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Kertas Asli/*Original Articles*

Usability Of An Interactive Board Game As Therapy Tool In Children With Speech Sound Disorders

(Penggunaan Papan Permainan Interaktif Sebagai Alat Terapi Di Kalangan Kanak-Kanak Dengan Kecelaruan Pertuturan)

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ABSTRACT

Speech sound disorders adversely affect speech intelligibility. It is important to address speech errors early to reduce the impact on long term communication skills. Parental involvement has been shown to increase the effectiveness of speech therapy because parents were able to carry out speech therapy tasks consistently with their children in the comfort of their own homes. This study aimed to explore the usability of an interactive board game as therapy tool in children with speech sound disorders. In Phase I, market survey and website search regarding existing board games were conducted. In Phase II, board game prototypes using the motor approach for speech intervention were developed. Finally, in Phase III, the usability of the board game was examined. Nineteen respondents comprising eight experienced speech-language therapists and eleven parents of children diagnosed with speech sound disorder participated in the study. Participants used the interactive board game with a child with speech sound disorder for a period of one week and completed a questionnaire. Findings show that majority of the participants (94.7%) were satisfied with the board game as a tool for speech therapy. Additionally, 89.4% of the participants agreed that the board game is fun, and all children choose to play the board game again. Suggestions to improve the board game were documented. Further research is warranted to examine the efficacy of this approach on speech therapy outcomes.

Keywords: Speech sound disorders; speech-language therapist; interactive board game, children

ABSTRAK

Kecelaruan pertuturan lazimnya memberi kesan yang negatif kepada kebolehfahaman pertuturan. Intervensi awal dapat mengurangkan impak jangka panjang kecelaruan pertuturan pada kebolehanan komunikasi secara menyeluruh. Penglibatan ibu bapa dapat meningkatkan keberkesanan terapi pertuturan kerana ibu bapa dapat menjalankan terapi pertuturan secara konsisten dengan anak dengan keselesaan di rumah. Kajian ini bertujuan untuk meneroka penggunaan papan permainan interaktif untuk terapi pertuturan dalam kalangan kanak-kanak yang mempunyai masalah pertuturan. Pada Tahap I, tinjauan dan pencarian laman web mengenai papan permainan yang sedia ada telah dilakukan. Pada Tahap II, prototaip papan permainan yang menggunakan pendekatan motor untuk intervensi pertuturan telah dihasilkan. Akhirnya, pada Tahap III kajian terhadap tahap penggunaan papan permainan dijalankan. 19 orang responden yang terdiri daripada 8 terapis pertuturan dan bahasa dan 11 ibu bapa kepada kanak-kanak dengan kecelaruan pertuturan menyertai kajian ini. Responden menggunakan papan permainan interaktif selama seminggu sebelum mengisi borang soal selidik. Hasil kajian menunjukkan bahawa majoriti responden (94.7%) berpuas hati dengan penggunaan papan permainan sebagai alat terapi pertuturan. Tambahan lagi, 89.4% responden juga bersetuju bahawa papan permainan tersebut adalah seronok dan kanak-kanak ingin bermain lagi. Cadangan untuk menambahbaik papan permainan direkod. Secara keseluruhan, papan permaian interaktif berpotensi menjadi alat terapi pertuturan yang berguna. Namun, kajian lanjut diperlukan untuk melihat keberkesanannya dalam membantu terapi kecelaruan pertuturan.

Kata kunci: Kecelaruan pertuturan; terapis pertuturan dan bahasa; papan permainan interaktif; kanak-kanak

INTRODUCTION

Speech Sound Disorders (SSD) is a diagnosis assigned to individuals who have difficulty in perception, motor production, or phonological representation of speech sounds (ASHA). SSD can be organic and functional in nature. Organic SSDs may result from motor or neurological impairments (e.g., apraxia, dysarthria), structural abnormalities (e.g., cleft lip and palate, trauma) and perceptual deficits (e.g., hearing impairment). Functional SSDs are idiopathic and include impairment to the motor and the linguistic aspects of speech productions. The treatment approaches for SSDs includes articulation and phonological/language-based approaches. Motor approach, also known as articulation approach, targets a single error at a time. A speech target is worked one at a time, progressing from syllable to word level, phrase level and then to sentence level and finally generalized at conversational level. Auditory awareness is emphasized throughout the intervention. Linguistic approach, also known as phonological approach, is to work on a child's understanding and production of rule systems for speech sound of a language. On the contrary to phonetic approach, a group of sounds with similar error patterns are targeted. Nonetheless, children with SSD require consistent practice for the target sounds to be successfully achieved.

According to the principles of motor learning, speech drills for SSD requires attention and repetition (Ruscello & Vallino 2014). Consistent practice over time is required to generate muscle memory in order to reinforce correct motor production. However, it may be difficult for families to achieve the number of target repetitions for meaningful progress. Past studies revealed that there are several benefits of interactive board game as an edutainment tool which includes capturing interest of learners during a repetitive lesson, disseminate information creatively, boost teamwork, making learning more enjoyable, encourage critical thinking and increase knowledge retention of a learned lesson (Gibson & Douglas 2013; Yoon et al. 2014). In addition, children will be motivated to play the games because of the competitive elements in an interactive board game. Thus, articulation therapy using interactive board games may facilitate speech intervention more effectively by allowing learners to participate in speech drills in a fun way.

Parental involvement is an essential component of effective early intervention programs (DeLuca 2020). Several studies show that both parents and children benefited from parent-led interventions (Ha 2015; Pamplona & Ysunza 2000; Scherer et al. 2008). For instance, mothers showed improvement in using language facilitation strategies which includes modelling of words, expansion of child's utterances and decreased use of commands. At the same time, children also showed improvement in speech, language and play skills in which they showed expansion in vocabularies, sound inventories and also percentage of consonant correct. There are several reasons supporting this view namely, (1) parents have more time around children than therapists (2) reduce in financial burden since parents contribute to traditional service delivery, and (3) intervention that is conducted in a naturalistic setting at home allows children to learn best following their optimal level and duration of attention and interest (Ha 2015). Another clinical benefit of a parent-led intervention is that this will be a good alternative for places where access to SLP services is limited.

The need for speech therapy exceeds the available resources as Malaysia is facing a chronic shortage of SLT's (Chu et al. 2019). Many hospitals and private centers are not adequately staffed with SLT's and the majority employed tend to work in urban areas of Malaysia. Not only families with children with speech and language difficulties are constrained to this shortage of service (Chu et al. 2018), the current pandemic has further inhibited rehabilitation as many SLT's have stopped providing face-to-face services. Hence, parent-led intervention will not only alleviate this situation but may provide long term solution to both shortage of resources as well as increasing the effectiveness of therapy. Therefore, the objective of this study is to develop and determine the usability of an interactive board game for children with SSD.

MATERIALS AND METHODS

This study consisted of three phases. In Phase 1, a market survey was conducted. In Phase II the prototype was developed, and the usability was tested in Phase II. The details of each study will be discussed in turn under each section. This research was approved by the Research Ethics committee of Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2019-752).

PHASE I AND II: DESIGN AND DEVELOPMENT OF BOARD GAME PROTOTYPE

Phase I involved market (e.g., bookstores and board game café) and online survey via Google and You Tube search engines to explore existing board games. The online survey was conducted with keywords search such as interactive board game, articulation therapy, benefits of board game, speech sound disorders, speech intervention. Different types of board games from cooperative and competitive modality were referenced. The components including draw

Figure 1 : *Monstack* Draw Sticks

Figure 2 : Words & Sentences Stimuli

Figure 3 : *Monstack* Scoring Board

Figure 4 : *Monstack* Tokens

FIGURE 1-4. The *Monstack* Board Game Kit

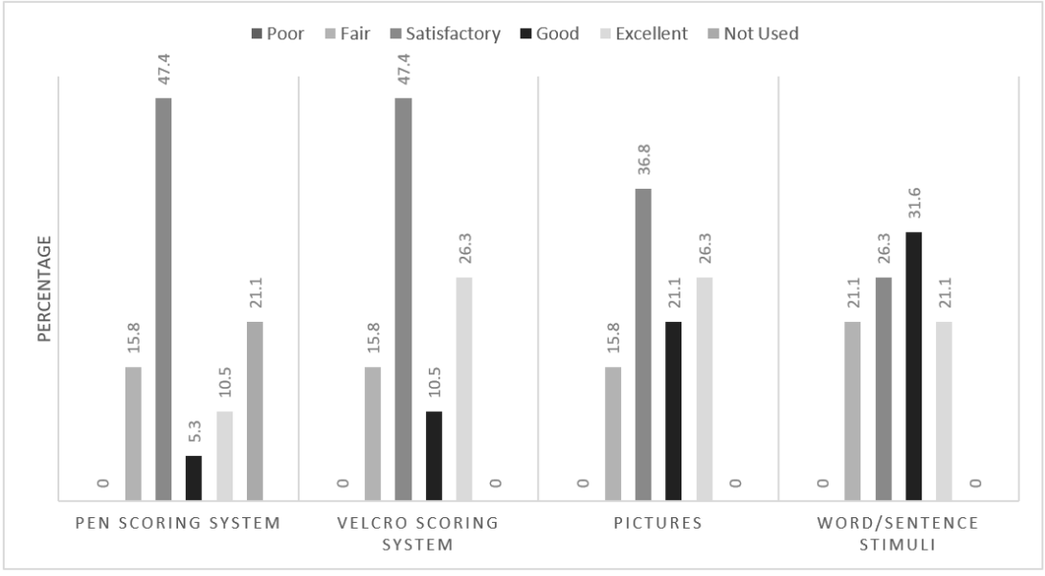

FIGURE 5. Evaluation on The Components of Monstack Board Game

sticks, pen and Velcro scoring system, picture stimuli at word and sentence level, and instruction sheet in the interactive board game were designed using Microsoft Word. Three sets of board game prototypes for three main languages English, Malay and Mandarin were developed for the trial. The board game prototype is specified in Figures 1-4.

PHASE III: USABILITY OF THE BOARD GAME PROTOTYPE

The usability of the board game prototype was tested by eight SLTs with experience of working with children with SSD and eleven parents of children between the ages of 3 – 8 who have attended speech therapy for SSD. The

exclusion criteria include children who have vision difficulties or with other medical diagnosis such as Autism Spectrum Disorder (ASD), Down Syndrome, and Global Developmental Delay (GDD). The participants were invited via email and/or WhatsApp. Upon consent, appointments were made to hand participants a copy of the board game prototype. In addition, tutorial videos on how to play the board game were also sent to the participants via WhatsApp. Each participant was given at least one week to try out the board game with their children or client with SSD in their own homes or clinical setting. Upon completion, participants provided their feedback by completing an online survey disseminated via Google form.

The online survey disseminated to participants were to evaluate the usefulness, satisfaction, and ease of use (USE) of the board game. USE was developed by adapting the survey used by Gang and colleagues (2017) to evaluate an interactive book application that was also used as a speech-language therapy tool. The survey consisted of three sections: (a) demographic information, (b) evaluation on the components of interactive board game, (c) evaluation of the usefulness, ease of use, ease of learning, and satisfaction of the interactive board game. A 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree) and short answer responses were used to evaluate the usability of the board game. For purposes of data analysis, the latter data were collapsed into 3 categories: agree (strongly agree and agree), neutral, and disagree (disagree and strongly disagree) as the purpose of this study is to understand how the participants perceived using the board game and the three-scale point provided a better accuracy of responses. The Social Packages for the Social Sciences (SPSS) version 25.0 for Windows was used for statistical analysis. The Mann-Whitney U test was used to analyze data between groups (participants: SLTs vs parents; child's diagnosis: CLP vs SSD). In addition, comments and suggestions regarding the interactive board game provided by the participants were analyzed qualitatively.

RESULTS

Data for the online survey on the usefulness, satisfaction and ease of use of the board game were obtained from 19 participants comprising eight SLTs and 11 parents of children with SSD that was residing in Klang valley. Participants sampled the board game on eight children with CLP and eleven children with SSD between the ages of 3 and 8 years old. The mean age of children with CLP (M: 5.7; SD: 1.4) and children with SSD (M: 5.9; SD: 1.3) were comparable.

TABLE 1. Demographic data of participants for board game prototype trial

No.	Participant	Age of child ,	Diagnosis of child
1.	Parent	3;11	SSD
2.	Parent	4;00	Cleft
3.	Parent	4;00	Cleft
4.	Speech-Language Pathologist	4;07	SSD
5.	Parent	4;07	Cleft
6.	Parent	4;11	SSD
7.	Speech-Language Pathologist	5;01	SSD
8.	Speech-Language Pathologist	5;02	Cleft
9.	Speech-Language Pathologist	5;09	SSD
10.	Speech-Language Pathologist	5;09	SSD
11.	Parent	5;09	SSD
12.	Parent	6;02	SSD
13.	Speech-Language Pathologist	6;07	SSD
14.	Speech-Language Pathologist	6;07	Cleft
15.	Parent	6;09	Cleft
16.	Parent	6;11	Cleft
17.	Parent	7;05	Cleft
18.	Speech-Language Pathologist	7;11	SSD
19.	Parent	8;02	SSD

The age and diagnosis of child is by which the Monstack board game is used with.

The age of child listed under SLP is the patient which the Monstack board game is trialed on

Figure 5 shows the evaluation of each feature of the board game. Majority of the participants rated Satisfactory (47.4%) for the pen and Velcro scoring system, whereas most of the participants rated 'Good' and 'Excellent' for the pictures and stimuli (more than 50%). Four out of 19 participants (21.1%) did not use the pen scoring system.

Recommendations given by the participants were categorized according to each component as shown in Table 2. Majority of the participants commented on the size and sustainability of the token in the Velcro Scoring System. In addition, participants also provided feedback to increase the number of word and sentence stimuli to be targeted.

TABLE 2. Recommendations on Interactive Board Game as Articulation Therapy Tool.

Questions	Responses
Scoring System	• To reduce the number of columns (Five columns instead of eight.) • Some of the stickers did not stick well. • Bigger laminated token picture and grid for scoring board for easier manipulation.
Word/Sentence Stimuli	• To prepare a word list in a document to be used during a session. • Some of the words were not used by Malay-speaking children. • Label the word stimuli or with 'PinYin' for Chinese characters. • To prepare two sets of different pictures and sentences for each sound as a child got bored after a few times playing as the words or sentence is repeated. • Can use colour paper to make the cards more appealing and easier to recognize. • The words or sentences may be overused and should be refreshed with new ones.
Draw cards	• Some of the cards did not stick well. • There are circumstances where no matching of monsters occurs even after turning the card around.
General	•Prepare a board, fixed for every stimulus to be more organized, especially for new user •The velcro straps easy to peel off, can try using magnetic board or like the puzzle board eg. If the project goes electronic, can try inserting the sound of the words

TABLE 3. Evaluation on Usability of Monstack Board Game (N = 19) [N (%)]

Statement	Disagree n (%)	Neutral n (%)	Agree n (%)
Usefulness			
My child can pronounce the sounds at word or sentence level easily and correctly after using the board game.	1 (5.3)	7 (36.8)	11 (57.9)
The board game makes the articulation therapy much easier to be accomplished.	0	1 (5.3)	18 (94.8)
The board game is fun.	0	2 (10.5)	17 (89.4)
The duration of the board game is sufficient.	0	5 (26.3)	14 (73.7)
Ease of Use			
The board game is user friendly.	1 (5.3)	3 (15.8)	15 (78.9)
The instructions to play the board game is easily understood.	2 (10.5)	1 (5.3)	16 (84.2)
This board game can be used to do the articulation therapy work easily and correctly.	1 (5.3)	0	18 (94.8)
Ease of Learning			
The pictures are clear to recognize.	1 (5.3)	1 (5.3)	17 (89.5)
We quickly become skilful with the board game.	2 (10.5)	3 (15.8)	14 (73.7)
Children are highly motivated to play the board game as articulation therapy.	0	3 (15.8)	16 (84.2)
Satisfaction			
I am satisfied with the board game.	1 (5.3)	0	18 (94.7)
I would recommend using the board game to do articulation therapy.	0	1 (5.3)	18 (94.7)
My child wants to play the board game again.	1 (5.3)	4 (21.1)	14 (73.6)
I feel I want to have it.	0	1 (5.3)	18 (94.7)

Results regarding the usability of the board game in terms of usefulness, ease of use, ease of learning and satisfaction is presented in Table 3. Majority of the participants agreed that the board game is useful as a tool for articulation therapy. 89.4% of the participants agreed that the board game is fun which contributed motivation for clients to practice the sounds. However, one of the participants (5.3%) disagreed that the child can pronounce the sounds easily and correctly after using the board game. Most of the participants (73.7%) agreed that the duration of the board game is sufficient, hence providing sufficient auditory feedback and training for targeted sounds. In terms of ease of use most of the participants (more than 75%) agreed that the board game is user friendly and easily understood. However, one out of 19 participants disagreed with the statement. Majority of the participants stated that they were satisfied (94.7%) with the board game and one participant (5.3%) was not satisfied with the board game. All participants would like to have the board game as therapy tool.

The results of the usability of board game were compared between groups; SLTs and parents and the two groups of children using the Mann-Whitney U Test (Table 4). While parents and children with SSD rated higher that SLT's and children with CLP for each domain, there were no significant differences between groups.

DISCUSSION

The objective of the study is to develop and determine the usability of a newly developed interactive board game for children with SSD. In this study, SLPs and parents perceived the board game as useful. The findings of this study were consistent with other studies that showed board game allows learning to be delivered and receive in a more enjoyable way to stimulate knowledge retention. (Gibson & Douglas 2013; Yoon et al. 2014). All participants agreed that the pictures were suitable and are easily recognized. The picture stimuli for both word and sentence level included representational image (realistic and almost photographic-like) and written text which allows children to decode the visual messages in pictures and encode them into oral language. Study conducted by Danko-McGhee & Slutsky (2011) revealed that 2-, 3-, and 4-year-old children preferred book covers that are colorful and with representational images, while five-year-old children preferred colorful and black and white images with 'scary' or 'mysterious' elements within. Hence, the picture stimuli and 'Monster' themed board game were suitable for children aged four to seven. Velcro scoring systems were more preferred compared to manual scoring using pen (Graph 1) as children tend to be distracted with the pen and scribble all over the scoring board. This may require

TABLE 4: Comparison of Board Game Usability Results Across Groups

Statement	Mean	SD	95% CI	P-value[a]
Usefulness				
SLP	16.00	2.45	13.95 – 18.05	0.968
Parents	16.18	1.78	14.99 – 17.38	
CLP children	15.63	1.41	14.45 – 16.80	0.351
SSD children	16.45	2.38	14.85 – 18.05	
Ease of Use				
SLP	11.88	1.46	10.66 – 13.09	0.545
Parents	12.00	2.19	10.53 – 13.47	
CLP children	11.38	2.26	9.48 – 13.27	0.395
SSD children	12.36	1.50	11.35 – 13.37	
Ease of Learning				
SLP	12.00	1.93	10.39 – 13.61	0.904
Parents	12.18	1.83	10.95 – 13. 41	
CLP children	11.38	1.77	9.90 – 12.85	0.206
SSD children	12.64	1.75	11.46 – 13.81	
Satisfaction				
SLP	16.63	2.00	14.96 – 18.29	0.717
Parents	17.09	2.17	15.64 – 18.55	
CLP children	16.63	2.13	14.84 – 18.41	0.657
SSD children	17.09	2.07	15.70 – 18.48	

the adults to control the materials and children's action during the intervention. In addition, children may associate negative emotions and feelings when their actions were restricted. On the other hand, the size of the token in the Velcro Scoring System should be enlarged for easier manipulation and storage. This will avoid distraction of looking out for the small-sized token which might drop easily.

The board game exhibited a form of collaborative learning (CL) that allows children to be actively engaged in the learning process. Several studies had shown the benefits of CL in which CL resulted in greater achievements, social competencies and higher self-esteem. (Akçay 2016; Laal & Ghodsi 2012, Zisopoulou, E 2019). This board game design is in line with Vygotsky's theory that places a central focus on social interaction as a medium in facilitating the learning process in children. The board game established opportunities for children to learn with the help of more-skilled partners, in this case the SLPs or parents as partners of the game play (Tudge & Rogoff 1989). Additionally, articulation therapy incorporating board game would be a useful way of practicing targeted sounds because children not only practice solely on their speech, but they also receive immediate feedback from other learners and adults. In therapy, adults are usually the ones providing models of appropriately articulated words. However, during an ongoing board game session, children can also be responsible for providing feedback for the speech accuracy of oneself or play partners. Hence, children will have a sense of ownership in the game and improve the production of targeted sounds. In addition, adults providing appropriate responses towards a child's speech will in turn increase their confidence to communicate verbally (Ha 2015; Pamplona et al. 2014). This will motivate children to continue practicing and learning.

All participants agreed that the duration of board game was sufficient. However, two participants commented that the game is too lengthy, and the child became restless towards the end of eight trials for each level. Hence, SLPs suggested to reduce the number of trials from eight to five columns. Participants also commented that board game was more beneficial for children of older age with longer attention span. Sense of accomplishment is an important game element that will enhance the effectiveness of board games in achieving its goals. Tan et al. (2020) in their study divided their success goals into two levels (1) attraction and stickiness to game play in Level 1 and (2) transfer of knowledge into the real world in Level 2. If children experience success in the initial rounds of game play, they will be motivated to continue playing. Thus, board games provide sufficient speech drills and will increase a child's motivation to practice the targeted sounds at increasing levels of complexity.

This study explored the usability of a newly developed board game among children with SSD. This study did not examine the effectiveness of articulation therapy from using the board game or examined the association between the severity of articulation errors and speech outcomes. Further larger scale study after the refinement of the board game prototype is warranted to evaluate the effectiveness of as an articulation therapy tool in children with SSD. In addition, factors that may affect the effectiveness of a parent-led intervention will also be investigated in future research.

CONCLUSION

A novel board game as a form of therapy tool for children with SSD was developed in this study. Positive feedback was obtained from the SLPs and parents of children with SSD regarding the usability of the newly developed interactive board game. Board games may be an effective therapy tool that allows the parents to conduct articulation therapy session at home more consistently and effectively.

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