

The Effectiveness of CVC Arm Tapping Interactive Application towards Year Two Students' English Language Achievement

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Abstract This study was conducted to examine the effectiveness of CVC (Consonant-Vocal-Consonant) Arm Tapping interactive application among Year Two students using mixed method approach and pre-experimental design through pre-test and post-test involving a group of 30 students who perform poorly in English Language subject. Eight teachers answered the questionnaire to obtain reliability value using Intraclass Correlation Coefficient (ICC) method. An average measure of .970 with a 95% confidence interval from .915 up to .373 ($F(7,259) = 33.898, p < .000$) showed a near-perfect agreement among the evaluators on the information, interaction and presentation design for the application. Findings from score analysis showed that no students were in the low profile while 66.67% of them rose to higher profile. Paired sample t-test showed a significant difference between pre-test and post-test scores after using the application ($t(29) = -12.62, p < 0.05$). Interview with five students and three teachers found teaching and learning using interactive application showed positive impacts on students' interest and motivation, meaningful experiences, and students preferred learning using technology instead of the conventional method. This study has identified suitable approaches and methods for phonics teaching.

Keywords Interactive Application, Phonics, Spelling and Reading Skills, Low-performing Students, Multisensory Approaches, Pre-experimental

1. Introduction

The education system in Malaysia has long made the English language as one of the curriculum content from pre-school through high school and has also been used as the medium of instruction in the teaching and learning process of most universities in Malaysia [1]. Therefore, high proficiency in English is essential to enable students to face the challenges of globalization today. Reading skills in the English language require a student to remember the words and sounds produced from the words [2]. In addition, with the formation of the Primary Standard Curriculum (KSSR), teaching of phonics is also emphasized to students [3]. If they are able to gain efficiency in the phonics of the letters, their reading skills will be enhanced [4], [5].

The integration of Information and Communication Technology (ICT) into the teaching and learning process is important as it can help improve students' cooperative learning skills as well as stimulate students' social skills, problem solving skills, self-reliance, accountability and self-reflection [6]. All of these elements are fundamental values that students need to have in order to be actively involved in teaching and learning environment [7].

1.1. Problem Statements

The difference between students who are good at spelling and students who are poor at spelling depends on

their phonological processing skills and the ability to learn and memorize letters in a word [8]. Drilling method in second language teaching and learning is tedious and cannot attract students' attention but can reduce students' motivation to learn a second language [9]. The teaching and learning process involving students in primary or pre-school should be conducted in a fun and inclusive manner with a variety of meaningful learning activities [9], [10] to help stimulate cognitive domains and behavioural domains, as well as their affective domains [11] while helping students to control their own learning [10], [12]. This proves that meaningful and enjoyable learning activities should occur during the teaching and learning process in the classroom.

As reviewed by [13], studies have shown that students have better reading skills if they are taught systematic phonics rather than teaching non-phonetic reading skills. However, when teachers use phonetic methods in teaching and learning English language, some students still find it difficult to perform decoding or encoding for the given word [13]. Teachers need to be more flexible in implementing a variety of teaching methods as each student has different learning styles [14].

The use of multisensory approaches is more effective than traditional teaching because students can actively participate in learning sessions [15]. The use of ICT in learning sessions also makes students more motivated because they are able to provide an active learning surrounding [16]. However, a study conducted by [17] found that the percentage of ICT use among teachers was less than that of students and suggested that teachers increase the use of ICT in teaching and learning processes in schools as it facilitates learning sessions and is applicable in all areas of subjects [18]. Therefore, the researcher had managed to introduce an interactive application of CVC Arm Tapping through this study to help low-performing students improve reading skills using phonics that integrates multisensory approaches through visual, auditory and kinaesthetic [19]. This application is further enhanced by the use of Arm Tapping technique adapted from the Sound Tapping technique by Wilson Reading Systems (WRS) to enable students to understand phonological processing skills and learn reading skills easily [20].

1.2. Research Objectives

There were four research objectives proposed through this study:

- a). To determine the reliability value of the ICC (Intraclass Correlation Coefficient) method for CVC Arm Tapping interactive application.
- b). To identify the score for pre-test and post-test of low-achieving Year 2 (8 years old) English language students.
- c). To determine if there is a significant difference between pre-test and post-test scores before and after using the CVC Arm Tapping interactive application among Year Two students (8 years old).
- d). To do a survey on how teachers and students view the application of CVC Arm Tapping in phonics learning for low-achieving Year 2 (8 years old) English language learners.

1.3. Hypothesis

H01: There was no significant difference between pre-test and post-test scores using the CVC Arm Tapping interactive application among Year Two students (8 years old).

2. Literature Review

2.1. Phonics Teaching in English Language Subjects

Some recent studies acknowledged that learning methods of reading skills in English language should involve phonics [13], [21]. [4], [22] suggested that phonics teaching be conducted explicitly so that students can isolate and manipulate the sound of each letter in a word to help them in the spelling and reading process [5]. To create this type of learning method, this study used the theory of social constructivism as the core for its theoretical framework, followed by VAK learning style models, multisensory approach, computer assisted learning (CAL), ADDIE model, and sound tapping technique. To show the relationship of the theory, models, approach, and technique used in this study, a diagram of theoretical framework is shown in Figure 1.

2.2. Theory of Social Constructivism

Social constructivism theory emphasizes the role of social interaction in cognitive development [23]. Before cognitive development is built during teaching and learning sessions, social learning needs to exist and will be followed by individual-level learning [24]). Social learning usually takes place with the help of More Knowledgeable Others (MKO) such as teachers, parents, peers or teaching and learning aids such as text, audio, video and electronic tutors or interactive application that are capable of acting as a teacher [25] within the Zone of Proximal Development (ZPD) which is closely related to scaffolding [24], [25]. Therefore, this interactive CVC Arm Tapping application can act as MKO to help students master their reading skills more effectively than traditional teaching in the classroom.

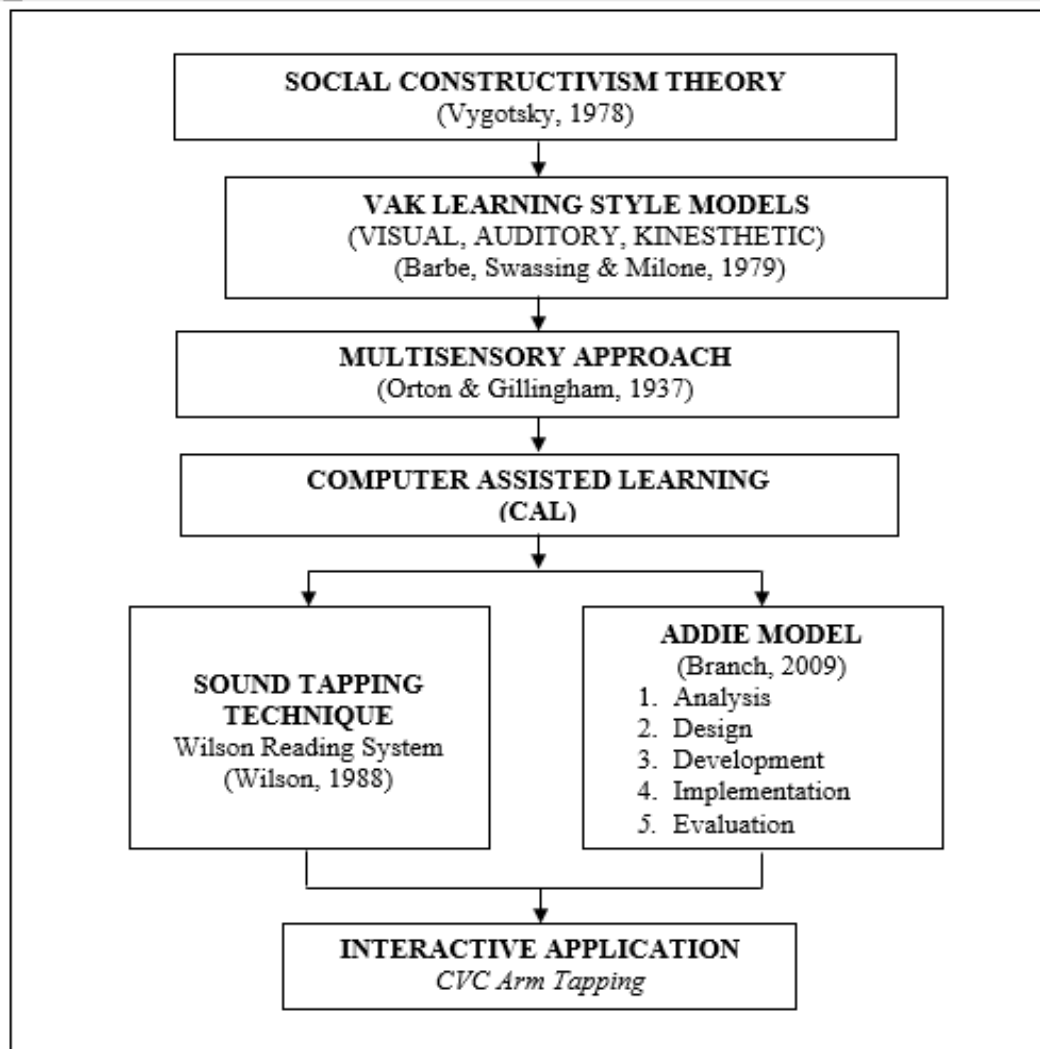


Figure 1. The theoretical framework used in this study

2.3. VAK Learning Style Models (Visual, Auditory, Kinesthetic)

Learning styles are defined as the natural means and natural selection of individuals to enable them to absorb, internalize and retain new information and skills [26]. It is influenced by factors such as the individual's experience, the variety of intellectual levels, and the individual's personal factors such as the tendency to engage in group or individual activities [27]. The learning style model described by [28] is based on three modalities namely visual, auditory and kinaesthetic (VAK) and an individual may have single modality strength or mixed modality strength [27]. When teaching is in line with students' learning style, it can help to enhance students' motivation, performance and achievement [26].

2.4. Multisensory Approach

Multisensory approach has been introduced as the basis for teaching reading methods developed for students with reading difficulties especially students with dyslexia [29]. Multisensory experiences enhance memory and help students to master spelling and reading skills especially when it involves two or more senses; visual, auditory, kinaesthetic [30]. Some studies as identified by [31], have shown students' improvement in spelling skills after a multisensory approach was adopted in their learning processes where they not only hear and see words or letters but also perceive the shape of the letters by tracing the letters on various media; paper, sand, or in the air [30]. The use of multisensory approach can support the development of students' literacy as using more than one sense can help them keep the information learned in minds [31].

2.5. Sound Tapping Technique

The sound tapping technique is a program that contains explicit teaching features developed based on the multisensory approach through WRS [29]. It is a technique whereby students decode the sound of a word using different fingers to spell each letter by saying the sound of the letter before reading out the word [20]. Teaching using multisensory approach and sound tapping technique can help students who have difficulty in processing the information learned during learning process especially while learning spelling and reading skills [31]. As stated by [20], sound tapping technique uses thumb, index finger, middle finger and ring finger to spell CVC words. However, this technique has been adopted in this study to produce an easily understood, viewed and practical technique to be practiced called the Arm Tapping technique.

The execution method of the Arm Tapping technique still resembles the sound tapping technique but differs in terms of movement and limbs involved which uses hand, shoulder, elbow and wrist. For example, if a student wants to spell cat, students will say /c/ while moving their right hand to their left shoulder, say /a/ while moving the same hand to the elbow, say /t/ while moving the same hand to the wrist, and finally move the same hand again from the left shoulder straight to the wrist while saying the sound /cat/.



Figure 2. The Arm Tapping Technique

2.6. Computer Assisted Learning (CAL)

Computer-assisted learning refers to the use of computers to support an individual's learning and training [32]. The purpose of implementing computer-assisted learning is to enable students to be tutors, peers, and examiners to provide a holistic picture of the educational processes, and computer-assisted learning modules can be used for students of either with visual, audio or kinaesthetic modalities [32]. As students listen to and use the educational material provided over and over again, students will go through a series of cognitive processes, including the process of forming categories, detecting patterns, and observing something new while imitating the contents [33].

Computer-assisted learning provides opportunities for students to learn an interactive learning content as well as to help them communicate and enjoy learning experiences with other students directly or indirectly [34]. The CVC Arm Tapping interactive application has been designed with the aim of facilitating phonics-related teaching and

learning so that students can read the CVC more effectively and provide students with phonics knowledge to spell more difficult words in the future [13]. It was designed using the ADDIE Model as a guide. The ADDIE model is the most popular teaching design model used for lesson planning because of its advantages in providing easy-to-follow process structures [35].



Figure 3. The initial view of the CVC Arm Tapping interactive application

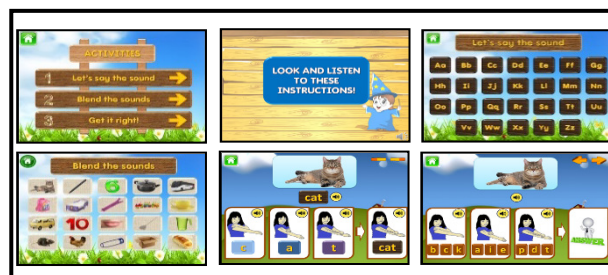


Figure 4. Contents in CVC Arm Tapping interactive application

3. Research Methodology

This study used an explanatory mixed method design [36] while pre-experimental design was used as the research design. The mixed method with an explanatory design means that researcher places priority on quantitative data collection and analysis, followed by the collection of qualitative data to refine the results of quantitative data. The quantitative approach involved questionnaire assessments as well as pre-test and post-test on low-performing Year Two students while qualitative approach involved interviews with teachers and students after a series of teaching and learning processes in order to see the effectiveness of this interactive CVC Arm Tapping application.

3.1. Population and Sampling

This study used convenience sampling method intact group since the selection of study subjects was based on their availability and suitability as well as the characteristics of the subjects in the population to be studied. 30 Year Two students were selected as a sample while for the interview data, three (3) English Language

teachers (experienced at least 5 years teaching in level one (7-10 years old students) in primary school and five (5) students were randomly selected for interview sessions after using CVC Arm Tapping application. Before teaching using CVC Arm Tapping application, eight (8) teachers were selected for ICC data analysis through the interactive application evaluation questionnaire to obtain the reliability of the CVC Arm Tapping interactive application after using the ADDIE model for the development of the interactive application.

3.2. Instrumentation

The instruments used based on the quantitative approach was a (i) questionnaire related to the evaluation of the CVC Arm Tapping interactive application for eight (8) teachers assigned as evaluators and (ii) pre-test and post-test questions answered by the 30 students who were involved in this study. The questionnaire which consisted of 38 items using a scale from one to ten had four main sections namely, the respondent profile, information design, interaction design and presentation design. This questionnaire was adapted from [37]. The pre-test and post-test questions consisted of two parts with part A was used for the written test and part B was used for the oral test. Both instruments with 20 items used CVC vocabulary such as cat, mop, pen and bus.

During the written test, students were required to fill in the blanks on the test question paper based on the three answer options provided. The number of correct answers was multiplied by five (5) to get the percentage. During the oral test, students were presented with 20 envelopes each containing five letter cards and a picture. One mark was given when the student spelled out the letters that form the word based on the picture, one mark was given when the student spelled the phonics for each letter correctly and another mark was given when the student repeated the sound of the word correctly. The total number of points from section B was divided by 60 and multiplied by one hundred to get the percentage. Instead of using quantitative approach, qualitative approach involving a set of interview protocols with four questions for teacher and another set of three questions for student was used after the teaching and learning process using the interactive CVC Arm Tapping application had been implemented.

3.3. Reliability and Validity

The result of the split-half reliability analysis for the oral test question set ranged from 0.89 while 0.88 were obtained for the written test question set. [38] suggested that the reliability index in a test is categorized as excellent if it is worth about 0.8. The result showed that both sets of verbal and written tests have sufficient reliability to be used in this study. Four panels consisting of English teachers who have served for more than 15 years were consulted to examine the content validity and face validity for a set of written and

oral test questions. The panel of experts acknowledged all of the items selected as appropriate to be tested to find out the level of proficiency of the Year Two students in spelling and reading.

3.4. Statistical Data Analysis

Descriptive statistics analysis and inference statistics were used to address the first three research questions. Statistical Packages for Social Sciences (SPSS) version 24.0 was used to address the first research question which was to obtain the reliability value using the ICC method of the CVC Arm Tapping interactive application, and to answer the third research question which was the testing of research hypothesis through sample paired t-test. The second research question was answered based on the calculation of the percentage of scores obtained by students from the pre-test and post-test.

3.5. Content Data Analysis

Content analysis to analyse the results of the interviews with teacher evaluators and Year Two students began with a review of the recorded audio recordings and transcripts of interviews with respondents. Further, the researcher compiled the data obtained by indexing the data to make it easier to be identified and to be rediscovered later [39]. The researcher then began writing based on the results of the systematic findings based on the themes published from the interviews with respondents.

4. Research Findings

4.1. Reliability Values Using the Intraclass Correlation Coefficient (ICC) in CVC Arm Tapping Application

As shown in Table 1, the ICC value was .970 with 95% confidence with intervals ranging from .915 to .373 (F (7,259) = 33.898, p <.000). According to [40], if the reliability value ranges from zero to one, and the more the value approaches one, the higher the reliability. Therefore, there was a high degree of reliability and an almost perfect agreement shown in the application of CVC Arm Tapping interactive application among the teachers.

Table 1. Intraclass Correlation Coefficient (ICC)

	Intraclass Correlation ^b	95% Confidence Interval		F Test with True Value 0			
		Lower bound	Upper bound	Value	df1	df2	Sig
Single Measures	.464 ^a	.262	.787	33.898	7	259	.000
Average Measures	.970 ^c	.931	.993	33.898	7	259	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

4.2. Students' English Language Score Profile for Pre-test and Post-test before and after Using the CVC Arm Tapping Interactive Application

Students' achievement profile analysis was conducted based on pre-test and post-test scores categorized into low (0 - 40 marks), medium (41 - 69 marks) and high (70 - 100 marks). Table 2 shows the profile of students' achievement scores for pre-test and post-test.

Table 2. Profile of Students Achievement Score Based on Pre-test and Post-test Scores

Type of Test	Level of Profile	Test				Mean	
		Written Test		Oral Test		(Written Test + Oral Test) / 2	
		No.	%	No.	%	No.	%
Pre-test	Low	4	13.33	18	60	8	26.67
	Intermediate	14	46.67	12	40	20	66.67
	High	12	40	0	0	2	6.66
Post-test	Low	0	0	4	13.33	0	0
	Intermediate	2	6.67	9	30	8	26.67
	High	28	93.33	17	56.67	22	73.33

Based on the mean scores in Table 2, no students were found to be at low profile level after the intervention was conducted using the CVC Arm Tapping interactive

application. The percentage of students classified into the medium profile level had also decreased by 40% during the post-test. However, the percentage of students classified as high profile had increased by 66.67% during the post-test. This showed that students have improved their reading and spelling skills after using the CVC Arm Tapping interactive application.

4.3. Analysis of Paired Sample t-test for Pre-test and Post-test Scores

Inferential statistical test analysis was obtained using the paired sample t-test for pre-test and post-test scores.

The result in Table 3 showed that there was a significant difference ($t = -12.623$, $df = 29$, $p < .05$) in pre-test and post-test scores. Since the mean value was $p = 0.000$, the researcher rejected the null hypothesis and concluded that there was a significant difference in test scores before and after learning using the CVC Arm Tapping interactive application among Year Two low-achievers students in the English language subject. Higher mean scores after the use of the CVC Arm Tapping interactive application in teaching and learning sessions indicated that learning the skills of reading using phonics through this interactive application could improve the reading and spelling skills of Year Two low-achievers students in the English language subject.

Table 3. Results of Paired Sample T-Test

Paired Differences	95% Confidence Interval of the Difference							
	Mean	Std. Dev	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pre-test scores – Post-test scores	-27.889	12.101	2.209	-32.408	-23.370	-12.623	29	.000

4.4. Interview Analysis

4.4.1. Teachers' Interview

Theme 1: The CVC Arm Tapping interactive application has successfully captured students' interest in learning reading skills

All of the evaluators felt that the interactive application was able to attract students with the use of animations, videos, pictures, songs and sounds that were included to enhance students' motivation to learn to read.

- *"The application was full of colours, videos, pictures, animations and sounds that appeal to students. It looked like they were having fun using this application. Students were more interested in exploring this application and thus stimulated student motivation in teaching and learning."* (G1)
- *"This application had wonderful colours, images, sounds and images and could motivate students in teaching and learning."* (G2)
- *"Using this application could create an exciting, organized and efficient learning environment, engaging students in learning something new, easy and fast to understand."* (G3)

Theme 2: The use of interactive application could provide students with experience and exposure to technology

The use of this interactive application exposed students to technologies that they might not have been exposed to before, as well as providing them with new experiences in both computer usage and CVC Arm Tapping interactive application.

- *"They seemed to enjoy the interactive application. I think, using this application, students were more interested in exploring this application and could increase their motivation during the teaching and learning process."* (G1)
- *"For me, using this interactive application could expose students to technology that some of them did not have at home. They looked excited while using the application."* (G2)
- *"Using this application could motivate students to learn through interactive multimedia technology,"* (G3)

Theme 3: The use of interactive application could help teachers use their time efficiently

Two teachers opined that this interactive application could make teachers manage time more efficiently since they did not have to spend a lot of time explaining to students. Students could repeat and learn at their own pace while using this application.

- *"Teachers could conduct their teaching and learning process in a planned and efficient manner."* (G2)
- *"This application is great and could save teaching time."* (G3)

4.4.2. Students Interview

Theme 1: Students' feeling while using the CVC Arm Tapping interactive application

Students enjoyed the integration of animations, videos, pictures, songs and sounds in this interactive application which was a great way to grab students' interest and got them excited while using the application.

- *"I really enjoyed using this application. I loved it when there was a video demonstrating the sound of the letters. There were pretty pictures and nice songs."* (M1)
- *"It contained wonderful videos, pictures and songs."* (M2)
- *"I liked the one with pictures and videos."* (M3)
- *"I really enjoyed part three because I could answer correctly."* (M4)
- *"I liked part one because I could replicate the movement."* (M5)

Theme 2: In-application activities that students love

Three students were found to be very fond of activity one especially the video as it showed how to sound the letters correctly and the students could replicate the phonics of each letter mentioned through the video.

- *"I loved it that there was a video demonstrating the sound of the letters."* (M1)
- *"I liked part one that had nice pictures and videos."* (M3)
- *"I liked part one because I could replicate the movement."* (M5)

Students loved the animation of the Arm Tapping technique and they were excited replicating the technique.

- *"I liked part two that could be duplicated using arms."* (M2)

Students' motivation increased while learning in activity three after they had successfully answered the questions in the exercises provided.

- *"I enjoyed part three because I could answer correctly."* (M4)

Theme 3: The use of interactive application provided experiences and exposures to technology

Some students enjoyed using this interactive application because they don't have a computer at home. There were students who found this interactive application interesting because they have never used an application that allowed them to learn.

- *"I really enjoyed and enjoyed using this application."* (M1)
- *"It was fun to use this application because I have never used a computer."* (M3)
- *"It was interesting to play the activities in the computer. My house has no computer."* (M4)
- *"This computer was not the same as the home*

computer. I could learn from this computer and keep doing it, and follow along.” (M2)

Theme 4: Preferences between the usage of technology or conventional learning

Students were found to respond more positively to learning using technology than conventional learning.

- *“I love studying in computer labs.” (M1)*
- *“It was fun to study in the computer lab because there were computers.” (M2)*
- *“I love studying in the computer lab because there were so many pictures.” (M3)*
- *“If we do not use the computer, it is not fun.” (M4)*
- *“The lab was large, computer-friendly. I liked to click the mouse.” (M5)*

5. Discussions

This study aimed to look at the effectiveness of using CVC Arm Tapping interactive application among Year Two students in primary school. The interactive application introduced by this researcher integrated the teaching of phonetic systems through a multisensory approach and managed to highlight visual, audio and kinaesthetic modalities in learning. This multisensory approach is used so that students can learn actively to help them perform effectively [41]. The results from the analysis of student score profiles based on the conducted pre-test and post-test using written test instruments and oral test instruments have shown that there was a positive increase in the percentage among the intermediate and high profile levels of students in the oral test instruments. There was also a reduction in the percentage of students at lower profile level to four students compared to 18 students previously. The findings from the written test instrument showed that no students belonged to the low profile after the post-test and showed that the students were able to spell a well-learned CVC word. The reduction in the percentage of students in the low profile indicated that almost all students succeeded in improving their post-test scores even though there were still a few low-profile students after the post-test. The result of the sample paired t-test analysis showed that students were able to master and improve their CVC reading skills in English after being given an intervention or treatment using this interactive application.

Students' success in mastering the CVC spelling and reading skills occurred after a series of lessons using the interactive CVC Arm Tapping application developed by the researcher. The result of the reliability assessment analysis using the ICC method for this interactive application found that there was almost perfect agreement among all evaluators who had evaluated this interactive application based on information design, interaction design and presentation design. This demonstrated that this interactive application was suitable to be used as effective

teaching aids to help students achieve the set learning objectives. This is because the construction of this interactive application had gone through a systematic design process through the use of the ADDIE model which involved five phases namely analysis, design, development, implementation and evaluation. Some researchers acknowledged that using the ADDIE model as a teaching design model could create a more effective, efficient and relevant teaching content [42].

Interviews with teachers and students found that students really liked this interactive application due to the integration of multimedia elements such as animation elements, videos, pictures, songs and sounds. [43] suggested that pedagogy should be emphasized more than technology even when technological advancement is involved in education. So, the teaching content was designed to meet the needs of students with different learning styles and intelligences [44] which enabled them to explore this application and make their learning more enjoyable and more visually appealing. They looked forward to using this interactive application. In addition, the findings also showed that using this interactive application could give students new experiences with technology as some of them have never used a computer. Therefore, it can be concluded that meaningful teaching and learning of students through 21st Century learning through technology integration can help increase students' interest and motivation [16].

6. Conclusions

Teachers in the 21st century need to improve their skills in ICT to enable them to keep pace with the ever-changing current state of modernization that emphasizes the use of technology in daily lives especially in education. Integrating multisensory approach into computer-assisted learning can enhance students' reading skills and develop their potential to produce knowledgeable and highly skilled future generations through more meaningful learning. In addition, teachers can help prepare students by making them more confident in facing the challenges of globalization which are going to take place in education by incorporating 21st century skills in teaching and learning and thus preparing students for a broader and more challenging future.

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