

An Interactive Science and Social Project 2010-2011

Developing interactive
educational media of
appropriate technology for rural
development: Bio-fertilizer

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Abstract

Educational media in rural areas was insufficient to transfer knowledge; as a result, students are not able to completely acquire the contents taught by the teacher. Therefore, the goal of this project was to produce motivating interactive media of appropriate technology education. Our team gathered information from questionnaires, interviews and direct observation of a class. The results showed that students learned best through “Learning by doing”. Consequently, interactive educational media using PowerPoint was created for the students in rural areas. After using the educational media, the students not only enjoyed the program but also were able to get higher score on the post-test.

Acknowledgement

This project was completed with the help and support of many people. First of all, we would like to acknowledge our project advisors Associate Professor Karen A. Lemone and Dr. Rojrit Rojanathanes for giving us countless information, important advices, suggestions and valuable advice used to improve this project's report. We are really thankful for their hospitality and would like to show our appreciation through this report.

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Lastly, we would like to express our gratitude to our parents, professors, seniors, friends and the people related who gave us superb support, recommendation and encouragement for completing this project.

Executive Summary

Students in the present day learn better with the help of technology. Fortunately technology was able to reach the rural areas; however, there were insufficient educational media in Baan Na Isan School to supplement the teachers' teaching especially on bio-fertilizer. Most students understand better through interacting; as a result, interactive educational media of appropriate technology such as videos, games and audios are needed. Educational media acts as an intermediary by carrying the course content from the teachers to students.

Instructors need to adapt and use technology along with their teaching to make learners interested in the course content. Therefore, there is a need to catch up with the current technology, especially in the field of education for all levels. Modern techniques using interactive media would further motivate and teach the children; this method could be used in other schools including schools where the teachers do not have much knowledge in these fields.

The goal of this project was to improve the science education of the students in rural areas by producing motivating interactive media of appropriate technology education. To successfully achieve the goal of this project, we set up four research objectives:

- 1) To identify course content.
- 2) Discover the student's attitude and interest.
- 3) Design and implement motivating interactive media.
- 4) Evaluate the interactive media.

Designing media for children is considered as a difficult task as most adults do not understand how the children feel. Children as target users have an issue regarding their attention spans which is much shorter than that of adults. Hence something that interests a child now may not interest them 10 minutes later. Other factors that influence children's enjoyment and entertainment are the decoration, colors, lighting and acoustics. Nature and the abundant use of plants in informal settings have been shown to enhance children's concentration, reduce their stress and help them further develop imagination and a sense of wonder.

Computer Assisted Instruction or CAI is one of the examples of an educational media which is a self-learning program. This educational software uses computer as an assisted tool to improve communication between teachers and students through the combination of graphics, text, sound and video in an attractive learning process. The use of computers has been beneficial to classes which motivate the students to understand thoroughly, easily and quickly. Computer mediated learning can be used for tutorials which minimize the problem of boring contents and uninteresting lectures. CAI programs can cover the information from basic facts to more complex concepts. Furthermore, it can provide a test which measures the students' understanding.

Identifying the course content and the level of education of the primary students enabled us to create the interactive media that would be most suitable and provide the maximum benefit to the students. Course content was identified by the information gathered from a focus group with the teachers and staffs. The scope of the content involves the basic science subject that the students were studying, as well as the applications and the essential information that the teachers included.

An interview was conducted with a professor from the Faculty of Education at Chulalongkorn University for collecting the information about the student's attitude and interest. The interview was based on the level of student's education.

Creating the story board was the first step of designing and implementing motivating interactive media. This step designed text and image format for the next step on a computer screen. Gamemaker, flash and power point were the alternative for creating interactive educational media. Having basic knowledge and understanding of how to create a manual is important in developing educational manual for CAI, whether it is a manual use for learning or instructional. The main purpose of the manual was taken into consideration since the manual helped in guiding the user for the best teaching method.

After the media had been designed and used as the teaching source, it should be tabulated. It is the measurement of the efficiency of the media, whether it is worthwhile for education or not. Is the duration too short or long? Tabulation is needed for further development of the media. Interviewing and observation of students were conducted to define the efficiency of the media.

During the information gathering week, the group members were able to gather some information from Baan Na Isan and the experts from the Faculty of Education. The group not only focused on the information within Baan Na Isan but also the nearby area which would make the interactive media applies to a wider area. The information obtained from the interview results of teachers and students from Baan Na Isan School was that the students were taught 1 hour per week on bio-fertilizer following the content of the guide book. All students from grade 4 to 6 learned the same course outline of bio-fertilizer. However, the content may vary with the level of education which students need to achieve.

Comparisons between chemical and bio-fertilizer were taught to the students so they knew the benefits and drawbacks of each one in the long run and students would apply the knowledge to use in their daily lifestyle. Focusing mainly on the content would not really attract the attention of students. Ajarn Sataporn has suggested animation to be put into either the guidebook or any kind of educational media. Furthermore, the teaching style being used was also very important and 2 out of 3 teachers said that students preferred “Learning by doing”.

As a result of conducting a personal interview with Aj. Pimpun, we found out that the students in different school somehow had different level of education on certain topics. Therefore, we carefully design the content of our interactive media so that most of the students would be able to catch up and learn most from the media. Games and activities were included to motivate the students to work in groups of 4-6 students and compete with each other in the process of learning according to Aj.Pimpun’s suggestion. Furthermore, the mini lab should be performed by the students while learning via Computer Assisted Instruction. Therefore, Computer Assisted Instruction would act as a summary and review the contents taught via mini lab.

To create the Computer Assisted Instruction, a storyboard was used to outline the important contents that should be included in the interactive media and Microsoft PowerPoint as a sequence of steps. Microsoft PowerPoint was used as a program to combine text, presentation, and animation. On top of this, usability test was done to evaluate the students’ performance after learning via Computer Assisted Instruction (CAI). The students in grade 4-6 understood the contents better than what has been expected. As a result, the CAI had to be

revised and corrected. In addition, the interactive educational media and the manual were had been created in bilingually in both English and Thai for more benefit in the future.

The results analyzed from questionnaire from the students shown that most of the students find difficulties in reading the questions. At the same time, the students did not do well in the written part of the questionnaires. Consequently, the questions were rewritten making it more understandable to the students in these ages. Thus the students were given the second set of questionnaires. This result portrayed a big improvement in which the average scores. Therefore, the wordings in the interactive power point were changed in order to make the appropriate media program for students.

The direct observation of grade 6 students in bio-fertilizer class was done. The teachings styles were questions and answers, asking for students' by calling their names, and simulate a situation in day life that could apply with content. These teaching styles are called "Teacher center". Subsequently, the teacher took the student to watch the procedure of making bio-fertilizer and allowed some students to do the experiment for a better understanding, which is called "learning by doing."

Questionnaires were done with the help of the teachers from Baan Na Isan School to evaluate the Computer Assisted Instruction. Their evaluation could be used to determine the contents' sufficiency that students needed to know. Furthermore, additional revision will be made if the content is insufficient.

A pre-test was completed by students before using the Computer Assisted Instruction to measure their fundamental knowledge on bio-fertilizer. Nevertheless, the students would do a post-test again after learning from the Computer Assisted Instruction. Therefore, the result could evaluate to find out whether or not that students had truly understood the content.

Authorship

Jantawat Chanisarangsima - contributed greatly to the background section and wrote parts of the results and discussion section of the paper. He served as one of the editors to the report. He also helped in the interviews and questionnaires on students. In addition, he contributed in the process of making of bio fertilizer, formulae of bio fertilizer and exercise part in the CAI. Finally, he edited some of the presentations slides.

Kiattikun Sawaison - help developed the Abstract, Introduction, Summary and Results section of the paper. He also wrote the initial drafts of methodology which outlined the interviews that he and the other group members performed at Baan Na Isan School. Along with Pinyada, he administered the surveys to Baan Na Isan students. Kiattikun and Pinyada also developed the data analysis section. He also did some of the presentation slides.

Pinyada Arkompituk – wrote the initial draft of the introduction section with Kiattikun, and part of the Abstract with Yanisa. She developed the analysis from the interviews with teachers and students. She also discussed the Survey with the teachers of Baan Na Isan school, and given out questionnaires to students from the Baan Na Isan school. Last but not least, she also contributed in the making of the CAI.

Yanisa Morakotwichitkarn – wrote the initial draft of the Background section. She contributed greatly in writing the Abstract, Summary, Results and Conclusion sections. In addition, she served as the main editor for all drafts and revised all sections of the report. She also played an important role in the completion of the CAI and organizing presentation slides. She helped organized the content page, list of figures and formatted the final report.

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1. Introduction

Her Royal Highness Princess Maha Chakri Sirindhorn has valued the importance of education of young villagers in the rural areas as education is essential to every individual. HRH has been working hard in order to improve the quality of life and educational background of young generations. As the world evolves, technology has become part of education. Technology is indeed essential to everyone's life; without the proper educational media to transfer the knowledge, students are not able to completely acquire the contents taught by the teacher. In fact, students in the present day learn better with the help of technology. Fortunately, technology was able to reach rural areas; however, there were insufficient educational media in the schools within the countryside.

Educational media in the schools of Baan Na Isan School was insufficient to motivate students to focus on the lessons because there was a lack of interactive media to supplement their teaching especially on bio-fertilizer. The school developed a technique to create bio-fertilizer from the reusing of its waste. In addition, the students were taught how to create this fertilizer with traditional teaching methods and the demonstration of how to do it themselves. Most students understand better through interacting; as a result, interactive educational media of appropriate technology such as videos, games and audios are needed. Educational media acts as an intermediary by carrying the course's content from the teachers to the students. Such media can be easily distributed throughout the rural areas of Thailand.

The teachers in the primary school of Sai noi district in Nonthaburi province use a combination of real samples such as the seedlings for agricultural use, documents, pictures, animations and audios in their teaching to show the primary school students the imitations or the exact objects. Although the most common methods used are experimentation, practical and demonstration, the schools of Baan Na Yao and Baan Na Isan conduct the lessons by using black boards on which the students could not visualize the content thoroughly.

In order to make learners interested in the course content, instructors need to adopt the use of technology along with their teaching. Therefore, there is a need to catch up with the current technology, especially in the field of education for all levels. Modern techniques using interactive media would further motivate the children; this method could be used in

other schools including schools where the teachers do not have much knowledge in the field of technology.

The goal of this project was to produce motivating interactive media of appropriate technology education. The goal was achieved by fulfilling the following objectives:

- 5) To identify course content.
- 6) Discover the student's attitude and interest.
- 7) Design and implement motivating interactive media.
- 8) Evaluate the interactive media.

2. Background and Literature Review

The lack of educational media was acknowledged as a problem in rural areas. In this chapter, the different types of teaching media and methods are explored. Factors on how to create interactive media for children were studied. The past works of other schools in rural areas from different provinces of Thailand were investigated and used as references for further improvement. Finally, how our project will fit into that larger initiative and the replacement of chemical fertilizer with bio-fertilizer was examined at the Baan Na Isan School as proposed by the HRH office.

2.1 Designing media for educational purpose ^[1]

An important criterion in education is the media that teachers use in their teaching, which is the educational media. Educational media is the key to help learners understand the content and get the real picture of what is being taught more than just lecturing from the textbook without any teaching tools.

Educational media is bringing media into the teaching by using materials, tools and methods to transfer the knowledge to learners. For the learners to gain as much knowledge and experiences according to the teaching's content while helping learners understand better and saving time.

Types of educational media

Educational media is classified into 3 types as follows:

1. **Software:** a small size media which its duty is to contain the teaching's content in a form of pictures and sound. It can be divided into 2 categories.



Figure 1: Printed Media

1.1 Printed media: different forms of printed media are documents, books, manuals and media which require writing and printing.

1.2 Non-printed media: media other than the printed media such as real sample, models, blackboard and sign boards. Including materials using with tools for example, video tapes, voice recorder, movie film, disk and video camera.

2. **Hardware:** media equipment that require electricity when used. For example, overhead projector, computer, CD player, microphone and television.



Figure 2: Hardware



Figure 3: Activities

3. **Technique:** media which require interactive and activities or even processes and different kind of teaching methods. Examples are seminars, demonstration, one on one tutoring, games and acting.

2.1.1 Interactive media for children: Gamemaker [2]

Most games were created by writing lines of code which requires a long time. However, currently software that allows game makers to create computer games for children without much difficulty by just dragging and dropping actions and it needed only a small amount of time. This program allows one to create a professional game to one's desires while making the games fun and educational. Desired backgrounds, animations, sound effects and 3 dimensional shapes are able to be put into the games. Besides, it can be downloaded and use for free. Other than that, one can sell the games made if they want to.



Figure 4: Interacting among children

2.2 Factors to consider when designing media for children

Designing media for children was a difficult task as most adults do not understand how the children feel. Children do not know what is right or wrong logically. Therefore, it is the responsibility of adults to look after their children. There were a few factors accountable for children's behavior and one of them was environmental factor consisting of four basic needs as followed.

2.2.1 Movement

Children need to feel safe when moving around within the area or else they would become frustrated and keep fidgeting around and try to gain access to restricted components of environment. As children's developmental skill change constantly as they age, the point where boredom sets in was a moving target. Children's physical, intellectual and social skills were constantly advancing and even the same age children have different levels of skills and acceptable challenge. Safety was also an important consideration. The environment must be designed to prevent unsafe behaviors, situations and injuries, but also designed to minimize injuries when an incident occurs. However, to attract children's attention, equipment must present some risks but risks where a child can evaluate the challenge. Environments considered appropriate and safe for older children will often be dangerous to younger children, requiring age segregation of areas. Environments with activities that are safe when children are supervised can be dangerous if children are left unsupervised.

2.2.2 Comfort

Children love the feeling of comfort which is a very important need that needs to be satisfied. There needs to be reasonable and diverse levels of stimulation for all the senses. Behavior is adjusted at a zone of stimulation. An overloading of stimulation and noise will distort with children's feelings of discomfort and result in undesired behaviors.

2.2.3 Competence

Children need to feel a sense of capability within them which shows that they are able to cope up with the environment. Children become bored when there's a mismatch between what they have the ability to do and what they are expected or want to do. They enjoy

themselves when their skills match the appropriate task at hand. If not challenging enough, they're bored.

2.2.4 Control

The ability children possess to interact, control and transform their environment is very important to them. Children want to explore, manipulate and transform the environment. Environments that children can manipulate, move and construct with are immensely more engaging than static equipment and environments. Children need to take control of the environment they are in. Children have to do trial and error to gain experiences so as to make decisions.

Children have an issue regarding their attention spans which is much shorter than that of adults. Hence something that interests a child now may not interest them 10 minutes later become boring. Other factors that influence children's enjoyment and entertainment are the decoration, colors, lighting and acoustics. Nature and the abundant use of plants in informal settings have been shown to enhance children's concentration, reduce their stress and help them further develop imagination and a sense of wonder.

2.3 Production and usage of multimedia in schools [3]

In general, the computer will be used in teaching and administrations such as financial, supplies, libraries, student affairs and management. Thusly, school should provide the suitable computer system, preparation a program or provide the crucial programs and plan to use it carefully. Using computers for teaching and learning was the key elements of multimedia. Multimedia enhanced for teaching and learning by following the reasons:

- Multimedia technology allows for the designing the respond concept for lessons and the learning process including the academic achievement. In the past, the research showed that the multimedia enhanced the learning process which increased the academic achievement even higher.
- Multimedia in type of CD-ROM was easy to use, easy to maintain portable and could be copied easily.
- An educational multimedia allowed the learners to study on their own.
- In currently, there have a program to help construct the educational multimedia which is easy to use and people who are interested can construct multimedia in their own way.
- Teachers can use multimedia to teach a new content, for exercise, for propose scenarios and for solving problems from the content.
- The technology of multimedia encouraged people to use multimedia for any ages and any level of their knowledge. The multimedia was designed with the suitable content.
- The quality multimedia would provide more value of the investment in school or organization. Moreover, the progressive of the network could enhance the advantage of multimedia for any organization.



Figure 5: Multimedia in school

2.4 Current problems

The two main problems Baan Na Isan School is facing are the unawareness of significance of science education and uninteresting teaching contents. The students at Ban Na Isan Border Patrol Police School (primary school) do not realize the significance of science education. As a result, the knowledge cannot be transferred to the students entirely. However, by developing an interactive educational media for the students especially in the science field would draw the attention from the students and raise awareness about science education. Therefore, the need to develop interactive educational media of appropriate technology seems to be really important for the school.

Students are not engaging in the current science education due to uninteresting teaching contents. Even though the subjects are uninteresting in the students' point of view, those subjects are vital and play important role in improving the living standard of the students as well as preventing environmental issues. The subject of how to make bio-fertilizer from natural waste in the replacement of chemical fertilizer is mainly focused. Since just the subject itself might not be the best thing to attract the students' attention, by using exciting and interactive knowledge as a transferring method would make those subjects more interesting and easy to understand.^[4]

2.5 Previous CAI work in Thailand

Between the year 2006 and 2007 Mr. Sitthichai Hirandith^[5] did a research on using Computer Assisted Instruction (CAI) of IPST for teaching elementary students in grade 6 at Wat Nong Pha Muang Uttaradit School, Uttaradit province to compare academic achievement of science studies on chemicals and electricity lessons before and after using Computer Assisted Instruction. The result obtained was that the average test scores of grade 6 students in 2550 after using CAI for learning were higher than the average test scores before using CAI for learning.

During year 2009, Mrs. Disaporn Wongwattana^[6] studied the use of Computer Assisted Instruction (CAI) under the topic “the set of laws on a daily basis”, group learning of social religion and culture studies. In order to analyze the efficiency data of CAI, to

compare the average test scores of students at grade 4 before using CAI and after using CAI for learning and to obtain the feedback of the students' satisfaction as well as to listen other teachers' comment on CAI. After the evaluation, the results are as follows: The data of effective of CAI under the topic "the set of laws on a daily basis" was higher than the standard set. The average test scores of students at grade 4 after using CAI for learning were higher than the average test scores before using CAI. The average satisfaction of students who used CAI for learning was very high. The average of teachers' comments on CAI was 4.78 from the range of (4.64-4.91), which was the highest result ever.

Furthermore, in the middle of year 2550 Miss Wanida Boonkarw^[7] did an investigation on using a set of teaching and Microsoft PowerPoint as a Computer Assisted Instruction (CAI) to teach students in grade 5. The objectives were to create and analyze the efficiency of a set of teaching and Computer Assisted Instruction (Microsoft PowerPoint) for elementary students in grade 5 following by the standard performance of 80/80, to compare the average test scores of elementary students in grade 5 after using a set of teaching and Computer Assisted Instruction (Microsoft PowerPoint) for learning and to examine the satisfaction of the elementary students in grade. The results showed the efficiency value of each set of teaching and Computer Assisted Instruction (Microsoft PowerPoint) was above the performance standards (80/80), which was 84.30/82.60. The average test scores of grade 5 students were higher than pretest scores and the overwhelming satisfaction from the students.

Recently, Mrs. Benjamat Arksorn^[8] investigated on using Computer Assisted Instruction (CAI) on English vocabulary for teaching students in grade 5, Wat Prom Sakhon School. The Computer Assisted Instruction (CAI) on English vocabulary consisted of 3 main topics, which were English vocabulary lessons, test of learning and satisfaction assessment of students. For English vocabulary lessons were divided into 3 units of learning; unit 1 was "Food and Drink", unit 2 was "Good Health" and Unit 3 was "Things in my life". For test of learning 30 questions were provided. For satisfaction assessment of students, 10 questions were provided. From the evaluation, it showed that students could take the test well after they had learnt English vocabulary via Computer Assisted Instruction (CAI). Teachers were very satisfied with results as well.

Miss Supitcha Poonpol^[9] studied on the development of Computer Assisted Instruction at Piboon Prachasan School under the Office of Special Education Administration, Office of the Basic Education Commission of Thailand, Ministry of Education. The purpose of this study was to determine the efficiency of Computer Assisted Instruction about the images and symbols which can be used in everyday life for individual students with autism from Grade 4 to Grade 6 according to the standard criteria 80/80. In addition, to compare learning achievement about images and symbols with autism from Grade 4 to Grade 6 after using computer assisted instruction. A group of individual student with autism without any other disabilities from Grade 4 to Grade 6 at Piboon Prachasan School was tested on the Computer Assisted Instruction. These 10 students were purposive sampling and the study was completed in 20 hours. The performance of the Computer Assisted Instruction about images and symbols was effective according to standard criteria 80/80. The achievements of learning through Computer Assisted Instruction about images and symbols after using computer assisted instruction were successful as the statistic was in the level of 0.05.

2.6 Approaches: Interactive media using CAI

Computer Assisted Instruction or CAI is one of the examples of an educational media which is a self-learning program. This educational software uses computer as an assisted tool to improve communication between teachers and students through the combination of graphics, text, sound and video in an attractive learning process. The use of computers has



Figure 6: Example of interactive educational media

been beneficial to classes which motivate the students to understand thoroughly, easily and quickly. Computer mediated learning can be used for tutorials which minimize the problem of boring contents and uninteresting lectures. CAI programs can cover the information from basic facts to more complex concepts. Furthermore, it can provide a test which measures the students' understanding.

2.6.1 There are six categories of CAI: [10]

1. **Drill and Practice** – CAI helps the students master their skills.
2. **Tutorial** – Information is presented in different format such as drill and practice, games and simulation
3. **Problem solving** – skills and strategies for solving specific problems are presented in CAI software
4. **Simulation** – software simulation can provide conditions similar to reality. The model does not cause damage to our real lives.
5. **Educational Game** – the software is created in form of a competitive game to earn the highest score and win, or beat the computer opponent.
6. **Discovery** – the software provides a large database, specific to a particular concept, a content or scope, as well as challenging the students to analyze and compare the diagnostic values based on a survey

2.6.2 Benefits of computer-assisted instruction (CAI)

1. Students can study on their free time in order to practice skills and knowledge.
2. Students can use this software at any time and in their convenient locations, whether it is home or school.
3. Computer-assisted instruction will be able to attract students and allow them to enjoy the learning atmosphere.

Key features of CAI:

1. **Information** – the contents have been compiled, allowing the students to obtain the skills according to the objective set by the author. Presentation may be in a direct or indirect style. *Direct style:* computer-assisted instruction such as reading, memorizing, understanding, practicing and presenting. *Indirect style:* computer-assisted instruction such as simulation games.
2. **Individualization** – difference responses between individuals is a very important aspect of computer-assisted instruction. Each individual has their own way of learning. Computer-assisted instruction is one of the media designed to observe for the difference responses between individuals.

3. **Interaction** – the relations between the students and computers. The software gives an opportunity for the learners to have as much interaction as possible.
4. **Immediate Feedback** – To evaluate students' understanding of contents or skills after the training is a requirement for good CAI.

2.7 CAI and Baan Na Isan

The type of computer-assisted instruction used in this project is “tutorial and/or educational game”. Since some students do not pay attention in class and their performance in their work were not very promising. The idea of computer-assisted instruction (CAI) is planned so that students can learn lessons by themselves without a time limit, without waiting for a teacher or attendance. In case of slow learners, students can go back and repeat the lessons again for better understanding. With the aid of computer-assisted instruction, teachers will be able to analyze each student to develop the teaching system according to the learners. The computer can help score various behaviors of students by assigning the lessons appropriate for each student. Educational games help increase motivation of the students since learning by computer is a new experience.

2.7.1 PowerPoint

Microsoft PowerPoint is a program of Microsoft Office suitable for presenting purpose needed for most business related industries. It can be applied to use with other purpose such as introducing new products, services, to make slide shows and plan designing.

2.7.2 Principle of PowerPoint

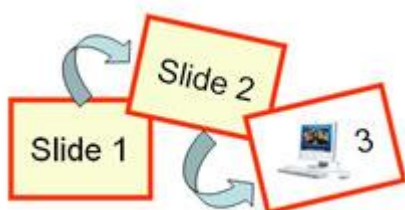


Figure 7: Slides

The principle of Presentation creating from PowerPoint is the slides that data, pictures, animations and sound can be put into the slide to make it more interesting. Furthermore, we can also set the slides shown to be automatic without having to click a button during the presentation.

Before the starting of making presentation, one should have in mind the design of how the power point slides should be. Even though if one does not has any idea, themes of various can be chosen from the existing templates in the program itself.

2.7.3 Overview basic of PowerPoint

- For introducing data in the form of messages, pictures, sound and animation
- Can be decorated with WordArt
- Can be separated into each individual page called slides
- Making slides with the help of slide layout
- Themes having design for making presentation easier
- Support animation such as Flash, Gif animation and videos
- Can be set and adjust to the user's desire
- Can command the printing in many format of slides and handouts
- Files created from power point have file type of .PPTX
- Presentation can automatically be open if the file is .PPSX file.

2.8 The purpose of using the educational multimedia^[11]

The goal is to teach the student in which the media can be the teaching material or supplementary text.

- Self-learning
- For general and specific objects by covering skills, knowledge, comprehension, and attitudes of focuses also involve on the purpose and structure of the content.
- Used for teaching and learning, however; it is not restricted to schools system.
- Form of instruction, it will focus on instructional design, interaction, validation of knowledge by applying psychological theory and the learning theory.
- Program was designed for learners who will control all of the activities by themselves.
- The effectiveness media evaluation was an important step that must be done.

3. Methodology

The goal of this project was to improve the science education of the students in rural areas by producing motivating interactive media of appropriate technology education. To successfully achieve the goal of this project, we set up four research objectives:

- 1) Identify course content
- 2) Discover the student's attitude and interest
- 3) Design and implement motivating interactive media
- 4) Evaluate the interactive media

3.1 Identify course content

Information on the content being taught to students in grade 4 to 6 was obtained by interviewing four students each grade. Questions related to the content of the processes, definition, benefits and drawbacks of bio-fertilizer were asked. Identifying the course content and the level of education of the primary students enabled us to create the interactive media



Figure 8: Focus group with teachers and staffs

that would be most suitable and provide the maximum benefit to the students. Course content was identified by the information gathered from a focus group with the teachers and staffs at Baan Na Isan School ^[12]. The scope of the content involves the basic science subject that the students were studying, as well as the

applications and the essential information that the teachers included.

This method was chosen as the interviewees thoughts and opinions are being shared at the same time. The teachers were interviewed since they were the one planning and creating the manual for teaching. The information obtained from the focus group revealed basic background of the students at Baan Na Isan schools.

Observing the students in class was another method chosen to identify course content. The school of Baan Na Isan had granted permission to make an observation while they were studying. This method helped in identifying the teaching style and the students' behavior in class.



Figure 9: Observing students in class

3.2 Discover the student's attitude and interest

This objective was one of the very important factors to consider in creating an interactive media because the problem of the project was that the students in rural areas were not engaged in current science education. To collect the information about the student's attitude and interest, an interview was conducted with the expert in the Faculty of Education, Chulalongkorn University.

Personal interviewing was another method chosen to identify the academic approach. This method was chosen because the teachers were quite busy; accordingly, personal interviewing provided large amount of information as well as clarifying the difficult questions. The personal interviewing was conducted with lecturer at the Faculty of Education Chulalongkorn University, Assistant Professor Dr. Pimpun Dachakupt.^[14] The interview was based on the teaching styles for students in grade 4 to grade 6.

Another method to collect the information about the student's attitude and interest was gathering additional information such as the teaching method and strategy. For this method, we spent 2-3 days for searching the information from books and internet as the manual of teaching. We tried to find the example of the interactive media from the internet so that it could provide all of us on what was the easiest and the most suitable way that the message should be delivered to the primary students with the full potential. By doing this, it could provide us useful information on how to communicate to the students through media.

3.3 Design and implement motivating interactive media

Topics to be concerned when developing an educational media are the title of the subject, goals, objectives and target users. Children as target users have an issue regarding their attention spans which is much shorter than that of adults. Hence something that interests a child now may not interest them 10 minutes later become boring. Other factors that influence children's enjoyment and entertainment are the decoration, colors, lighting and acoustics. Nature and the abundant use of plants in informal settings have been shown to enhance children's concentration, reduce their stress and help them further develop imagination and a sense of wonder.

3.3.1 Methodology for successful media ^[15]

1. The goal - must consider whether the receiver was delivered what they seek for through the media
2. The students - must consider whether the students' fundamental knowledge and background
3. Cost - does the cost correspond with the budget?
4. Technical specialty - if we do not possess the quality, will we be able to find the professions
5. Apparatus - are we fully equipped with apparatus necessary for the production?
6. Facilities - they are in our possession or do we have to get them
7. Time - do we have enough time for the designing and production of the project?

3.3.2 Select, Modify, or Design Materials

Selecting the appropriate media by fulfilling the three main requirements:

1. The selection of existing media; in most educational institutions often have the resources to be used as the media; therefore teachers have to check to see if anything is to be used as a medium for teaching by matching the style of learning and purpose

2. The modification of an existing media that work well. This would depend on time and budget for the modification of media.
3. Design new media production. If the media already exists and matches the purpose of teaching and learning, we can use them straightaway, but if there is no matching media, we can adapt it according to the usage. Lastly, if media is not able to be used or applied, then new media has to be produced.

3.3.2 Steps to create the storyboard

Creating the story board was the process of preparation and presentation for overall of media and multimedia on paper. This step designed text and image format for the next step on a computer screen.

This step also created a structure chart, including the media works by setting a table within the framework of the content as designed with the following steps.

1. Prioritize the work according to the contents of each section is based on details from the design stage.
2. Use the structure plan from each episode to create the storyboard.
3. Analyze and evaluate the feasibility of the program.

3.3.4 Steps to create the program

This step utilized the expertise of the software applications that the media must understand the properties of the core program elements for the media, and support programs as well as other in order to be able to bring the potential of those programs used to create rich media. Main programs for creating CAI are Macromedia Authorware, Macromedia Director or Asymetrix Toolbook, etc. The processes are as follows:

1. Place the media according to the process designed in storyboard
2. Place the various interactive and Response as designed.
3. Customize the interesting features of the program by adding transition to the display.
4. Test walking program. It should be tested periodically.
5. Analysis of the walking program. Working in each section.

3.3.5 Development of the manual^[16]

Having basic knowledge and understanding of the manual's function is important in developing educational manual, whether it is learning or instructional manual. The components and the consideration in the manual are stated as followed (Boonkeur Kualhawet 2000: 100 -102):

The role of the teaching manual or “teacher guide”:

- Warn and suggest teachers to content preparation before teaching.
- It helped teacher to know their respond in advance while they teaching and made them know problems that might occurred.
- To made the teacher know their own activities for teaching the student in step by step.
- To helped teacher for arranging the appropriate lessons in each unit.
- The teacher could evaluate the student's behavior before and after teaching.

In parts of the component in the manual, there were 2 ways for processing. 1st was CD-ROM which suit for the moderated of content and 2nd was textbook which appropriated for acknowledgment on the prominent role. Whether, it should be following these key:

- In the Introduction part, it should be the expression of feeling and opinion from the writer for informing the user about pros and cons of this manual.
- The component of the educational media for inspect before using.
- Instruction
- The requirement item that would apply with that educational media when using.
- Role of teachers and students when using this educational media.
- Explanation of each unit and the way for setting the learning group.
- The plan of teaching which made the user to know such concepts and the scope of the content.
- The contents of an educational media following the sequential order.
- A practice and the answer sheets for students with solutions.

If the exercise before and after learning the educational media was the same, the information should be in the manual. Thus, teachers could print a duplicate and used with students. Furthermore, after finishing the test; the answers should be provided to evaluate the students instead of having trouble with finding answers to the test again.

The main purpose of the manual was taken into consideration since the manual helped in guiding the user for the best teaching method. The following should be considered when creating a manual:

- Using a clear language for understood easily.
- Realizing about the problems and different situation thoroughly. For helping teachers to use the educational media efficiently.
- Designing with an interested visual.
- There should be some picture or cartoon for made student interested.
- The manual should has a beautiful cover and durable for user. For the body of manual, the same subject should be the same color on the manual body for easy identification.

3.4 Evaluate the interactive media

After the media had been designed and used as the teaching source, it should be tabulated. It is the measurement of the efficiency of the media, whether it is worthwhile for education or not, is the duration too short or long? Tabulation is needed for further development of the media. Interviewing and observation of students were conducted to define the efficiency of the media.

3.4.1 There are three ways to evaluate

1. Evaluation of the teaching process - whether the goal has been achieved or not, from both the delivers and the receivers of the media. The evaluation can take place before, during, and after the teaching.

2. Evaluation of the successfulness of the students - depends on the goal set whether how much should be delivered. The evaluation can be through quizzes, asking questions, or from students' assignments.

3. Evaluation of the media and the delivery process - by having the receivers criticize and give suggestions on the media used and the teaching techniques, whether they are appropriate or not

3.4.2 How to evaluate learning and teaching^[18]

The department of Non-Formal Education (1995:170), guidelines for how to assess the quality of the media in general form as following.

1. Subjective evaluation by analyzing and evaluation from the media. This assessment used by the expert or teacher in each subject. It starts from the evaluation details of the course (Course Description) and analysis, what content should be and see the overall media. It is appropriate for each grade of student or not.

2. The initial trial (Try Out), which was divided into individual and small group

A single trial (1:1) was characteristic of an individual experiment with a teacher and student one on one. The teachers have to supervise the observation closely and write down

any problems encountered. If possible, this process should be the responsibility of the person who researches this part to receive the information directly and also faster and easier for modifying content. The purpose of this single trial or 1:1 was to determine the difficulty of the content, the correspondence between the objective, activities and media content, etc.

The small group (1:10) was a set of students about 6-10 people by observing closely by one of teacher per ten of students to evaluate the content again after adjusted from single trial, as some of the activities may not be measurable in a single experiment. It is an activity that must be done by group processes such as the interview along with the observation of behaviors.

3. The real test (Trail Run)

The actual trial (Trial Run) which is the method that brings the educational media that passed the initial test use for teaching for a semester. To ensure, that the course has a good quality in real-life situations.

The students were asked to take a pretest before using the Computer Assisted Instruction to measure their basic knowledge on these topics. The students would then again ask to take a post-test after learning from the Computer Assisted Instruction. The result was evaluated to check whether or not the students had truly understood the contents of the lesson.

4. Results and Analysis

The main purpose of this project was to produce motivating interactive educational media of appropriate technology for rural development. The major problem was the lack of interactive educational media to motivate students to pay full attention to the course content. During the information gathering week, the group members were able to gather some information from Baan Na Isan and the experts from Faculty of Education which are analyzed in this chapter. The group not only focused on the information within Baan Na Isan but also the nearby area which would make the interactive media applies to wider area.

4.1 Interview results of teachers and students from Baan Na Isan

Teachers were questioned about how much content is being taught in each grade on the topic of bio-fertilizer. The information obtained from the teachers was that students were taught 1 hour per week on bio-fertilizer following the content of the guide book. All students from grade 4 to 6 learned the same course outline of bio-fertilizer. However, the content may vary with the level of education which students need to achieve. Comparisons between chemical and bio-fertilizer were taught to the students so they knew the benefits and drawbacks of each one in a long run and students would apply the knowledge to use in their daily lifestyle or even offset the current drawbacks. By focusing mainly on the content would not really attract the attention of students, in order to turn the boring content of the lesson into an interesting detail, something attractive has to be added to the content. Ajarn Sataporn has suggested animation to be put into either the guidebook or any kind of educational media. Furthermore, the teaching style being used was also very important. Among the 3 teachers interviewed, 2 out of 3 said that they preferred students to act more than just sitting on the chairs and listening for the students could absorb the facts better.

As for the teaching style, the students were asked about the preferred teaching methods on bio-fertilizer. Certainly, the most wanted method was the practical part of the lessons where students were allowed to perform the process of bio-fertilizer by themselves with the supervision of the teacher in charge. Additionally, students were probed about how they manage the leftover of the meal that could be used in the process of making bio-fertilizer and have they ever pass on the knowledge gained from the class to their parents so they could

at least use them to improve their career depending mostly on the agricultural products. They were also questioned on how many formulae are there in making bio-fertilizer and what could



Figure 10: Teaching environment at Baan Na Isan School

they gain from learning about bio-fertilizer. The answers were that the students knew that there are 3 formulae in making bio-fertilizer and they knew the benefits of bio-fertilizer as well. At the same time, these questions could measure their basic knowledge on the content and determine how much they really know about bio-fertilizer.

Initially, the group presumed that the students in grade 4-6 did not know much or did not know at all about bio-fertilizer and its use. Surprisingly, the predicted results seem to be the opposite way. The students knew almost everything based on the content they should have known. Therefore, after the data was collected, it could be conclude that the students in grade 6 know how to apply the use of bio-fertilizer better than grade 4 and grade 5. A lot more information has to be changed along with the changing information obtained. Moving on to the step would be almost impossible for the group if not for the collected data.

4.2 Interview results of an educational expert at the Faculty of Education

In order to address the 2nd objective “Discover the student’s attitude and interest”, we interviewed three teachers from Baan Na Isan School and for additional information; we also interview 2 experts who has more or less teaching experience. The scope of the interview for teachers at Baan Na Isan School was focused on the teaching style and student’s attitude on each style. Merely, the scope of the interview for the expert was focused on how to apply CAI in the classroom and its influence on students.

First of all, we assumed that CAI could use for teaching and it could motivate student to follow the whole content in the classroom. Nevertheless, the result from interviewing the teachers was that the students prefer to perform an experiment. It could be determined that

the student prefer “Learning by doing”. The teachers also said “The students would be more excited and tend to be active when they get to do some experiment.”

Furthermore, the result after we interviewed the experts was “Learning by Doing”. They said that teachers can use CAI as part of the whole content which is introductory part for motivating the students by using some animation (cartoon) or some interested



Figure 11: Learning by doing

context in the media. The experts that the teachers should add part of performance in the teaching style to make students understand the contents efficiently. Thus, students could use knowledge from “Learning by Doing” style to apply in their life or think forward beyond it.

As a result of conducting personal interview with Aj. Pimpun who has been teaching for more than ten years, we found out that the students in different school somehow had different level of education on certain topics. Therefore, we carefully design the content of our interactive media so that most of the students would be able to catch up and learn most from the media. Games and activities were included to motivate the students to work in groups of 4-6 students and compete with each other in the process of learning according to Aj.Pimpun suggestion. “Learning by doing” is another concept that was implemented into developing the interactive media because students would learn with better understanding if they were to perform and think by themselves.

As to illustrate, the mini lab should be performed by the students while learning via Computer Assisted Instruction. Therefore, Computer Assisted Instruction would act as a summary and review the contents taught via mini lab. Information that we obtained from the personal interview was very useful because we discovered that the smartest students could learn the lessons by using interactive media in 20 minutes but most of the students could not concentrate on the lessons more than 30 minutes. The students at this age had a short concentration skill so the suitable range of the interactive media should be around 20 to 30 minutes.

To collect the data on the basic knowledge about the concept and about the background of the students, focus group were interviewed at Baan Na Isan School on December 19, 2010. The focus group provided us with thought and opinion from different specialists such as teachers, school principal, and students. The information obtained was used to apply in creating the interactive educational media. According to the teachers, the students at Baan Na Isan School had a basic knowledge of using the existed resources but they were not fully understood the entire chemical processes and the purpose of doing. Consequently, interactive media was created including all the needed information that is most beneficial to the students. Moreover, this media would be as assistance to the teachers to aid their teaching and students would gain a thorough understanding of the concept.

To discover the students' attitude we observed a class with the students at Baan Na Isan, and realized that the students were more likely to be interested and engaged in the activities and games that the teachers provided. Students were more enthusiastic in study if they were able to take part in the lesson not only sat down in the class and listen to the lecture. As a result, we decided to create the interactive media that contained attractive animation with colorful cartoons, drawings, and include game or test so that the students were able to participate.

4.3 PowerPoint as an interactive media

For the detailed of creating the Computer Assisted Instruction, we used storyboard and Microsoft PowerPoint as a sequence of steps. First of all, the storyboard was used to outline the important contents that should be included in the interactive media. Microsoft PowerPoint was used as a program to combine text, presentation, and animation that were created in a different program. Furthermore, the usability test was created by Microsoft PowerPoint to evaluate the students' performance after learning via mini lab and Computer Assisted Instruction.

The students in grade 4-6 understood the contents better than what has been expected. As a result, the story board had to be revised and corrected. After prioritizing the work on the contents, detailed description was provided so that other people would also understand the concepts. In order to attract the students' attention; besides, the interactive educational media and the manual had been created in bilingual so that it can be shared to every school.

Designing an interesting content while maintained the quality of the contents is very challenging.

Due to the time limitation, the idea of implementing a combination of flash and HTML as an interactive media was a challenging task. Therefore, interactive PowerPoint was designed and developed instead.

4.4 Questionnaire results on students

During the trip to Baan Na Isan on February 6-8, 2011; the questionnaires were being distributed to five students per each grad 4-6. Each student answers the questions on their own way. The results were analyzed showing that most of the students find difficulties in

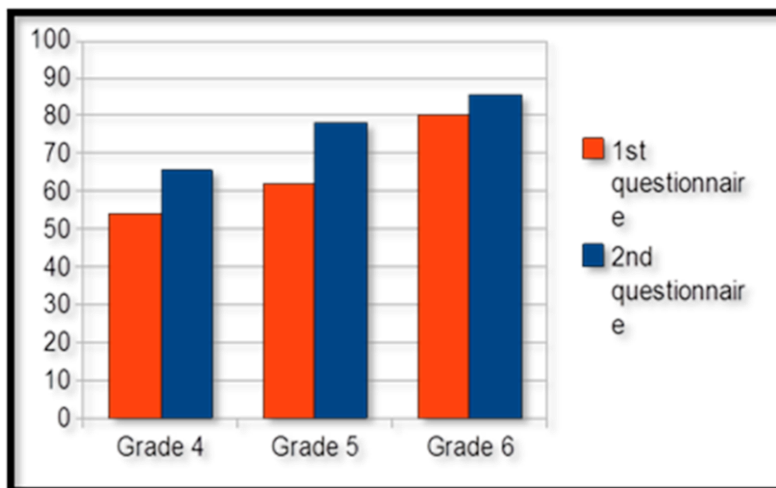


Figure 12: Results from 1st and 2nd sets of questionnaires

reading the questions. The average score for grade 4, grade 5 and grade 6 are 54%, 62% and 80% respectively. At the same time, the students did not do well in the written part of the questionnaires. Some students were not able to distinguish between the different types of bio-fertilizer processes.

Consequently, the questions were rewritten making it more understandable to the students in these ages. Thus the students were given the second set of questionnaires. This result portrayed a big improvement in which the average score for grade 4, grade 5 and grade 6 are 65.7%, 78.29% and 86.00% respectively.

4.4.1 Direct observation of a class

Our group did a direct observation of grade 6 students in bio-fertilizer class. The teaching styles were questions and answers, asking for students' opinion by calling their names, and introduce a situation that happens in real life. For the introductory part, the teacher conducted the lesson through lecturing on the blackboard, while the students take down notes; this is called "Teacher center". Later on, the teacher asked the student to watch

the process of making bio-fertilizer and allowed some students to do the experiment for a better understanding which is called “learning by doing.”

The processes of direct observation method are composed of

- a. *Make direct observation plan:* Our direct observation plans were to observe the attitude of students and interrelationships with other students after learning lessons from Computer Assisted Instruction, the performance on test program, interrelationships with other students and the ability to make use of the message delivered accordingly.
- b. *Follow plan:* We would inform the students about the plans and work corporately with them so that we could follow the plans accordingly.
- c. *Report:* We would take notes of important details regarding activities observed in order to adjust and make an improvement to our interactive media.
- d. *Interview:* After the students at Baan Na Yao School finished watching Computer Assisted Instruction, we prepared to interview students and obtain additional information from them. In addition, we decided to ask some students to clarify which points they do not understand and to explain what other information that should be included.

4.4.2 Survey the teachers

The survey would be done by giving the questionnaire to the teachers at Baan Na Yao School to evaluate whether the content of the Computer Assisted Instruction covered all the information that the students need to know or not. Additional revision will be made if the content is insufficient.

4.4.3 Create a usability test for program

The students were asked to take a pretest before using the Computer Assisted Instruction to see how their basic knowledge on these topics. The students would then again ask to take a posttest after learning from the Computer Assisted Instruction. The result was evaluated to check whether or not the students had truly understood the contents of the instructions.

4.5 Feedback after using CAI

After the educational media was completely implemented, four students of each grade from Baan Na Isan School were chosen to use the software. The group members observed each student's response while they were using the program. Accordingly, the teacher also used the educational software and commented on some slides.

4.5.1 Response from students



Figure 13: Spreading microorganisms' method in CAI boys were interested and showed great enthusiasm during slide 2, where hospital appears and ambulances moves in with the sound effect. It was proven that all students had a better understanding after using the educational media; since they were able to explain what each slides represented. The students also realized the drawbacks of using chemical fertilizers. Two out of four students said “Chemical fertilizers can cause damage to the soil and can cause health problem.”

Students from grade five enjoyed the CAI. The students looked very happy and cheerful; they said that they were able to gain more knowledge about the Bio-fertilizer while learning at the same time. Regarding the content of the CAI, a student stated that she could learn lots of things about Bio-fertilizer through the use of CAI.



Figure 14: Process of making biofertilizer in CAI

Most of them love the process of making Bio-fertilizer in the CAI as it helps understanding of how to make Bio-fertilizer easier. They discovered the consequences of using chemical fertilizer such as damaging soil via CAI. From the response of the students, they said that they could save money by making and using Bio-fertilizer instead of chemical fertilizer. After knowing the benefits of Bio-fertilizer and consequences of chemical fertilizer, the students said that they started to dislike chemical fertilizer. As for the features of the CAI, most students like the cartoons characters, animals such as pig, rabbit and bees and plants used in the CAI.



Figure 15: Features in CAI

They also like the sound effects of the CAI like the siren of the ambulance from “the consequences of chemical fertilizer” slide and the birds’ chirping in the forest from “the finding of micro-organism in the forest” slide. However, a student said that there was too much chirping of the birds, it was quite irritated for her. Last but not least, most students found the narrators’ voice soothing.

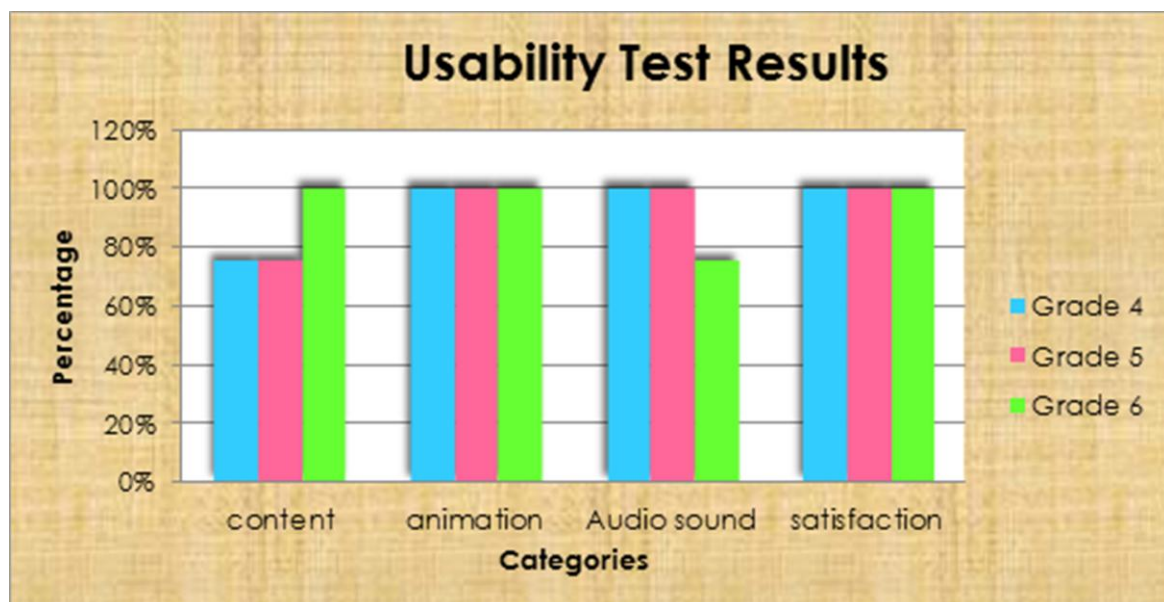


Figure 16: Usability Test Results

Three out of four students from grade six were interested in CAI software than the lecture in class. The results from the post-test showed that the students’ comprehension on

the content has greatly improved. All four students preferred the animation features such as sound effects, animated cartoon characters and moving objects in the educational media. Moreover, most of the girls preferred the cute cartoon on CAI such as the little birds, growing flowers, moving trees and working nurses. Furthermore, after the students learned from CAI one student stated that “I like bio-fertilizer because it does not cause damage to the soil like what chemical-fertilizer does”. The answer was reasonably surprising to us since it determined that the students understood the content very clearly and was able to make a comparison between chemical-fertilizer and bio-fertilizer.

4.3 Suggestions from the teacher

Aj. Sataporn, the teacher of Baan Na Isan School gave some comments about the CAI. He said that the CAI was a good media for the students and these could be a new innovation for the teaching industry in other rural areas. He gave some comments on what to improve for CAI such as the suitable words to use, content of the Bio-fertilizer to emphasize on and the level of difficulty of the post exercise. He also added that with the help of CAI, students would pay more attention in the lesson. It would help them understand the lesson more easily as well. Generally, compliments from both the teacher and students were given for the CAI.

5. Conclusions and Recommendations

After gathering enough information and using the data for implementing interactive educational media, the group defined certain recommendations based on the observations and results obtained from our case study. More research needs to be done before mass production of educational media to other schools in remote areas.

5.1 Science education in rural areas

In order to improve the science education of the students in rural areas, educational media using Computer Assisted Instruction was created for Baan Na Isan School especially in the science field; the content was based on the topic of bio-fertilizer. By creating CAI, the combination of local wisdoms and modern technology has improved the community living standard and local economy. Besides, this project was designed to encourage the well-being of students and raise awareness about science education.

5.2 Alternative methods in implementing educational media

From the data, it was determined that “Learning by doing” is the approach preferred by most students. Accordingly; Educational media through the use of PowerPoint was created for the Baan Na Isan School to attract the students’ attention while learning. Several alternatives are available to meet these necessities.

5.2.1 Flash design

One possible alternative for producing interactive educational media is the use of Flash design. Adobe Flash development allows for the creation of a wide range of interactive media applications and interactive media presentations. With the advantages of Flash program, it could transform movement of objects and create attractive animation that can draw the audiences’ attention.

5.2.2 HTML (HyperText Markup Language)

HTML is another program that can be used to create interactive educational media. HTML was widely used which was supported by almost every browser. Moreover, the

webpage can be used in rural areas where internet cannot be accessed. HTML webpage was the main element in creating all websites. HTML is able combine both context and images in order to create a collaborating form of media.

5.2.3 Game Maker

Game makers can be used to create computer games for children without much difficulty by just dragging and dropping actions which requires only a little time. This program allows the user to create a professional game to one's desires while making the games fun and educational. Desired backgrounds, animations, sound effects and 3 dimensional shapes can be put into the games. Besides, it can be downloaded and use for free. Other than that, one can sell the games made by if they want to.

After using the interactive educational media, most of the students were able to get higher score on the post-test compared to that of the pre-test. This proved that the students were more interested which led them to a better understanding of the content and that the content of CAI was sufficient to educate the students on the topic of Bio-fertilizer. However, they got confused in one specific question asking which of the following ingredients are needed to make bio-fertilizer. Some students understood that things that can be composed could be used to make bio-fertilizer.

5.3 Learning by Doing

“Learning by doing” is proven to be the best approach preferred by both teachers and students. The students at Baan Na Isan showed great enthusiasm in the educational media, CAI. They were able to be involved and participate interactively in the activities through trial and error.

5.3.1 Mini lab

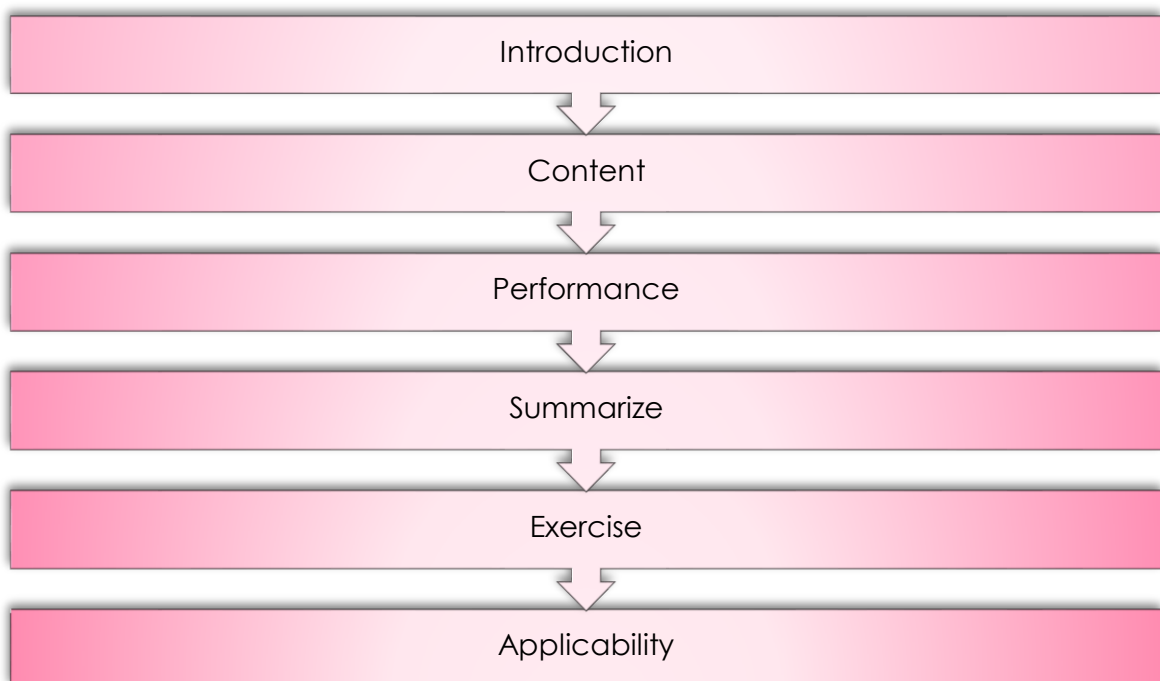
Ajarn pimpun, a teacher from the faculty of education who had 10 years of experience in teaching suggested that the CAI should act as an introduction of bio-fertilizer. When it reached the process of making bio-fertilizer, the CAI would pause and that was where a mini lab came into the learning by doing process. The small samples of the actual materials for making bio-fertilizer were prepared. After that, the students were then allowed to make their bio-fertilizer. Finally, CAI would sum up everything on bio-fertilizer including exercise.

5.3.2 Interactive PowerPoint

Interactive PowerPoint could be as effective and attractive as Flash or HTML program and still maintained the concept of learning by doing. This approach allowed the students to lead the flow of the program according to their desire. In the process of designing PowerPoint, the functions are not difficult to cope with comparing to Flash and HTML. Nevertheless, the program produced outstanding result combining all factors needed to create an interactive educational media.

Interactive PowerPoint contained extraordinary features incorporating texts, sounds and objects to create animation which attract the audiences. Since there were moving objects in every slide, hence the students tend to focus on the animations otherwise they lose track on what was happening.

5.3.3 Recommendation on the process of teaching using CAI



From the introduction part of the course content, teachers usually started the lesson with question relating to the course topic. In this step, students were engaged by the question/answer which forced them to pay more attention in class. Moreover, the realistic situation in daily life was example to make the students understand the content easier. Thus, it made the students think orderly in a logical way.

“Teacher center” a technique used in the content part. It was about teacher’s explanation, lecture, etc. In this step, students have learnt a lot in content. Thus, teacher has to provide the other educational media (like some of image, video visual, games) for stimulated them to be excited and make the to be more interested on content. Furthermore, inviting the expert to teach the student was another alternative to made student more understanding on content.

After students knew content or process, they had to do performance or experiment, which made them to learned and had more understanding the whole content (Learning by Doing). Furthermore, student had to learn more than knowledge from this step. They learned about social skill such as leadership, team performance skill, communicative skill which all of these allow them to adapt themselves to the environment they lived in.

In part of conclusion, CAI was used to summarize the whole content, which recognized students again about the content. Moreover, when students used CAI by self-learning process. Students had opportunity to learn and express their idea to do experiment (Learning by doing) in CAI, which was interactive educational media for them.

For practicing, teacher gave some challenge to student such as exercise for revising the lesson, holding the competition between students in each class, which made students to be more discovering knowledge for their best result.

Finally, applicable on what they learn/what they understand to day life was very important for student. Thus, the forward step like project, exhibition, and talent were significant for students which done by their knowledge and their ability. Nevertheless, all of these elements develop student forward to beyond in the future.

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Appendix A: Historical and geographical context of Baan Na Isan Border Patrol Police School (primary school)

In the past, there was no school in Na Isan village and the nearest one was Ban Na Yao border patrol police school which was six kilometers away. In order to educate the children in the village, the villagers helped each other to build the temporary buildings and hire teachers to teach the children. However, it was quite difficult for the villagers to support the school in a long run.

Therefore, when H.R.H. Princess Maha Chakri Sirindhorn paid a royal visit to the school to see the development of the school, HRH learnt the problems faced by the villagers including educational service. Hence, so as to support the educational service for Na Isan village, HRH has initiated the establishment of Ban Na Isan Border Patrol Police School under the supervision of the border patrol police headquarter at Na Isan village.

The school was established in the year 1994 and is under the supervision of border patrol police headquarters, Royal Thai Police. It is situated in Ban Na Isan, Thakradan sub-district, Snamchaikhet district, Chachoengsao province which used to be forest with the area of 16 acre. Presently, there are one hundred and forty eight households in the area. After the Initiated establishment the school has the following facilities:

1. A learning building
2. A multi-purpose building
3. 1 residence for the teachers
4. First- aid room and shops
5. A library
6. An agricultural tools storage room
7. Chicken raising house
8. Underground water, 2 latrines

The school provides basic education from grade 1-6 following the Basic Education Core Curriculum B.E. 2551 (A.D. 2008). The Basic education Core Curriculum has prescribed the following eight learning areas:

1. Thai language
2. Mathematics

3. Science
4. Social Studies, Religion and Culture
5. Health and Physical Education
6. Arts
7. Occupations Technology
8. Foreign Languages

There are 10 teachers consisting of 8 border patrol police teachers and 2 teachers who are mainly polices and farmers.

An academic year is divided into two semesters as followed:

Table 2.1 Academic year period

1 st semester	May-October
2 nd semester	November-March

Table 2.2 Enrolment of students in year 2009

<u>Grade</u>	<u>Numbers of students</u>
Grade 1	18
Grade 2	22
Grade 3	20
Grade 4	23
Grade 5	13
Grade 6	16

Appendix B: Types of teaching methods

Types of principles and approaches used for instruction are defined as teaching methods. Generally, there are many types of teaching methods. Some of the teaching methods being used today are class participation, demonstration, recitation and memorization. Different teaching methods are being applied into use depending on the information and skill of the teacher who is trying to convey the message. As well as considering the background knowledge of the students, environment and learning goals. When a teacher is deciding on their method, they need to be flexible and willing to adjust their style according to the students as students have different ways of absorbing information. Students' success in the classroom is largely based on the effective teaching methods.

Teachers could also use a combination of techniques to help students in having better understanding. For example, including questioning into the lessons to collect information of what the students have learnt and what need to be taught. It is also very important to include auditory, visual and kinesthetic as much as possible into the lessons. Below are the main types of teaching methods.

Explaining

Explaining is similar to lecturing whereby lecturing is taught by giving a speech on a specific topic that is open to the public, normally conducted in the classroom. This method can be improved by adding visual aid such as modeling, overheads and slides show to help the students visualize of what was being taught. This method is a preferable method for auditory learner through speech.

Demonstrating

Demonstrations are done to provide an opportunity to learn new information and visual learning from a different angle. A teacher may use an experiment to demonstrate ideas in a science class. A demonstration could be used in the condition of proving conclusively a fact such as reasoning or showing evidence.

Collaborating

Another way a teacher can direct lesson is to have the students work in groups. Collaborating allows students to talk with each other and listen to all points of view in the discussion. It helps students think in a less negative way. When this lesson plan is carried out, the teacher may be trying to assess the lesson by looking at the student's ability to work as a team, leadership skills, or presentation abilities.

Collaborating (kinesthetic) is great because it allows active participation in the learning process. The students who learn best this way are able to relate to the lesson in the way that they are physically taking part of it in some way. Group projects and discussions are a great way to welcome this type of learning.

Learning by teaching

Having peer tutorial sections of the class as a group or as individuals is a great way to get the students to really study out the topic. Hence, they would understand it and be able to explain it to their peers. This method is somehow effective when being done correctly. By having them participate in the teaching process it also help builds self-confidence, self-efficacy, and strengthens one's speaking and communication skills. Students will not only learn their given topic but they will gain experience that could be very valuable for life as well.

Appendix C: Elements of multimedia in education

Interactive media is the integration of digital media including combinations of electronic text, graphics, moving images, and sound, into a structured digital computerized environment that allows people to interact with the data for appropriate purposes.^[3] Different types of interactive media include websites, PowerPoint presentations, flash websites, and product demonstrations. Interactive media permits the exchange of thoughts and opinions by means of most appropriate demonstration and communication media. The goal is to deliver an empowering situation where multimedia may be used anytime and anywhere. The technologies used must remain clear to the end user. Elements used in multimedia involve: text, sound, video, animation and graphics. These components must be combined in order to create a powerful innovative educational tool as well as for learning to take place.

Text: has the most impact on the quality of the software interaction. Normally, text provides the important information and acts as the foundation tying all of the other media elements together. It is well written text that makes a multimedia communication wonderful.

Sound: used to provide emphasis or highlight a transition from one page to another. Sometimes sound is implemented to elucidate visual display of a complex image so that the audiences get a better understanding of the situation. The advantage of this approach is that it can be stopped and started very easily.

Video: The use of video to convey information by using visualization capabilities can be instant and persuasive. There are many occasions where students find difficulties when facing with a scenario that seems extremely complicated when expressed in only text form. Thus, video help portrays a theoretical concept into a more comprehensible context. Video is occasionally used to give illustrations of issues discussed in the text.

Animation: used to elucidate variations in state over time, as well as to portray the material slowly to students so they have time to integrate information in smaller portions. Animations, when combined with user input, enable students to view different versions of change over time depending on different variables. Animations are predominantly used to exhibit an indication or clarify a theory.

Graphics: the art of using design elements to convey information or create an effect. Graphic designs consist of photographs, drawings, graphs from database, or pictures from CD-ROM, including hand-drawn work.

Impact of interactive media in education

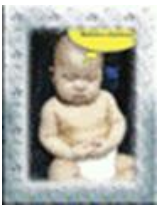
The utilization of multimedia within the education sector has become more common in recent years. Because of the excitement from animations and interactive media, the contents become more interesting; as a result, the students are more engaged to the lessons. Also, the interaction between students and contents which require immediate reaction from the students will help create a better learning environment and help the students understand the lesson easier and more throughout. The interactive media used in education field usually come in the form of computer-based training courses (CBTs) or computer-assisted instruction (CAI) which basically is a series of contents in computer; computer program, presentation, sound, graphic, animation, etc. One of the biggest advantages of CBTs or CAI is that the media can be easily distributed and used at anywhere and anytime, thus, developing CBTs or CAI will give the opportunities to all students to have the same quality of study material as well as the ability for the students to be able to access the lesson at any time which will encourage self-education mind of the students. Since all of the contents can be stored and distributed using CD-ROM, Internet, or other types of storage; the cost of producing hard copies and distribution can be greatly reduce and become more environmental friendly.

Appendix D: Characteristics of Good Design

1. Design should suit the purpose of usage.
2. Design should be easy to understand
3. Design Should be proportional with the use of media
4. Design should blend in with the equipment used and its environment.

Fundamental design of educational media

1. The goal of teaching and learning determine the behavior of the learners.



In general, the behaviors of learning are categorized into three types as follows:

1.1 **Cognitive Domain:** Behaviors that show the intellectual knowledge of the subject which describe the synthetic or analytical problems associated with the content and solve them.



1.2 **Psychomotor Domain:** The behavior of the physical movements of the body and the swiftness in solving problem.



1.3 **Affective Domain:** A behavior that indicates emotional feelings towards what they learn and their environment.

2. Characteristics of learners.

The content and details of a particular type of media would vary along with age and basic knowledge of the learners. However, in reality every individual student is different from one another. Therefore, in practical the characteristics of learners are used as the primary aspect in considering a media. If necessary, the consideration of media would be specifically for students in a special group.

3. Characteristics of environment in producing media.

A. Style of learning activities. The teacher may have several forms such as

- Teaching a large group, in the form of lectures and demonstrations.

- Teaching small groups.
- Individual tutoring.

Teaching and learning activities rely on many types of media such as media slide Films which is an appropriate learning styles using a large group of video images while medium group of video images for teaching small groups. The media must be unique in the way that it allows children to learn and do self-evaluation

B. Facilities used in the media such as electricity which is an essential element in the designing of media for schools. Schools without electricity should avoid the use of electrical media.

C. Local material which is easy to find and will also help students realize the relationship of what they learn in real-life.

4. The appearance of media. It's important that manufacturers must have the knowledge about the media in the following topics:

A. Unique characteristic of each media. Some media types are appropriate for some student of a certain level or the number of students at the different levels. For example, radio which is suitable for large population.

B. Standard size of media. Although the exact numbers is not determined yet however, the approximate number can be used as the basis for media production.

As for the screening materials, must be prepared and ready to minimize problem during filming. The determination of the original includes three main factors as the following.

- Drawing and writing letters with ease.
- Easy Storage of the original
- Ratio of width to length according to the type of screening material.

In consideration of choosing teaching media, teacher should know the suitability of each educational media.

1. Suitability: media used should be fitting with the content and the purpose of teaching.
2. Correctness: media used should provide the accurate conclusion.
3. Understanding: media used should make the learners think reasonably.
4. Experience: media used should help learners increase their experience.
5. Age fitting: difficulty level of the content in the media used should fit the capabilities and
the desire of the learners.
6. Accuracy of the content: is the media used capable of transferring the accurate content.
7. Function: media used should enhance learning performance of the learners.
8. Worth the cost: is the result worth the time, the price and the preparation.
9. Satisfaction: media used make learners engage in the teachings according to the teachers' demand.
10. Interesting: media used should attract learners' attention for long enough.

Appendix E: The tenth national economic and social development plan (2007-2011)

Education Policy

1. Invest in raising the quality of the entire educational system, to address the development of teachers, curricula, instructional media and information technology; improve the quality and knowledge of students in accordance with educational plans, available resources and surrounding factors; create a system of life-long learning for Thai people; and establish Thailand as a regional educational hub.
2. Ensure that every Thai citizen has access to no fewer than 12 years of basic education, free of charge, with attention focused on reaching the disadvantaged, the disabled and those living in difficult circumstance; increase access to further education through student loan schemes, linked to policy concerning the production of knowledgeable and capable graduates; and provide supplementary scholarships for both domestic and overseas education.
3. Adjust teacher training and development to ensure quality and high moral standards among teachers, while guaranteeing teachers appropriate remuneration and welfare for a good quality of life; develop and modernize curricula and instructional media in line with global changes; promote studies in Thai language and history to instill a sense of Thainess; expand the role of creative learning systems through organizations such as the Office of Knowledge Management and Development, the development of a modern library system, and the establishment of new learning environments including knowledge parks, a National Discovery Museum Institute, the Thailand Creative and Design Centre, a centre for the development of sports, music and arts, and a centre for the treatment and development of autistic persons, children with attention deficit disorder and other disadvantaged individuals.
4. Promote the intensive use of information technology to enhance learning efficiency; ensure access to the necessary infrastructure, technologies and software to complement learning; give particular attention to the development of foreign language learning.

5. Develop the quality and standard of higher education institutions to guarantee a high level of academic and professional services, to achieve excellence in research and innovation, and produce and develop a workforce that corresponds to structural changes within the manufacturing and services sector; accelerate the development of high quality workforce with clear career paths to enhance the country's competitiveness in various sectors such as petrochemicals, software, food, textiles, health, tourism and logistics management; provide occupational and professional competence certification; and continue the expansion of the role of the Fix It Centre at the community level.

6. Promote and adjust regulations to support the decentralization of educational administration and management to district education offices and academic institutions; encourage the involvement of private sector in educational management; build the capacity of local administrations to prepare them for the transfer of responsibility and to ensure the required quality standards are met.

7. Coordinate all aspects of educational management through the different stages of the planning cycle, including identification, planning, supervision, monitoring and evaluation, making effective use of evaluation outcomes to review and adjust existing strategies, and to develop appropriate, new strategies.