped behaviors than her sustained attention from Day 6 - 8 since she got negative emotions by screaming, bouncing on the chair, turning back, and saying "enough the time went out". Her occupational therapist noticed a controller of the hand skate was broken so that visual cue and verbal prompt were needed for continuing the game until 10 minutes. Its usability via the UEQ out of 3 total scores per each item were completed by only one occupational therapist for this case study: attractiveness 1.5, perspicuity 0.5, efficiency 0.5, dependability 1.75, stimulation 2.0, and novelty 1.5. When compared to benchmark the data set contained from 468 worldwide innovative research (n = 21,175) the hand skate for cognitive play was likely to be excellent dependability and stimulation in the range of 10% best result.

Discussion

This case report seems to be accessibility to technological devices for kids and their modern families [8] similar to an effective video game with fun and visual feedback used as technology-based interventions for the ASD children [6,10]. The case study was observed on the fifth day that engagement in the first and third game enabled rapid acquisition of learning to inhibit stereotyped behaviors and then to improve sustained attention with positive emotion. Both games are designed to focus on gross motor movement with controllable patterns.

However, the case study was found fluctuation of sustained attention after the fifth day. Consequently, negative emotion was observed in parallel to her increased non-productive behaviors which were agreed to unmet needs of broken controller of 'Phunkphon' hand skate. It is very challenging to encourage adaptive learning under an independent play at the age of nine [9]. Although this game-based intervention provides training of visual perception and cognition but visual cueing and verbal prompting could be an essential motivation to improve sustained attention [7]. Not only delayed communication, but also altered perceptions were found that the case study showed emotional intolerance when three games and the second game were selected. As seen in the second game, the manipulative cognition is required in relation with fine motor control of complex movement which made her not be enjoyable and boredom mentioned in the earlier study [5]. To extend the usability of hand skate for cognitive play, home-based activities may be benefits for positive parenting integrated social emotional learning without game dependence [6]. Randomized controlled trials are further needed on multi-sensory interventions against the 'Phunkphon' hand skate in larger sample sizes of children with ASD and other special needs including standardized outcomes.

Conclusion

This is the first case study with ASD showed dependability and stimulation on the 10-day training of cognitive play with 'Phunkphon' hand skate. Based on the UEQ the viewpoint of one OT has highly perceived that the case study felt in control of the interactive play as well as its motivating to use with fun.

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