

Using Mobile Devices to Improve Educational Outcomes: An Analysis in Primary Education

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Abstract. Significant challenges to the delivery of quality education remain as Taiwan has carried on its educational reform. In the attempt to find solutions to these challenges, desires associating new information and communication technologies (ICTs) should be put into consideration. Mobile-assisted-language-learning (MALL) is one of the examples. Nowadays, even though having wireless learning environment in Taiwan, schools have difficulties in implementing mobile learning if they do not possess the appropriate courseware. This article examines the extent to which mobile devices facilitate M-learning in terms of educational outcomes of Taiwan. The purposes of this study are: 1) developing the appropriate mobile learning application (App) for language learners, (2) designing the mobile learning curriculum model, and (3) evaluating the effectiveness of mobile learning. Analysis of the study indicates that there important evidence of mobile application facilitating EFL (English as a Foreign Language) learning. The results also indicate that students are motivated to use the application in their spare time and that this benefits their learning. Mobile technologies should be emdedded in a natural learning environment. As for the future investigation, more technical breakthroughs in curriculum and instruction need to be put into consideration, in order to gain an overall picture of the optimal outcomes of English teaching.

Keywords: Mobile devices, mobile learning, application (App), EFL (English as a Foreign Language), information and communication technologies (ICTs)

Introduction

As prosperity of the tools with the Internet, the international contact is frequent, from the exchange of information, science and technology, industry and commerce, even the educational use. Ministry of Education (MOE) of

Taiwan has announced “information technology should blend into subject teaching” which emphasizes learning should take place with the assistance of multimedia material to promote subject learning. Language requires a lot of input and practice. In addition, information technology blends into teaching increasing the variability of the course. From the perspective of English language teaching, the integration of information technology provides rich database resources as well as enhances a fully interactive learning during class.

MOE (Ministry of Education) of Taiwan aims to achieve universal primary education. However, significant challenges remain, particularly the huge gap between urban and suburb areas. It is believed that information and communication technologies (ICTs) can provide new modes of delivering and transforming teaching and learning process, in which interaction and communication is facilitated.

Current research intends to explore the potential of integrating mobile devices, such as smartphones, tablet computers and other mobile devices as educational tools inside and outside the classroom with alternative educational outlets (Collis & Wende, 2002; Prensky, 2007). In addition, increasing attention to mobiles outside the classroom should be recognized not just as social and entertainment devices, but as learning tools. How mobile devices are changing the way students learn and think about learning will be the significance of the research. The study might also bring about influence of the traditional student-teacher dynamic.

In light of the internationalization of English, Education should change progressively along with the science and technology in order to innovate some traditional teaching methods in children's English teaching and learning. With respect to English teaching, integration of information technology not only provides a rich database resources, more is to help teachers to create the best media interactive learning (Lai, 1998). Establishing an appropriate learning environment and developing effective teaching strategies are characteristics of children English teaching (McGlothlin, 1997). The multimedia materials concentrate words, videos, and variety of multimedia characteristics to make computer materials adapt individual demand to reinforce elasticity and interaction (Lippert, 1989). Therefore, educators must rethink current pedagogical strategies in order to increase educational achievement and learning outcomes.

With the promotion of technology, the ways of teaching have become more and more diversified. The unique aspect of a MALL (Mobile-Assisted-Language-Learning) system is that is not confined to a classroom, or the part of the day when the learner happens to be at a computer. In addition, the multimedia auxiliary not only allows children to have diversified learning environment and promotes their learning motivation, but it also provides the English learning whenever and wherever possible.

This study aims to create a different mode of teaching and learning that is speech-synthesis. Speech technology in computer-based systems can be used to

teach foreign language skills via creating robust interactive environments. Technology connected to the Automatic Speech Recognition (ASR) provides elementary school students a touchable learning companion. Text-to-speech (TTS) is one kind of speech technology, which transforms texts into voice files. TTS is like a learning robot, which has human's pronunciation and interaction to bring up learners' motivation. With fore-mentioned functions transformed into video clips shown in multimedia materials makes students to be clear at a glance, and clearly realize their problems should be improved.

In Taiwan, most teachers use traditional teaching methods, such as imitation, recollection and oral repetition practice. The TTS synthesis by rule has now reached human-like quality (Dutoit, 1997). The TTS technology is now reaching the stage where it can be applied to MALL. If teachers use TTS to facilitate teaching, it might result in high motivation, high learning self-confidence and low learning anxiety. TTS not only helps normal students to learn, but also assist blind people to recognize words through audio signals.

With the advancement of technology, the impact of English learning combining mobile devices has dramatically increased. Given the strong interest in the potentials of computer technology in language learning, mobile-assisted-language-learning (MALL) enhanced EFL learning. In addition, MALL not only boosts the self-learning and the motivation of children, but it also brings the welcome air of novelty to break the boredom of the language classroom. As a consequence, this study seeks to explore the process of designing an appropriate courseware. Furthermore, it examines the level of the acceptance of a mobile language learning application on elementary students featuring children English literature.

Research Questions

1. The level of acceptance of the Text-to-Speech and English children literature App on elementary students.
2. Whether the synthesis of Text-to-Speech (TTS) and English children literature improves the interest of learning English of elementary students.

Literature Review

M-Learning (Mobile Learning)

In the light of the development of mobile devices, a new form of learning environment was set up in which students can become totally immersed in the learning process, namely the mobile learning (M-Learning) (Kong, 2013). M-learning is beneficial for several reasons (McTeer, 2014). M-learning is a flexible educational technology that learners can learn anywhere at any time. M-learning can also be cost-effective, because most people possess mobile devices and learn without going out.

M-Learning is trans-regional limitation and a kind of learning way. Not only can learning take place in the classroom, but it also can happen in any

places. The application must perform the content of learning in effect, and provide educators and learners bidirectional exchanges. It is a wireless service so that learners will not be limited to time and location in learning (Harris, 2001).

There are varieties of aspects toward M-Learning. According to Living Technology Education Journal (2009), there are two parts in terms of education, 1) Innovative materials: exploring learning, cooperation learning and application software and 2) Assist traditional learning: promoting learning effect, instead of old tools (Chang, 2006). In addition, the popularity of smartphones and PDAs results in overall digital learning stage of the teaching activity and these devices have become the mainstream in the future. Mobile technology provides various resources and tools for language learning that encourages learners to be more motivated, autonomous, and socially interactive (Kim & Kwon, 2012). Traditional learning methods have transformed to M-learning in which people can learn anytime and anywhere (Chen & Hsieh, 2006).

M-learning can be implemented in many forms, such as face-to-face, distant, or online modes. Although using mobile phones to learn may take more time than computers, learners feel more freedom of time and space, so that they can spend their spare time to learn a second language when and where they are (Miangah & Nezarat, 2012). English learning will not be confined to written textbooks anymore. The advantage of mobile learning brings convenience to our daily life. Instead of physically participating in the traditional classrooms, M-Learning can be developed anywhere.

TTS (Text-To-Speech)

Nowadays, the technique of TTS has developed gradually. TTS is an artificial voice, which may be exempted from the trouble of pre-recorded, and save time and money at the same time. In addition, the sound engine of TTS system has increased a lot of rhythm tones to make synthetic speech lively. According to Dutoit (1999), his points out two modules of Text-To-Speech (Figure 3).

1. Natural Language Processing (NLP). It is a kind of language technology, used for everyday communication by humans. This module supplies in a wide sense to cover any kind of computer manipulation of natural language, combining the tone and the sound.
2. Digital Signal Processing (DSP). This module converts the received symbol information into speech.

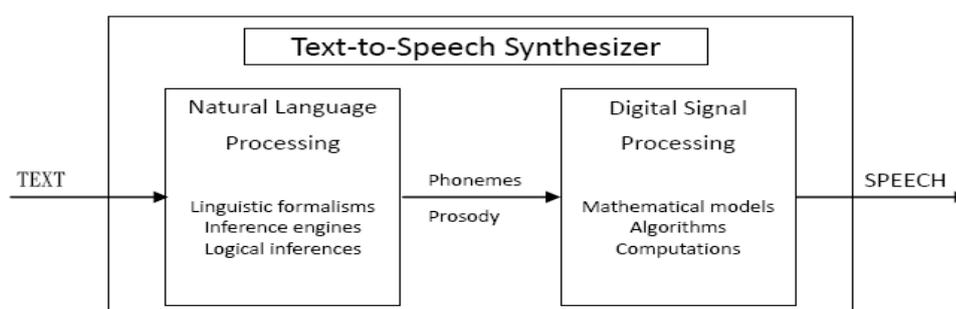


Figure 1. The Basic Operation of TTS

Text-To-Speech (TTS) plays an important role between learners and the computer, because speech as a communication interface is the most convenient and humanized. Compared with the traditional interface text, Text-To-Speech brings a cordial feeling and convenience. Furthermore, this system can break through the limitation of time and space. It can be employed anytime and anywhere. The most important, it provides a non-compulsory and no episodes of learning environment. In addition, if learners continue to practice the system, it will promote their oral and the confidence of speaking English spontaneously and simultaneously.

The application of TTS in language learning

Text-to-Speech (TTS) and Speech Recognition are commonly applied on language learning. The key point is the technology makes computers understand the significance of human speech (Ehsani et al., 1998; Neumyer et al., 1998). TTS can turn text information into voice reading, using the technique of artificial intelligence and natural semantic analysis. This technique can clearly read out the simulated human sound, with natural pronunciation, and the learner can adjust the speed and frequency on their own. The most important, it can facilitate the blind to learn new things.

Application Software (App)

Applications software on education can be used as a complement to the course, for home-schooling purposes, or for parent-guided literacy activities. They range from tools for storytelling, development of writing skills, and multi-sensory phonics-based instruction. There are also a large variety of apps that can be used to enhance organizational skills for students with learning disabilities.

Methodology

An exploratory design was conducted for data collection and analysis in this study. According to the statistic analysis, discussion, suggestions and pedagogical implications were provided. The App was designed mainly for elementary students. For the utmost achievement, multimedia animation technology as well as TTS technology was adopted to create a mobile application with diversification.

The researcher hopes to set up a new learning mode which can inspire children to learn English and stimulate students' interest in English learning and gain more knowledge in an amusing way. Consequently, the researcher designed an App combining TTS and animation for elementary students especially with the integration of children English literature. The App adopted a lively, romantic and interesting story as the main subject so as to inspire children to learn English and acquire English knowledge in an interesting way.

This study is divided into five stages. The first stage is Learning Mode Initialization. This stage is mainly to define the motivation, purpose and research questions. Afterwards, documents and references are collected at this stage in order to initialize the design of the learning mode. The second stage is

Actual Operation stage. In order to correspond to the level of elementary students, a well-known English children literatures with basic 1200 English vocabularies embedded is adopted as a topic to establish this application featuring TTS. The third stage is Data collection. Elementary students are the subjects of this experiment to explore the effectiveness of the mobile learning application. During the experiment, the conductor carries out an experiment by means of distributing a bilingual questionnaire. This part provides information for further analysis. The fourth stage is Data analysis. According to the statistic analysis, discussion, suggestions and pedagogical implications are provided at the fifth stage.

Instrument

A survey questionnaire invented by the researcher with both English and Chinese versions was employed, including 5-scale questionnaire for investigating participants' acceptance toward the app. The questionnaire was divided into two parts. The first part is basic information. The second part is to evaluate the overall design and effect of the App integrating TTS and children English literature. All subjects were asked to fill out the questionnaire and the participants were told that the purpose of the tests was to evaluate the level of the acceptance toward the app in terms of three aspects, including preference, involvement, and activeness.

The mobile application, which combines with TTS, and English children literature, was adopted in this study in order to determine the effectiveness as well as the satisfaction. There are verbal and visual effects in the application created for children to easily understand words or sentences.

Subjects

The target subjects were an unselected convenience sample. One hundred 5th and 6th grade students voluntarily participated in this study. Participants experienced the App for one lesson (fifty minutes) and filled out the questionnaire in order to receive the analysis with validity and reliability.

Materials

In order to create a joyful teaching and learning environment, "The Little Mermaid" was chosen to be the materials of this research. The App integrating TTS and children English literature was designed into three parts composed of main story, reading, and listening comprehension games.

Date analysis

The backgrounds of the subjects were first analyzed based on the collected information, including participants' English learning experiences and years of using computers and Internet. Secondly, the level of acceptance and the willingness of participants were analyzed according to the results of the survey questionnaires in order to examine whether the App affected students' learning

efficiency.

Results of Data Analysis

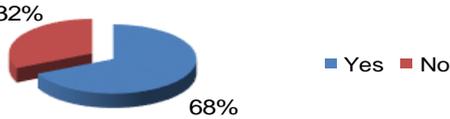
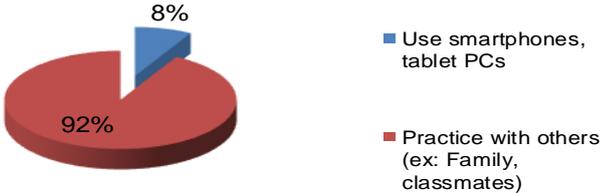
Demographics

The subjects were one-hundred 5th and 6th grade students. Among these participants, 43 % were males and 57 % were females. Most participants (60 %) reported they have learned English for 5~6 years; 32 % of the participants have learned English for 3~4 years and 8 % of the participants have learned English for 1~2 years.

Among the participants, 33 % of the participants have started learning English since 1st grade; 3rd grade is next and 27%. Kindergarten is 23% and the remaining 17 % of the participants have started since 2nd grade. The data collected from the questionnaire also revealed that the majority of the participants (88%) learned English from cram school; none with tutors or through self study and the remaining 12 % learned English from bilingual school.

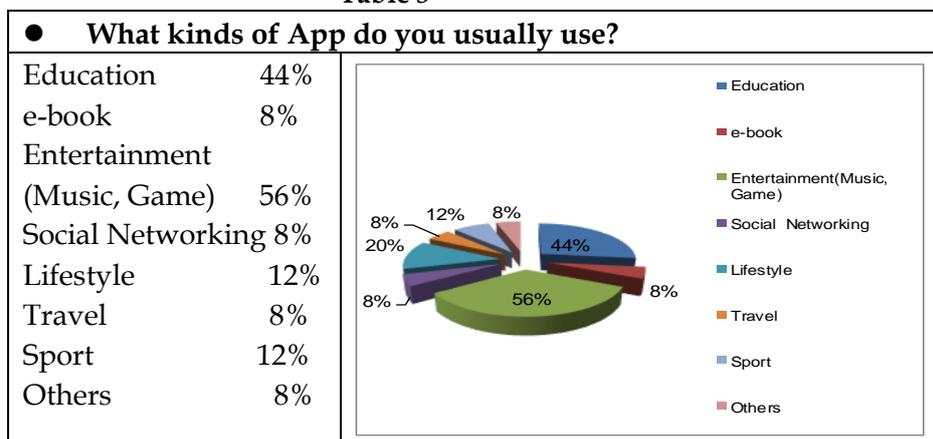
In the question "Will you practice English outside English class?" 32 % of the participants do not access English at all outside the classroom; 68 % of the participants said "Yes" among which 92 % of the participants practiced with others (ex: Family, classmates) and only 8 % of the participants practiced English through smartphones or tablet PCs (Table 1 & 2).

Table 1 & 2

● Will you practice English outside English class?	
Yes 68%	
No 32%	
● By which means?	
Use smartphones, tablet PCs	8%
Practice with others (ex: Family, classmates)	92%
	

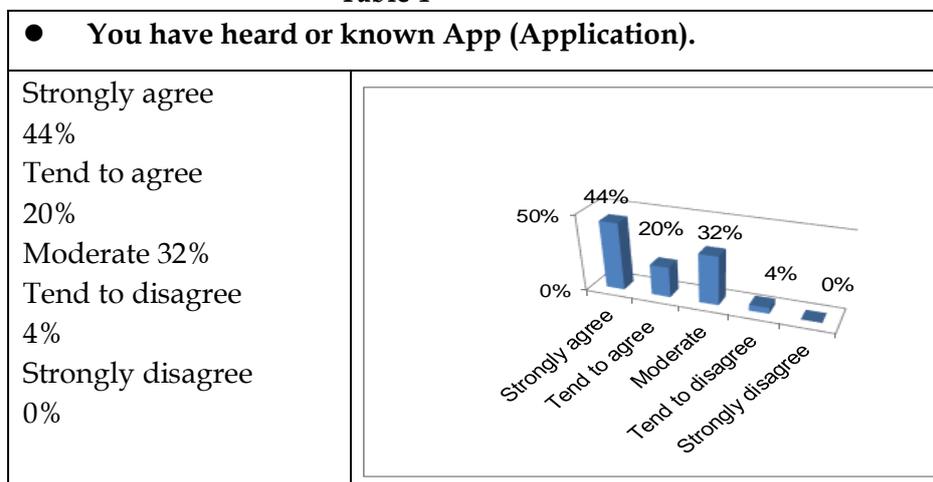
In terms of the question “What kinds of App do you usually use?” among the participants, 56% of the students reported that the main purpose of using App is for Entertainment, including music and games. 44% of the participants use App for Educational purpose; 12% for Lifestyle; 12% for Sport, and 8% for E-book, Social Networking, and tourism respectively (Table 3).

Table 3



Regarding question “You have heard or known App (application)”, the result revealed that the majority, 64% of the participant, have heard App and they usually download entertainment Apps (music, game). 32% of the participants have no opinion and remaining 4% of the participants have barely heard about App (Table 4).

Table 4



With regard to question “You have ever downloaded some educational Apps software before.” 36% of the participants agree to the statement; 48% of the participants remain neutral and remaining 16% disagree on the statement and thought they have never downloaded any educational Apps before (Table 5).

Table 5

● You have ever downloaded some educational Apps software before.	
Strongly agree	32%
Tend to agree	4%
Moderate	48%
Tend to disagree	12%
Strongly disagree	4%

As for question “The synthesis of TTS (Text-to-Speech) and children English literature App is very useful after you use it”, the results indicated that over half of the participants (56%) satisfied with the overall design of the App and considered it really useful toward the synthesis. 36% of the participants think the synthesis of TTS (Text-to-Speech) and children English literature App had moderate effect. 8% of the participants disagree on this statement (Table 6)

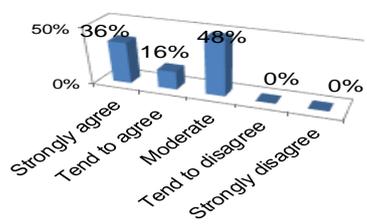
Table 6

● The synthesis of TTS (Text-to-Speech) and children English literature App is very useful after you use it.	
Strongly agree	36%
Tend to agree	20%
Moderate	36%
Tend to disagree	8%
Strongly disagree	0%

In terms of question “In your opinion, the synthesis of TTS (Text-to-Speech) and children English literature App is well-designed”, 52% of the participants considered it well-designed. 48 % had a neutral stance and none of them responded negatively (Table 7).

Table 7

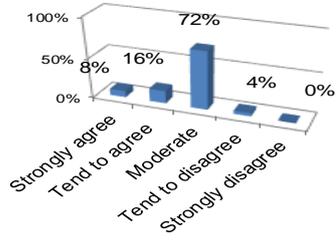
● In your opinion, the synthesis of TTS (Text-to-Speech) and children English literature App is well-designed.	
Strongly agree	36%
Tend to agree	16%
Moderate	48%
Tend to disagree	0%
Strongly disagree	0%



With regard to question “You want to download TTS (Text-to-Speech) and children English literature App”, 72% of the participants have ordinary feeling toward the App. 16% of the participants would like to download it and only 4 % of the participants disagree on the statement (Table 8).

Table 8

● You want to download TTS (Text-to-Speech) and children English literature App?	
Strongly agree	8%
Tend to agree	16%
Moderate	72%
Tend to disagree	4%
Strongly disagree	0%



As far as the following question was concerned, 32 % of the participants are willing to share TTS (Text-to-Speech) and children English literature App to their friends. On the other hand, majority of the participants (64%) depended or had no idea and only 4 % of them are unwilling to share (Table 9).

Table 9

● You are willing to share TTS (Text-to-Speech) and children English literature App to your friends.	
Strongly agree	16%
Tend to agree	16%
Moderate	64%
Tend to disagree	4%
Strongly disagree	0%

According to next question “you want to use this App on your daily life?”, 76 % of the participants considered it with moderate effect; 12 % of the participants agreed they felt useful and would like to download this App so that they can use anytime and anywhere and the remaining 12 % reported negatively (Table 10).

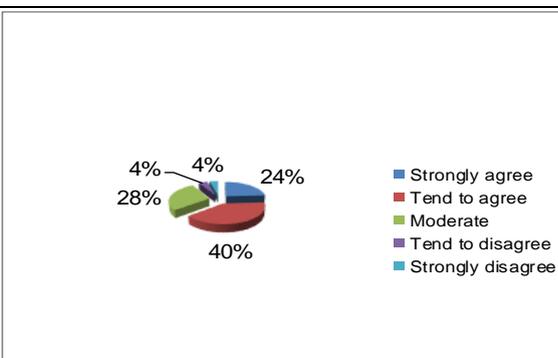
Table 10

● You want to use this App on your daily life.	
Strongly agree	4%
Tend to agree	8%
Moderate	76%
Tend to disagree	8%
Strongly disagree	4%

Regarding the question “the animation and sound effect bring about your interest of learning English”, over half of the participants (64%) supported the idea of using visual and sound media. 28% of the students considered it with moderate effect and the remaining 8 % implied the sound effect of generated speech is not natural enough to make the story lively and active which might influence the interest of English learning through this App (Table 11).

Table 11

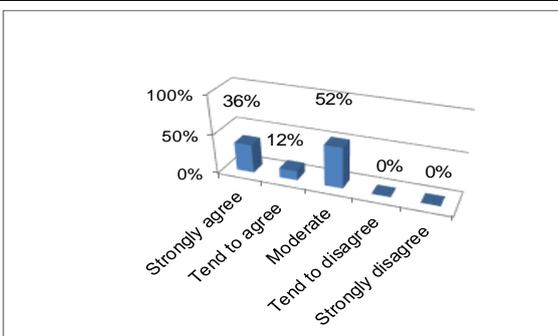
● The animation and sound effect bring about your interest of learning English.	
Strongly agree	24%
Tend to agree	40%
Moderate	28%
Tend to disagree	4%
Strongly disagree	4%



In terms of the following question “the contents and design of this App increase your interests in language learning”, 48% of the participants expressed they are familiar with the literature and extremely like the presentation and the contents. However, over half of the participants (52%) considered it with moderate effect and none of them disagree on this statement (Table 12).

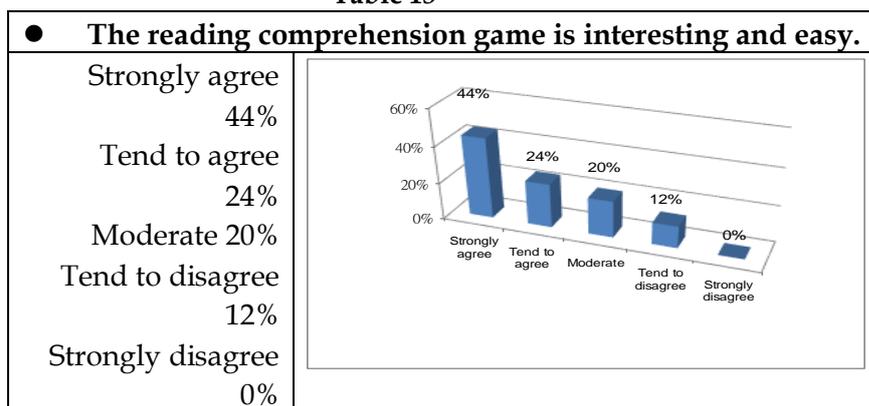
Table 12

● The contents and design of this App increase your interests in language learning.	
Strongly agree	36%
Tend to agree	12%
Moderate	52%
Tend to disagree	0%
Strongly disagree	0%



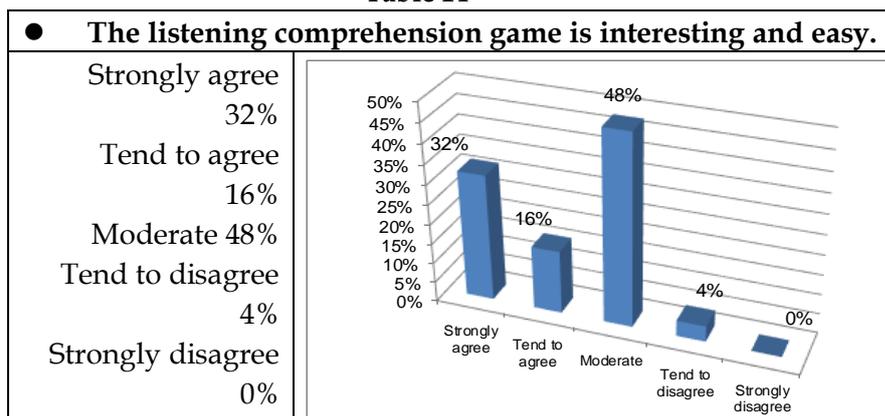
With regard to the question “The reading comprehension game is interesting and easy.” the results shows that majority of the participants (68%) thought it is pleasant and understandable toward operating the game; 20 % of them considered it moderate and the remaining 12 % disagree on this statement (Table 13).

Table 13



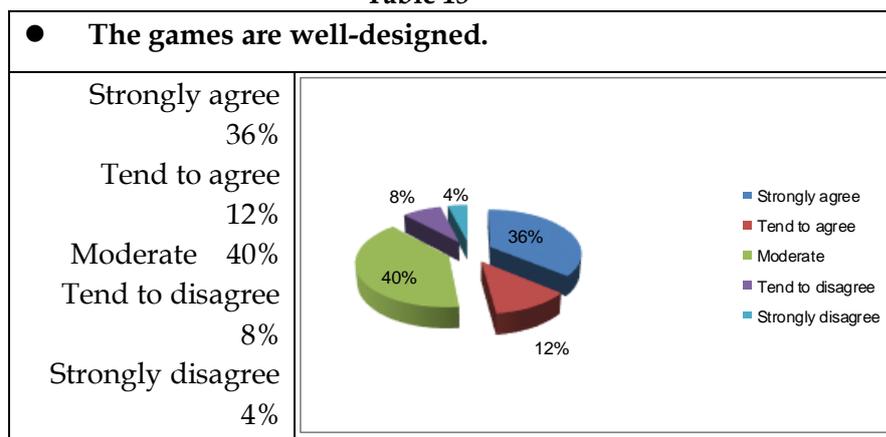
With regard to the question “The listening comprehension game is interesting and easy.” the results shows that 48 % of the participants thought it is pleasant and simple. On the other hand, 48 % of them considered it moderate and the remaining 4 % disagree on this statement (Table 14).

Table 14



According to the last question “The games are well-designed.” the results indicated that a majority of students (48%) satisfied with the overall design of the games and considered it really easy and understandable; 40% of the participants had no opinion and the remaining 12% of them implied they encountered a bit difficulty toward the game operation (Table 15).

Table 15



Discussion

In recent year, smartphones seem to be a trend in this society. With the great popularity of smartphones, there are lots of inventions coming up such as App, Android Market, QR Code, etc. In this way, students can download the App of English learning material and practice outside the classroom. After designing this App, the researcher did a survey toward App and investigated the satisfaction of this creation.

From written children story books in the past to the present e-books, the language learning system has shown a great advancement. With the voice, image and other modern technology, English learning has become to be abundant and practical. The effect of combining animation and sound is far better than the traditional children story books, which are more vivid and interesting as a whole. For children, this App not only possesses educational effect but it facilitates tem to download games with lively effects. In addition, due to the habitual behavior of Taiwanese, children are fond of sharing things with others once they get it.

Regarding the level of acceptance, participants express their preference toward the design of games and the app. In addition, majority of the participants considers this app helpful, which shows their great involvement of the operation. With regard to reading and listening comprehension games, participants think it is interesting and interactive because the content is well understood. In addition, sound effect such as hand clapping sound or spring sound coming with each question is really encouraging and inspiring. As a consequence, the synthesis of Text-to-Speech (TTS) and English children literature improves the interest of learning English of elementary students.

Nevertheless, few students reflect they do not like to be quizzed because they dislike the feeling of examination under huge time pressure. Moreover, there is no follow-up explanation section and learners might get confused. Among some questions, participants have no opinion toward the willingness and activeness of the usage. The reasons are provided as follows. First, TTS is mechanical voice, which is different from real man voice after all. Next, the

harmony of subtitles and sound does not reach at a satisfactory level. In addition, the story is more inclined to girls, which does not take general population into consideration. After that, some children indicate they are not familiar with the operation of the interface. Furthermore, most of the participants implied they prefer downloading Apps for entertainment or games. Few children have interests toward educational Apps. Finally, the researchers did not come up with the sequel or advanced level of the story so that it might be the main reason our educational App does not catch their eyes.

According to the results, children agree the design and content of this App has learnability and has aroused their interests of English learning. On the other hand, some children consider the content is too easy and it is not challenging enough. Furthermore, it is not easy to operate the app via mobile phone partly because the screen is too small.

The result of this survey showed that App is a powerful tool to deliver mobile information and knowledge in this E-era. Users may search and use appropriate Apps in daily life and learning. Mobile learning is a trend and more and more students may learn without time and space limitation. Learning languages by situational and simulating teaching is a good and life-long strategy. Additionally, TTS is an incredible tool to provide more authentic listening input. By using this App, learners can promote self-study in learning languages.

Conclusion

Generally, parents are aware of the tendency of the global village, and they are afraid that their children will fall behind others at the beginning in the fiercely competitive society. Therefore, the researcher hopes to establish a new learning mode, which can motivate children to learn English as well as arouse their learning interests.

It is estimated that the annual growth rate of children e-books are around 60% and can be up to \$1.3 billion in 2015. Mobile application can interact with books than traditional written books, which are more popular with the kids and their parents. The researcher observed this tendency and investigated the influence of one innovative learning mode regarding the effectiveness of English learning with the use of TTS technology and children English literature.

In recent years, many studies have confirmed that correct, appropriate application of using technology to assist teaching, effectively enhances learning (Kitao, 1993; Warschauer & Healey, 1998). In addition, according to Cheng (2001), his research shows that combining information technology with teaching not only increases the variability of the curriculum, but it also builds up autonomous English learning which is another way of teaching innovation. It helps children in the absorption of language knowledge, and cultivates the ability of language use.

Information technology uses the characteristics of information technology in teaching to create deep learning. According to Jonassen, Peck & Wilson (1999), their research shows by means of computer facilitates the children learn to break the bondage of written materials. Internet technology builds an online learning

environment to promote learning and create intellectual interaction, which is the manifestation of information science and technology into teaching.

This study adopts children's English literature as the topic featuring Text-to-Speech and animation in the context. Designing and establishing a lively teaching material assists teacher in English teaching. By the employment of animation as the teaching tool, students' learning motivation and comprehension will be more easily to be promoted and improved in order to replenish the deficiency of traditional English teaching methods. Students can learn the course materials either in class setting or e-learning with self-paced studying modes. In addition, constructing versatile English teaching/learning environment can enhance students' learning interests and willingness to boost learning effectiveness.

Designing an appropriate courseware along with App makes teaching resources varied and practical for learners in various learning domains. In light of this prospect, the researcher looks forward to providing teachers and students with more complete and diversified digital learning avenues. This project can be a good pedagogical reference for other researchers and educators to share technical English teaching.

Potential Implications and Contributions to Academics

With the advent of digitalization, more and more learning modes with diversification like APP, PDA, and digital passport are used more frequently. TTS engine relying on the current Android Platform supports several major languages, such as English, French, German, Italian and Spanish. TTS can freely converted text into any voice output of the above five languages. However, in the development of TTS technology, intelligibility and naturalness of the generated speech are the major issues being concerned in terms of system performance.

From the aspect of academic achievement, the educators can take advantage of technological innovation to edit their own teaching/learning materials. In light of the discrepancy of each learner, various teaching strategy should be put into consideration. This technology for English teaching is really a technical breakthrough. Students can learn the course materials either in class setting or e-learning with self-paced studying modes. In light of this prospect, the researcher hopes to achieve this expectation in the near future and looks forward to providing teachers and students with more complete and diversified digital learning avenues. This project can be a good pedagogical reference for other researchers and educators to share technical English teaching.

One goal of English education is to promote students' ability of independence, lifelong learning and learning motivation. In order to achieve this goal, continuity is an important factor influencing and motivating users to their mobile applications. The accessibility and interaction of information allows learners to access learning material in a variety of situations and will likely influence how they use their mobile devices. Rainger (2005) states that

accessibility is the “key to strategies to support inclusion, participation, and diversity within education and training” (p. 57). Therefore, educators should advocate uses of technology so as to maximize learners’ inclusion in the learning process.

In recent year, smartphones seem to be a trend in this society. Under this circumstance, using M-learning software combining TTS and Adobe Flash interactively and simultaneously enables students to become more versatile in language acquisition. Employing current constructed mobile learning application as a basis can continuously carry out the reinforcement of students’ foreign language ability. As for the future investigation, more technical breakthroughs in curriculum and instruction need to be put into consideration, in order to gain an overall picture of the optimal outcomes of language learning.

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