Developing a Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process

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Abstract

This research aimed to develop and examine effectiveness of a teacher training program in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process. The curricular development process consisted of these 4 stages: 1) Examination of basic data was preparation of basic data involving conditions of problems and needs of trainees and involved people. The data were used for determining components of the teacher training program in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process to be appropriately congruent with conditions of trainees. 2) Drafting program was the use of basic data for making the draft of the teacher training program in creating innovations for multimedia computer the courseware with an emphasis on the analytical thinking process in order to use the obtained data for revising the program draft to be more complete. 3) Checking program effectiveness was a try-out of the program to examine feasibility of the program. The focus group consist of teachers at 1 school under the Office of Roi Et Educational Service Area Zone 1 in the second semester of the academic year 2009, obtained using the purposive sampling technique. The training duration lasted for 9 weeks or 45 hours. 4) Program evaluation and revision were the use of the obtained data from the program try-out for improving the program to have more completeness. The instruments used for evaluation were a test of analytical thinking knowledge, an evaluation from on ability to design multimedia computer courseware, an evaluation form on ability to construct innovations, an evaluation form on innovation quality, and an evaluation form on teacher’s satisfaction with the training program. The collected data were analyzed by comparing mean scores before and after training, calculating for an effectiveness index, and finding out mean and percentage. The research results could be concluded that this program was effective and every item passed the established requirement. Thus we could be confident that it could be applied to training teachers at different educational institutions in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process.

Keywords: Creating innovation, multimedia computer courseware with an emphasis on the analytical thinking process
1. Introduction
Basic Education Core Curriculum B.E. 2551 has the major purpose for learners to achieve these 5 competencies: communicating ability, thinking ability, problem-solving ability, life skill using ability, and technology utilizing ability (The Ministry of Education. 2008 : 3-5). However, the result of evaluating education quality as a whole throughout the country revealed that learners could not yet meet the standards of thinking ability (The Office of National Education Standards and Quality Assurance. 2007: 24). This can reflect that organization of learning and teaching from the past has not yet been successful in developing learners to achieve learning standards and thinking ability.

For efficient development of learners’ thinking ability, it is necessary to create basic thinking skills and there should be training for learners to have suspecting skills and raising questions. The skills which need training include skills in: observing, listening, summarizing, and linking. These are parts of the analytical thinking process (Suwat Wiwatthananon. 2007 : 59). Analytical thinking is an important basic skill. It is thinking at the basic level which is necessary for everyone and it is basic for thinking in other dimensions such as comparative thinking, creative thinking, futuristic thinking and integrated thinking. Analytical thinking can help us know facts, know primary reasons of what have happened, understand the backgrounds of events, understand the components and details of different things, obtain facts which are basics of knowledge to be used for solving problems and decision-making on different matters correctly (Kriangsak Charoenwongsak. 2003 : 1-2). Besides analytical thinking being the basic of advanced thinking, it is the basic for learners to increase their own learning achievement. As it can be seen from the research results of The McREL Institute led by Marzano who conducted a research study of the teaching techniques which teachers could implement from the kindergarten level to grade 12 by using meta-analysis. The result of the study can by summarized that the teaching techniques with high effects on learning achievement of the students are in this order according to the size of effect: 1) identifying similarities and differences, 2) summarization and taking-short-notes, 3) reinforcement of efforts and acceptance, 4) homework and practices, 5) non-verbal communication, 6) collaborative learning, 7) determining purposes and feedback, 8) setting up hypotheses and testing hypotheses, and 9) questions, clues, and the structure of thinking before learning and teaching (Marzano, Pickering, and Pollock. 2004 : 15-18). Most of these teaching techniques used the analytical thinking process, then causing learners to learn efficiently.

From the significance of analytical thinking, it is essential to develop learners’ analytical thinking skill in continuity. The persons who have an important role in developing learners are teachers. If teachers lack knowledge and clear understanding of the analytical thinking process, lack self-confidence, lack support and promotion from their administrators, and lack good modeling of thinking, they will be able to affect their students’ thinking levels (Thatssana Saemmani. 2003 : 52-53 ; Smith. 1992 : 124). Therefore, in developing learners in terms of thinking, it is necessary to begin with developing teachers to understand the method of thinking, making teachers able to think and able to organize activities for learner development in ability to think. The development of the thinking process and the learning process of learners needs to be relying on adequately potential instruments for stimulating learners to be interested and enthusiastic about thinking. Thus utilization of computer technology in learning and teaching will be able to generate learners’ more intellectual development than other technologies which can only present contents. This is because computer is an instrument which helps learners be able to give instructions to it to work and to determine the direction of learning by themselves (Nopphanet Thambowon. 2006 : 49). Multimedia computer is necessary for teachers in the present age. Strengths of multimedia computer include: able to copy, cut, connect, and repeat the content again and again with the least impacts on the information quality. It can be easy to make multimedia through the computer system with a low budget; and a variety of media can be created (Faculty of Science, Rajabhat Chiang Mai University. 2009 : 5). Thus it is appropriate to promote learning of student at present and it is appropriate for teachers who need a large number of instructional media under limited budget. Currently most schools have computers, internet systems, television self, and video projectors. However, these different teaching aids have not been worth while by utilized for
developing learners because some of the problems are that teachers are not encouraged to utilize technology for organization of learning and teaching as they should be, and there is a lack of organization of training in innovations for learning-teaching organization in continuity (Somechit Butthongthim. 2006 : 82-84; Wannaphong Sirichairanai. 2002 : 122-136; and Kitsana Mansom. 2002 : 83-86).

From the conditions of problems and needs as mentioned above, the researcher developed a teacher training program in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process to help teachers understand techniques of training analytical thinking by using multimedia computer for training analytical thinking, and to be able to create innovations for multimedia computer courseware with an emphasis on the analytical thinking process. It this development of the training program, the researcher operated the training based on the job training concept, which was the method of learning together with job practice by using the job training place as the training place. This would enable trainees to increase their training ability. The mentioned method would help teachers receive development without quitting learning and teaching at school because teachers were allowed to spend their free tune, while preparing for teaching, on studying additional knowledge and job training (Jacobs. 2003 : 12; Sayan Phanit. 2005 : 30). The teachers selected the contents from their won teaching time-tables to adjust to be multimedia computer courseware emphasizing the analytical thinking process. Then the courseware was used for teaching their students according to the determined plans together with evaluation for revising the courseware to respond to more learning, interests, and thinking of learners. It could be seen that the teachers taught the contents traditionally and learned additionally about creating multimedia computer courseware with an emphasis on the analytical thinking process. They repeated training from the first courseware content to the next courseware until they were skilful and could create innovations for multimedia computer courseware emphasizing the analytical thinking process for dissemination to their work-peers and other educational personnel to utilize the created innovations in the future.

2. Research Method

2.1. Scope

The researcher determined the research scope as follows:

1. This developed Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process operated training based on the on the job training concept, aiming for teachers who received training to learn and understand the methods of developing learners in analytical thinking together with developing skills in designing multimedia computer courseware, then using creative thinking to generate ability to invent innovations from available resources and multimedia according to each educational institution potentials to develop to be multimedia computer courseware with an emphasis on the analytical thinking process.

2. The variables in the study were as below.

2.1 The independent variable was the training according to The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process.

2.2 The development variables were effects on the teachers who were trained according to The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process, consisting of the following:

2.2.1 Knowledge of analytical thinking,
2.2.2 Ability to design multimedia computer courseware,
2.2.3 Ability to create innovations,
2.2.4 Quality of innovative work, and
2.2.5 Teachers’ satisfaction with the training program.
3. The target group consisted of teachers from 1 school under the office of Roi Et Educational Service Area Zone 1 in the second semester of the academic year 2009, obtained using the purposive sampling technique based on the research purpose by using the criteria for selecting from the following supporting factors:

3.1 The Educational institution administrator provided supports to the operation according to The Teacher Training Program in Creating Innovations for multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process.

3.2 The teaching staff realized the importance, had foundation of introduction to computer use, and showed their needs for developing ability to create innovations for multimedia computer courseware with an emphasis on the analytical thinking process.

From the criteria for selecting the target group mentioned above, the researcher determined the target group of 9 teachers at Ban Si Somdet School under the Office of Roi Et Educational Service Area Zone 1 in the second semester of the academic year 2009.

4. The training process based on this Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process used the on the job training method because it was the method of developing personnel being simultaneously conducted together with developing the personnel efficiently. Also, there were good effects on teachers and students without quitting their learning and teaching for a long time while teachers were attending the training program.

5. The duration spent on training based on The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process was 9 weeks or 45 hours. The duration was considered from mean ($\bar{X}$) obtained from investigating research studies in relation to training programs and by considering from the numbers of units of contents and activities in the training programs. Details of stages of performing activities and the training model could be adjusted from the meeting for analyzing the needs and determinations of targets together among trainees according to the stages of the on the job training.

2.2. Procedure

This development research of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process consisted of 4 stages with the following details:

1. Basic data examination was the preparation of basic data involving the conditions of the problems and needs of the trainees and involved people in order to synthesize the obtained data for determining the factors of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process to be appropriate and in congruence with the level of trainees, consisting of these 3 stages: (1) studying data from documents and related literature by conducting an analysis of data according to the documentary research process. This was the collection of concepts involving The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process by using the documentary research process. This caused the researcher to discover beneficial concepts and then to use those involved concepts to synthesize to be factors of the program, consisting of purposes, contents, training activities, and training evaluation leading to determining the program structure, and improvement and development leading to details of the program. (2) studying basic data from involved people by collecting data using focus group meeting, which was the method of sharing opinions about The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process from various perspectives. There were exchanges in reasons and experiences which could provide useful details for factors of the program. Then they were used for determining details of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with
an Emphasis on the Analytical Thinking Process. (3) Evaluating teachers’ needs by conducting the evaluation using the researcher-constructed evaluation form from the data collected from documents and related literature, and studying basic data from the involved people and the detailed were used for determining the evaluation framework and constructing an instrument. Because working conditions of the focus group were different, conclusions had to be made to represent the focus group’s needs appropriately for making The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process.

2. Making a draft of the program was the use of basic data for making the draft of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis of the Analytical Thinking Process with the details consisting of the program draft, documents in supplement to the program, evaluation of the program draft, and pilot studying by the focus group of pilot studying, using 1 school under the Office of Roi Et Educational Service Area Zone 1 in the second semester of the academic year 2009. They were teachers officially permitted by their administrator to attend training based on The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process for using the obtained data to revise the program draft to be more complete.

3. Checking the program effectiveness was a try-out of the developed program to examine feasibility of the program in real practice. The focus group consisted of teachers from 1 school under the Office of Roi Et Educational Service Area Zone 1 in the second semester of the academic year 2009, obtained using the purposive sampling technique. Before training, the researcher tested knowledge of analytical thinking of the teachers in the focus group, operated training based on the program in the second semester of the academic year 2009 for 9 weeks or 45 hours. While training, trainees’ ability to design multimedia and ability to create innovations were evaluated. And after training, the researcher tested the trainees’ knowledge of analytical thinking, evaluated their innovation quality, and questioned them about their satisfaction with the training program.

4. The program evaluation and improvement aimed to consider the program effectiveness whether or not the program achieved the purposes of training. The researcher used the data obtained from the program try-out at the school of the focus group to revise the program for it to be more computer. The instruments used for evaluating the program were a 25-item 4-choice test of knowledge of analytical thinking, a performance-rating evaluation form on ability to design multimedia computer courseware with an Emphasis on the Analytical Thinking Process, interpreting the effectiveness by comparing with the criteria of the effectiveness index at .50, and calculating for mean and percentage of the evaluation scores on ability to design multimedia computer courseware, evaluation scores ability to create innovations, and calculating for mean score on evaluating the quality of innovations created by the teachers.

3. Results

1. For the results of developing The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process, the following was found:

1.1 The results of evaluating appropriateness of the draft of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process appeared that there was appropriateness as a whole at a high level. When the results of evaluating appropriateness were considered from 8 major items, it was found that one item was appropriate at the highest level: problems and needs for the program. The remaining 7 items were
appropriate at a high level. However, the researcher still improved several items according to the experts’ recommendations and observations.

1.2 For the results of evaluating congruence of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process, there appeared that the experts opined that the training program had congruence as a whole with the congruence indices ranging 0.50-1.00. Most of the items (15 items) had a congruence index of 1.00, and the other remaining items had a congruence index of .80, which were in conformity with the established requirements.

2. For the results of examining the effectiveness of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process, the following were found:

2.1 For the knowledge of analytical thinking, it appeared that the results of comparing analytical thinking knowledge mean scores between before and after training were different at the .01 level of statistical significance. When the mean scores on testing before and after training were considered, it could be summarized that the teachers who were trained according to The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process had a higher mean score on tested knowledge of analytical thinking after training than before training, and an effective index from training based on The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process was 0.52 which was higher than the established requirement.

2.2 For the ability to design multimedia computer courseware, it appeared that the teachers who were trained based on The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process had a mean score on ability to design multimedia computer courseware at 92.69 percent. When each teacher was considered, it appeared that every teacher who was trained had ability to design multimedia computer courseware which passed the 80-percent criterion.

2.3 For ability to create innovations, it appeared that the teachers who were trained based on The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process had ability to create innovations at averagely 85.19 percent. When each teacher was considered, it appeared that every teacher who was trained had ability to create innovations which passed the 80-percent criterion.

2.4 For the quality of the innovations created by these teachers, it appeared that every teacher who was trained based on The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process had the quality of innovations created by the teacher averagely at the 2.60 level. When each teacher was considered, it appeared that the teacher who was trained had the quality of the created innovations which passed the quality at the 2 level.

2.5 For the teachers’ satisfaction with the training program, it was found that the results of evaluating teachers’ satisfaction with The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process had satisfaction as a whole at a high level. When the results of evaluating satisfaction in each aspect was considered, it was found that the teachers who were trained showed their satisfaction at a high level in every aspect.
4. Discussion

The results of the research and development of The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process could be discussed and classified according to the research purposes as follows:

1. The results of developing The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process showed appropriateness as a whole at a high level, and the congruence index was in conformity with the established requirements. All these resulted from having the process of systematic treatment and development in the parts of program outline, media, plans for organization of training, and instruments for collecting data. Additionally, strengths included: there were activities for learning sharing from experiences of their own and their peers in the aspects of knowledge, and experiences in organization of learning and teaching, brainstorming, focus group discussion, reflection of ideas from performance, and participation in determining guidelines for practice. Moreover, the training method did not only emphasize principles and theories but also gave the importance to applications and implementation of knowledge. These could cause trainees to review and learn more from job performance. Significant issues included: learning through real practice could cause teachers to see guidelines and to generate learning more in the same way as the concept which says that a good training program must create learning motivation by providing useful knowledge; content presentation must be appropriate; and training topics must be clear, can be implemented in job practice; and there must be evaluation and follow-ups in continuity (Nirachara Thongthammachat. 2000 : 83-95). This is also in accordance with the basic principles of organization of training adults to learn well. There must be a needs assessment, creation of safety climate, creation of good relationships between trainers and trainees, creation work performance, and reflection of learning by doing. There must be creation of clear roles, teamwork learning by breaking into small groups to generate help with one another and generate a feeling of safety in the type of helping each other as well as help create commitment between trainees and engagement learning (Vella. 1994 : 3-22). Furthermore, it is in congruence with the process of training program development which states that there must be an analysis for needs and wants for determining rationale, purposes, job analysis, topic determination, determining principles/theories of learning, determining the method of training, research duration, and methods of follow-ups (Somchat Kityanyong. 2001 : 45). It can be concluded that for the concepts involving the training principles to be successful, there should be consideration of needs for development or wants for changing knowledge, thoughts, attitudes, and skills through the process of knowledge giving and practice with the concepts of learning theories, acceptance and participation of trainees. There must be clear evaluation and follow-ups for improving factors of training. In developing The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process was conducted based on the process of systematic program development. Thus the appropriate program was obtained as a whole at a high level, and the congruence index was in conformity with the established requirements.

2. This developed Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process could help the trained teachers gain higher knowledge of analytical thinking than before training, have ability to design multimedia computer courseware at averagely 92.59 percent, have ability to create innovations at averagely 85.19 percent, have quality of innovations created by the teachers at averagely the 2.60 level which was at the level of passing the criteria, and have teachers’ satisfaction with the training program as a whole at a high level which was in conformity with the established effectiveness requirement in every item. This is in accordance with Kesarin Manunphon (2001 : 75-158) who conducted a study of the development of teacher training
program for promoting competency in making experience development textbooks which are in accordance with local circumstances. The program development was conducted in the type of research and development comprising these 4 stages: 1) examining basic to be used for planning to construct the program, 2) constructing the program, 3) trying out the program, and 4) evaluating the program. The results of evaluating the program revealed that the program could be efficiently implemented; and training achievement after training increased significantly. Also, it is in congruence with Wichian Intharasomphan (2003 : 84-106). He conducted a study of the development of a training program for enhancing competency in integration of ethics into the Basic Education Curriculum for secondary school teachers. In development Intharasomphan divides his study into 4 stages: Stage 1 was an examination of basic data. Stage 2 was construction of the curriculum. Stage 3 was the try-out of the curriculum. Stage 4 was evaluation and improvement of the curriculum. The results of his study revealed that the competency in integration of ethics into the curriculum after trying out the curriculum was higher than before trying out the curriculum at the .01 level of statistical significance. A mean score on knowledge and understanding was more efficient than the requirement of 70. Mean scores on attitudes and job practice skills were higher than 3.50. A mean score on works of integrating ethics into the curriculum was at a good level. Finally, appropriateness of the curriculum from trying it out was at a high level.

The results of investigating effectiveness of The Teacher Training Program in Creating Innovations for Multimedia computer Courseware with an Emphasis on the Analytical Thinking Process were in conformity with the established effectiveness requirements in every item. This may be because this developed training program relies on the training process while on the job training. It caused the trainees to learn simultaneously with job performance which was the learning with goals. Thus the trainees could realize benefits of learning new contents which could provide good effects on job performance. Moreover, these trainees participated in the training process because it was the training with an emphasis on action. They had learning sharing, reflected their own learning outcome and actual practices reflection of learning achievement and actual action, causing trainees to pass the problem-solving process which generated from training and actual work. Their works from training could lead to actual practices in the classroom. The effectiveness as mentioned was the effect from the use of the concept and principle of being on the job training. It was training in their won duties which they were doing. They were trained directly in their (current positions, were trained in their present major duties to have more knowledge and expertise to minimize errors, or to be all correct, to decrease the loss of raw materials, or to save more materials, and to spend less time on practice but to gain more works. Thus trainees had to be on the job training (Sayian Phanit. 2005 : 30). Moreover, this may be generate from that the developed program was in congruence with the teachers’ needs for self-development in creating innovations because it would lead to upgrading their teaching profession to be more advanced. It is in accordance with the results of the study conducted by Sathian Sailuatkhram (2008 : 48-53) who conducted a study of the conditions of utilizing innovations for developing learners in literacy of teachers at Ban Si Somdet School under the Office of Roi Et Educational Service Area Zone 1. He found that the teachers needed self-development in terms of media production to be modern in the form of multimedia computer courseware. Because there is a serious lack of computer courseware at present, it is what to respond to the teachers’ needs in which they are greatly interested. In addition, computer courseware is works which can help teachers be able to stimulate learners’ learning more. It can cause learners to be interested in contents and to respond well to individual differences among learners. It can also help learners build the body of knowledge, summarize issues/topics meaningfully and generate more motivations for learning (Wolfe. 2001 : 69-73) Also, multimedia computer courseware can promote learners to generate skills in other aspects more than learning according to the contents such as searching skills, data interpreting skills, word pronouncing skills, communication and knowledge skills, (Jonsseon. 2000 : 17-22). Thus multimedia computer is necessary for teachers in this present age. Strengths of multimedia computer include: being able to be
continually copied, edited, and reproduced in contents by affecting the data quality the least. Multimedia can be easily made through the computer system with a small amount of budget, and a variety of media can be created (Faculty of Science, Rajabhat Chiang Mai University. 2009 : 5). Teachers can realize usefulness of creating computer courseware. When computer courseware has added the concept of learning with an emphasis on the analytical thinking process which is a learning method that causes learners to understand contents better, the more the teachers realize usefulness of the program mentioned. Thus they try to study and practice according to the training process quite well. They studied courseware while performing works and learned by having a mentor available to provide advice in continuity, causing teachers not to have too much stress. It has become learning together until there is development to top up the works to become innovations for multimedia computer courseware with an emphasis on the analytical thinking process as mentioned.

The research results can reflect that analytical thinking and creative thinking are the processes which promote one another, and they are important foundations of designing multimedia computer courseware with an emphasis on the analytical thinking process. Therefore, teachers should be adequately supported from their school administrators and agencies involved to have opportunities to develop multimedia computer courseware in full potentials. Supporting teachers to be confident in more thinking out of the frame will naturally lead to the design of learning activities in new models which can stimulate or promote learners to practice analytical thinking more efficiently, can respond to different needs of learners, and can reduce overlapping of organization of learning-teaching activities, which will be beneficial to development of education provision at the school in the future.

5. Conclusion
The research results were as follows:

1. For the result of developing the teacher training program in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process, it was found that the draft of the teacher training program as a whole was appropriate at a high level, and the experts opined that the training program was in congruence with each other as a whole with congruence indices ranging 0.80-1.00 which passed the established requirements.

2. For the results of examining effectiveness of the teacher training program in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process, it was found that the teacher trainees had a higher mean score on testing analytical thinking knowledge after training than before training at the .01 level of statistical significance, with an effectiveness index of training of 0.52. The teacher trainees had ability to design multimedia computer courseware averagely at 92.59 percent, and had ability to create innovations averagely at 85.19 percent. Every innovations created by each trainee had quality which passed the quality requirement at grade 2. For the result of evaluating teachers’ satisfaction with the training program, their satisfaction as a whole was at a high level. It could be concluded that this program was effective and every item passed the established requirement. Thus we could be confident that it could be applied to training teachers at different educational institutions in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process.

6. Recommendations
Multimedia computer courseware with an emphasis on the analytical thinking process is an instrument for organization of experiences for learners using main concepts from the main learning strands in the curriculum to determine to be the situations through the multimedia computer systems for learners to perform activities by the use of the analytical thinking process. They include: comparison, categorization, classification of errors, summarization of general significance, and implementations of
the principles. These things can generate understanding of main concepts and can provide appropriate answers to the given situations: The results of developing teachers in creating innovations for multimedia computer courseware with an emphasis on the analytical thinking process can be summarized as recommendations in the following 2 aspects:

1. Policy Recommendations

1.1 The agencies involving determination of educational policy should support the policy or allot budgets for developing multimedia computer courseware with an emphasis on the analytical thinking process to generate continuity in creating and disseminating innovative works, consisting of multimedia computer courseware, courseware use handbook, and a report on outcomes of courseware use.

1.2 School administrators should determine to have a project for developing multimedia computer courseware with an emphasis on the analytical thinking process in the school annual operational plans and should determine to have persons responsible for the project in clarity to encourage development of works in continuity.

2. Recommendations for Implementations

2.1 This program is appropriate for implementation in training trainees to have ability to create multimedia computer courseware with an emphasis on the analytical thinking process and to disseminate innovative works, consisting of multimedia computer courseware, courseware use handbook, and a report on outcomes of courseware use. The project is appropriate for training in-service teachers working at the same workplace or nearby workplaces. The number of trainees should not exceed 10 per resource person to be able to closely give advice while on the job training.

2.2 There should be arrangements of open-climate training by supporting trainees to present their knowledge and experiences and to express their opinions independently to help trainees have more self-confidently and satisfaction with training. Important issues are that there must be summarization of the concept received every time, and that there must be clear assignment so that trainees will be able to perform correctly which will help shorten the length of time for the resource person to supervise and follow up.

2.3 Because on the job training must organize training at the workplace where teachers often have work to do all the time, meetings should be held for learning between trainers and resource persons after lunch or after school. During the time mentioned, most of the trainees have free time and they can attend the meeting together.

2.4 The training duration should be flexible as appropriate by having trainees participate in planning and determining the periods of time for studying contents, on the job training, implementing knowledge or works in organization of learning activities in the classroom, and evaluating performance. These things will cause the training process to be in congruence with trainees’ learning-teaching activities to be in conformity with the concept of on the job training.

3. Recommendations for Further Research Studies

3.1 There should be a study of the developments concerning learning achievement and analytical thinking abilities of learners in the group that learn with the teachers who have been trained according to The Teacher Training Program in Creating Innovations for Multimedia Computer Courseware with an Emphasis on the Analytical Thinking Process.

3.2 The should be a research study of developing a model of training in other types for development of teachers’ abilities to create innovations for multimedia computer courseware with an emphasis on the analytical thinking process.
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