

## USING INTERACTIVE STORYTELLING APPROACH IN SCIENCE EDUCATION

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### Abstract

This research was aimed to develop interactive multimedia software and to determine its competencies. This Computer Aided Learning (CAL) was established based on National Pre-School Curriculum, 2006, Education Ministry of Malaysia. This Computer Aided Learning (CAL) focused on Science subject with the theme of 'Explore the Space' for pre-school level. The development of educational multimedia software with animated story approach making the learning process more fun as well as enable teachers to convey knowledge in easier way. Furthermore, this study refers to the learning theories, for instance, behaviorism, cognitivism, constructivism as well as scaffolding. This software package was developed using ADDIE methodology and Adobe Director 11 software as the base. The interactive animated story approach used in the exploration module includes stories of 9 planets in the solar system; Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. Early analysis was done in 10 preschools managed by the Education Ministry of Malaysia. From the analysis, it was found that the current Science teaching is teacher-oriented. This contributes to the development of the children with criterion such as passive, lack of confidence to speak and depend solely on their teachers.

Index Terms— Multimedia, interactive, storytelling, pre-school, science

## **Introduction**

The purpose of this research was to identify the capabilities of multimedia software in enhancing the effectiveness of teaching and learning of Science subject in pre-school level. The approach being used was interactive animation story, with reference to a number of past learning theories. The development of educational multimedia software with animated story approach making the learning process more fun as well as enable teachers to convey knowledge in easier way. Thus, the main objective of this research was to equip the teachers and pre-school children with more quality Learning Aided Tool (LAT) in order to enhance the effectiveness of Science subject teaching, to attract pre-school children in learning Science and to promote reading as well as to improve their reading abilities.

This software package was developed using ADDIE methodology and Adobe Director 11 software as the base. The interactive animation story's approach used in the exploration module includes stories of 9 planets in the solar system; Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. With the development of this interactive multimedia package of software, it is hoped that the pre-school children will be more interested in learning the Science subject which will then contribute to the upgrading of pre-school education's quality, in building a competent and knowledgeable society in Malaysia.

## **Interactive Storytelling**

An interactive story is defined as "a form of interactive entertainment in which the player plays the role of the protagonist in a dramatically rich environment" (Crawford C. , 2004). It is used to develop computer game, film and virtual reality. Multimedia elements are the content of interactive story. The story line is non-linear. The movement from interface to another is depending on the user's action. The user should be actively involved particularly in the digital story with play design, problem solving or answer searching. While watching and having fun, the viewer is bombarded with questions and is given instructions which allow the user to think actively.

The feature of the interactive story is almost similar to digital story except for the ending. One of the interesting features of interactive story is the user can never guess the ending. However, sales competition in the market forces digital story makers to maximize their creativity and skill. Interactive story is created with maximum graphic, animation and advanced special effect with narrow story lines. In times, the interactive story makers have to be satisfied with the capability of limited computer accessories. The makers start to focus their creativity on creating strong story lines to charm their audience.

In general, the features of an interactive story can be divided into four categories namely unlimited freedom, originality and variety of the story lines, various goals and deeper immersion (Mate & Jaden, 1). Interactive story for children education is developed for teaching and learning of basic subjects such as mathematics, science, language etc. Disney Pixar is among the pioneer in this area.

## Science for pre-school children

Behaviour of children aged 4 to 6 years old changes over time. Their attention span lasts for only 5 minutes. Therefore, it is tough for teachers to ensure that the children focus on learning. This is because naturally younger children have short attention span. They process information in a very slow manner. Just like an adult who get tired after working throughout a day, they will feel tired if they were to think about complicated things. If the teachers force them to do so, they are actually killing the children interests towards learning at that moment.

The most effective method is to use a practical method in getting them to be actively involved. This allows them to learn through experience by their teachers' guidance. The activity chosen must be mundane to their environment. Unusual phenomenon will be hard for them to do. Sometimes, teachers must convey unstructured topics because this method may capture children attention as they are free to explore and apply concepts taught by their teachers. This method can be easily applied by using interactive multimedia software according to children requirements.

Every child has a deep curiosity. This curiosity encourages them to do many different things just to find out or learn new thing. This sort of curiosity is crucial in order to promote development in Science subject. They have to have the desire to explore their environments. Exploration method can be developed in interactive multimedia software with combination of many kinds of media namely text, graphic, animation and audio in assisting children to explore the entire software content. At the end of software exploration, children may comprehend and memorize information gained.

### Early Analysis

The questionnaires were distributed to pre-school teachers during the visit in order to obtain information on the performance of the pre-school children in Science subject under their observation. The process of filing in forms was done face to face in order to prevent any errors. The questions were in a form of multiple choices and open ended. Generally, the questions focused on pre-school children's abilities in performing 9 of the science processes and the toughest theme that will be taught by the teachers. The analysis of the questionnaires to identify the toughest theme and the lowest score for Science process was done using Likert scale as stated below:-

Theme	Body Parts	Plants	Birds	Machines and Machineries	Nature	Explore the Space
Min	1.0909	1.0000	0.9091	1.2727	2.2727	4.6364
Min Deviation	0.5455	0.5455	0.5785	0.8099	0.9009	0.5950

TABLE 1.1 Min of the Hardest Pre School Science Theme from Teachers' Perception

Process	Observe	Measure	Classify	Expect	Investigate	Hypothesize	Predict	Explain	Communicate
Min	3.8182	3.2727	3.7273	3.4545	3.5455	3.0000	3.9091	3.3636	3.7273
Min Deviation	0.3471	0.2975	0.3388	0.3140	0.3223	0.2727	0.3554	0.3058	0.3388

TABLE 1.2 Min of the Lowest Ability to Perform Science Processes in Pre School Level from Teachers' Perception

As shown in the above table, 'Explore the Space' theme is the toughest theme to be taught by the pre-school teachers with min value of 4.6364. This result is parallel with the verbal statement of the pre-school teachers and is supported by the Department of Educational Technology, Education Ministry of Malaysia. The second toughest theme is 'Nature' with min value 2.2727 followed by the 'Machines and Machineries' with min value of 1.2727. Meanwhile, the lowest score to perform science processes among pre-school children is 'Hypothesize' with min value of 3.0000, 'Explain' with min value of 3.3636 and 'Measure' with min value of 3.2727. Therefore, the theme chosen for the development of MyScience is 'Explore the Space'.

### Objectives

The objective of this study is to develop interactive animated multimedia software using story-telling approach. Under this objective, the tasks completed are analyzed to identify the methodology of software development, followed by developing design model or instructional design (ID). Then, the MyScience prototype started to be developed.

The next objective is to conduct an evaluation on the effectiveness of MyScience prototype. The evaluation process includes measurement of students' performance use MyScience, and identification on the effective factors influencing students' performance as well as evaluation on the difference of students' performance before and after using MyScience software.

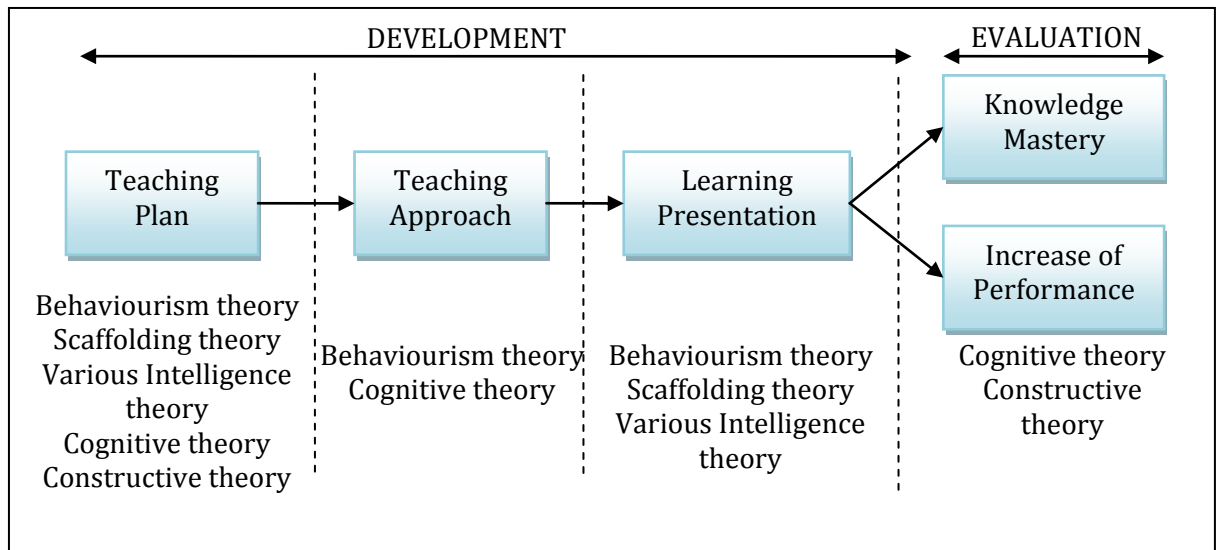


FIGURE 1: Conceptual Framework and Research Theoretical

### Scope and Sample

Specifically, the main activity of this research was:

- i. to develop a software for teaching in Science subject themed ‘Explore the Space’ and after this software was fully developed,
- ii. the usage was studied to identify how far it may enhance the effectiveness of Science teaching for that particular theme.

For this reason, the research used 20 pre-school children as study sample. Munir (2001) also used sample of 20 people for his research titled ‘MEL’ in pre-school level. Shortly after this software was fully developed, the pre-school children and teachers were trained to use it, and later the data were collected and analyzed to assess on its effectiveness.

### Methodology

This study is a quantitative based which uses Pre-Experimental Design type One Group Pre Test-Post Test that does not include control group (Campbell & Stanley, 1963). A treating group will be formed, which will then undergo experimental treatment process. The group will be tested using Pre Test and Post Test. The design of this experiment may evaluate the difference of performance before and after the similar group of students have used MyScience prototype (Zaidatun, Jamalludin, & Razman, 2008).

This study covers two phases namely prototype development phase and efficiency evaluation phase. MyScience prototype is developed with reference of ADDIE Model developed by Rosset which often serves as a basis to design model with different direction like Dick and Carey model (Richard, 1999). ADDIE model has five phases namely analysis phase, design phase, development phase, implementation phase and evaluation phase.

#### *Analysis phase*

In this phase, the researcher performs analysis of pre-school students' features, their learning needs, the design of concept map, identification of distribution channel, identification of learning constraints, identification of items required by the students to enhance their capabilities, schedule planning, identification of learning difference in class as well as identification of things that need to be considered for online pedagogy or compact disc.

#### *Design phase*

Gagne (1992) stressed that ADDIE model possesses three general functions namely identification of learning material, development of learning material and evaluation of efficiency of learning material (Rita, 2000). At this stage, the researcher designs a plan to achieve the study objectives, identify effective prototype design to build skill and knowledge of the user, design strategies and collect sources to be used in the prototype, structure the content of learning material and plan ways to evaluate the efficiency of MyScience prototype and students' performance, in other words to confirm whether MyScience prototype successfully achieves the objective or vice versa.

#### *Development phase*

Development phase in ADDIE model refers to tools and process used to develop learning material, and in this study context it is MyScience prototype. This phase covers activities of designing story board, Graphic User Interface and multimedia elements like txt file, photo, image, animation, audio and video. In conclusion, the researcher develops learning material which is MyScience prototype to achieve the study objective. This is followed with planning of testing method to prototype produced.

#### *Implementation phase*

After the prototype is successfully developed, it will be delivered to its users which are pre-school students. The researcher provides training to its users to prepare them in using the new LAT and prepares all requirements to implement the prototype into the learning system such as user manual, compact disc, additional software or plug-in, and to ensure all links and navigations are fully functional.

#### *Evaluation phase*

At this phase, the researcher measures the level of effectiveness and efficiency of MyScience prototype. Each evaluation phase which is widely known as formative evaluation is conducted with reference to the subject expert, learning material expert, visual expert, multimedia developer, audio and video expert, and prototype user. Comments from that group will assist the researcher in developing MyScience prototype. Moreover, summative evaluation is carried out to identify the significant factors, learning output, user behaviour and to measure user's performance after using the prototype.

### **Literature Review**

Children in the millennium era are easily excited with learning materials that incorporate computer technology and multimedia software in specific. The first schooling experience for a child has to be beautiful, exciting and memorable. A happy learning experience in

pre-school will retain a child's love and interest towards knowledge for life. This learning enthusiasm can be emulated by providing convenient environment. Active involvement may provide meaningful and effective life experience. The creation of fun Learning Aided Tools (LAT) is able to motivate children to learn.

Behaviorism defines learning as a change of one's response to a situation. Meanwhile, cognitivism defines it to internal process which may change one's thinking and cause permanent change of one's behaviour. In this study context, experiences gained by the preschool children will determine whether they become positive individuals towards learning or vice versa.

Learning process in preschool is done through informal education method. This method suits the thinking ability of children age 4 to 6 years old. Their minds are not prepared to accept systematic and proper formal education method. Just like a game, learning of a subject is done indirectly. This method encourages children to get involved in learning activities. New knowledge gained may assist these children to build new life skill.

Interactive animated story is the entertainment-based computer software. This term was first created by Chris Crawford, a software researcher and developer. He stated that the experience of using interactive story is different than the conventional linear story. Interactive story allows the movement not according to the order with various possibilities in a dramatic world. The earliest attempt to understand interactive story was done in 1970s by Roger Shank in his research in Northwestern University.

In the early 1980s, Michael Liebowitz developed interactive story titled "*Universe*". In 1986, Brenda Laurel published her PHD dissertation titled, "*Toward the Design of a Computer-Based Interactive Fantasy System*" from the University of Ohio State. In addition, in 1990s, a few research projects on animated storytelling began such as the "*Oz Project*" which was headed by Dr. Joseph Bates from the University of Carnegie-Mello, Ken Perlin who headed "*IMPROV Project*" from the University of New York, and many others.

There were also conferences regarding this topic, such as "*Workshop on Interactive Fiction & Synthetic*" in 1990, "*Interactive Story Systems: Plot & Character*" in 1995, "*Lifelike Computer Characters, Snowbird*" in 1996, "*First International Conference on Autonomous Agents at Marina del Rey, CA*" in 1997 and many more. The most recent was in 2006, "*Technologies for Interactive Digital Storytelling and Entertainment*" (TIDSE) which was held in Darmstadt, Germany has produced a myriad of works in digital and interactive story field and other related topics.

The software development for teaching and learning must also refer to the past learning theories. Behaviorism theory (Verenikina, Harris, & Lysaght, 2003) stressed that the users should be active listeners. Thus, the creation of good multimedia software is the one that allows users to be actively involved in it. Furthermore, cognitive theory (Zheng, Bromage, Adam, & Scrivener, 2007) stressed on the perception aspect which is the sensational interpretation received by human senses. Therefore, topics included in the

software must be arranged according to hierarchy. Moreover, constructive theory (Roussou, 2004) explained how user creates the understanding of the information regarding certain issues or facts through personal experience and this type of learning relates to the past knowledge or experience.

Social development theory (Zone of Proximal Development) clarified how a child may reach a stage where he no longer needs the help from his guardian (Vygotsky, 1984). According to Lev Vygotsky, there are two levels of cognitive development which are the level reached by a child when he puts an effort alone while the other higher level is reached when a child receives guidance from a more capable parties.

### **The importance and contributions of research**

In Malaysia, Science is perceived as the most crucial knowledge and skill in developing the country due to the fact that a more prosperous and better modern life relies a lot on it. Hence, the researcher took the initiative to provide a small contribution in improving the teaching of Science subject in the lowest level which is the pre-school level. Briefly, the contributions are presented below:

- i. To develop a methodology of suitable multimedia application that may enhance the effectiveness of teaching in Science subject.
- ii. To produce pedagogy in the form of multimedia software which may enhance the quality of content presentation.
- iii. To produce learning aided tool that may train children to think creatively and critically in scientific fields, so that the mastery of skill in certain scientific concept can be enhanced.
- iv. To produce Learning Aided Tool (LAT) or ‘scaffolding’ for teaching in Science subject.

### **Conclusion**

Today, the scenario of education field especially in pre-school level in Malaysia is no longer depending on printed books to serve as Teaching and Learning (T&L) tools. Pre-school children are also interested in using computer for entertainment, play or learning purposes. This software is hoped to help teachers and pupils in T&L of Science subject in pre-school level. However, this does not imply that the teacher’s role will be replaced by this software. Instead, the presence of effective learning media may assist in enhancing the quality of T&L.

Educational technology in the 21st century which is parallel to the era of Information and Communication Technology (ICT) perceives Science as a vital element for the modernization of the society. In this era, students must strengthen their skills and enrich their minds with knowledge in order to build an effective, and competitive society. The Smart School Project (MDEC, 2007) under the Multimedia Super Corridor (MSC) has upgraded the development of technological teaching. In the end, hopefully, the purposes and general objectives of pre-school education can be assisted by this research, as well as to act as guidelines for lifelong learning.



## References

- Campbell, D. T., & Stanley, J. (1963). *Experimental and Quasi-Experimental Designs for Research*. U.S.A: Wadsworth Publishing.
- Crawford, C. (2004). *Chris Crawford on Interactive Storytelling*. New Riders.
- Crawford, C. (1980). *Chris Crawford on Interactive Storytelling*. New Riders.
- Curriculum, D. C. (2006). *National Pre School Curriculum*. Ministry of Education Malaysia.
- Gobel, S., Malkewitx, R., & Ido, I. (2006). Technologies for Interactive Digital Storytelling and Entertainment. *Proceeding of the Third International Conference (TIDSE 2006)*.
- Joseph, B. (1992). *The Nature of Characters in Interactive Worlds and The Oz Project*. The Virtual Reality Casebook.
- Ken, P., Mary, F., & Andrea, H. (2005). The Rapunsel Project. *International Conference on Virtual Storytelling*, (pp. 251-259).
- Laurel, B. (1986). *Toward The Design of a Computer-Based Interactive Fantasy System*. *PhD Thesis*. Drama Department, Ohio State University.
- Lind, K. K. (2005). *Exploring Science in Early Childhood Education*. Thomson Learning.
- Mate, T., & Jaden, L. (1, 5 2010). *Interactive storytelling in entertaining*. Retrieved 7 2010, 3, from [http://www.cs.uu.nl/docs/vakken/ani/Papers2008/Wk6-Tomin-Liu\\_vs2.pdf](http://www.cs.uu.nl/docs/vakken/ani/Papers2008/Wk6-Tomin-Liu_vs2.pdf)
- McCue, P. (2005). Learning Games and Narrative: The Crucial Role of Animated Children's Educational Games. *ACM SIGGRAPH 2005 Educators Program (SIGGRAPH '05)*.
- Munir. (2001). *Pembangunan dan Keberkesanan Pakej Multimedia Dalam Pendidikan Untuk Memotivasikan Literasi (MEL) Di Kalangan Kanak-Kanak Pra sekolah*. Universiti Kebangsaan Malaysia.
- Richard, M. E. (1999). Designing Instruction for Constructivist Learning. In H. D. Jonassen, *Instructional design theories and models: A new paradigm of instructional theory* (pp. 141-160). Mahwah, NJ: Lawrence Erlbaum Associates.
- Rita, R. C. (2000). The Future Role of Robert M. Gagné in Instructional Design. In *The Legacy of Robert M. Gagne* (pp. 255-281). Syracuse, NY : ERIC Clearinghouse on Information & Technology.
- Roussou, M. (2004). Learning by Doing and Learning Through Play: An Exploration of Interactivity in Virtual Environments For Children. *Computers in Entertainment (CIE '04)*, (pp. 10-10).

Verenikina, I., Harris, P., & Lysaght, P. (2003). Child's Play: Computer Games, Theories of Play and Children's Development. *Proceeding of The International Federation For Information Processing Working Group 3.5 Open Conference On Young Children And Learning Technologies (CRPIT '03)*, (pp. 99-106).

Vygotsky, L. (1984). *School Instruction and Mental Development*. In M. Donaldson, r. Grieve and C. Pratt (Eds) *Early Development and Education*. B. Blackwell Inc.

Zaidatun, T., Jamalludin, H., & Razman, A. (2008). Penilaian Perisian Multimedia Bertajuk Pythagoras Theorem Form Two Dari Aspek Reka Bentuk Dan Pencapaian Pelajar. *Seminar Kebangsaan Pendidikan Sains Dan Matematik* (pp. 1-10). Johor Bahru: University Teknologi Malaysia.

Zheng, S., Bromage, A., Adam, M., & Scrivener, S. (2007). Surprising Creativity: A Cognitive Framework for Interactive Exhibits Designed For Children. *Proceeding of the 6th ACM SIGCHI Conference on Creativity & Cognition (C&C '07)*. ACM Press.