The Development of Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Learning Abilities

- **Theeranut Pimpan**
- **Chalong Tubsree**
- **Montree Yamkasikorn**

Abstract: *This research aims to develop the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Learning Abilities to meet the 80/80 efficiency criteria. The research follows the process of research and development according to the ADDIE learning development mode (1980s) by way of analysis, design, development, implementation and evaluation. The research instruments comprises 1) learning management plans, 2) a learning achievement test, 3) a test of analytical and synthesis abilities, 4) a learning management suitability evaluation form, and 5) a learning system evaluation form. In validating the efficiency and assuring the learning achievement, the samples used were 34 Prathomsuksa6 students of Nakhonsawan Rajabhat University Demonstration School. The results were that the developed learning system consisted of 6 small units as follows: unit 1: environmental and readiness preparation; unit 2: analysis and readiness preparation of learners; unit 3: curriculum and learning plan preparation; unit 4: learning management; unit 5: supplementary teaching and activities, and unit 6: evaluation. The constructionism approach consisted of 5 steps which were 1) introduction, 2) presentation of content, 3) practice, 4) practice results and suggestion, and 5) evaluation. When used with the implementation group, it was found that the students' learning achievement after learning was higher than that prior learning significantly at the level of .05. Their knowledge increased by 27.50 percent. The learning achievement of the students in the high learning ability group was higher than that of the average learning ability and low learning ability group significantly at the level of .05, whereas that of the average learning ability group was not different from that of the low learning ability group. The analytical thinking and synthesis thinking abilities of the students after learning were higher than prior learning significantly at the level of .05. It is suggested that teachers can apply this developed learning system in other subject areas or in other educational levels by taking the school context into account.*

Keywords: learning systems, constructionism approach, analytical thinking and synthesis thinking

Introduction

The assessment results under the Program for International Student Assessment (PISA) conducted by the Organization for Economic Co-operation and Development – OECD (2014) revealed that Thai students' scores in reading, analytical thinking, synthesis thinking and applying were below the criterion when compared with those other countries (The Institute for the Promotion of Teaching Science and Technology (IPST), 2014). This indicates that learning and teaching in Thailand still lacks promotion and development of analytical thinking, synthesis thinking and application creatively. Wasi (1999: p.8) said, "... Teachers now still focus on rote learning by starting from knowing, remembering, doing and using' which is the learning process that has taken place from the kindergarten level to the higher education level without emphasizing on knowledge building by oneself on the part of the learner..." and this, as pointed out by Khaemmanee (2011, p.188-204), "...needs improvement and development..." The researcher has studied ways for improvement and found that analytical thinking and synthesis thinking development can be done through the learning by doing process, and therefore, Constructionism Approach of Papert was brought as a theoretical framework in designing the learning process to develop analytical thinking and synthesis thinking which is consistent with Israsena Na Ayutthaya (2013, p.25) who indicated that Constructionism "... is a method used very well in developing people from early childhood to working adults including being a type of choice that enable the learners to build knowledge by themselves and to learn friendlily in groups or as a team."

Research Objectives

1. To design and develop the learning system for the development of analytical thinking and synthesis thinking according to the learning process with Constructionism approach.
2. To study the effectiveness of learning system for the development of analytical thinking and synthesis thinking according to the learning process with Constructionism approach.

Literature Review

The following topics were reviewed and taken into account so as to arrive at the theoretical framework of this research.

1) System Theory (Romiszowski, 1981, p. 5)

System refers to the various elements that are arranged in a relationship together toward a goal. The process of system consists of 3 parts: 1. Input which refers to the various elements introduced into the system 2. Process refers to the activities of the interacting elements within the system to achieve the system's objectives and 3. Product, which represents the results of operations

Figure 1 Parts of a System

2) ADDIE Model

ADDIE is an Instructional Systems Design (ISD) model. The ADDIE model is a framework that lists generic processes that instructional designers and training developers use. It represents a guideline for building effective training and performance support tools in five phases.1. Analysis 2. Design 3. Development 4.Implementation and 5. Evaluation

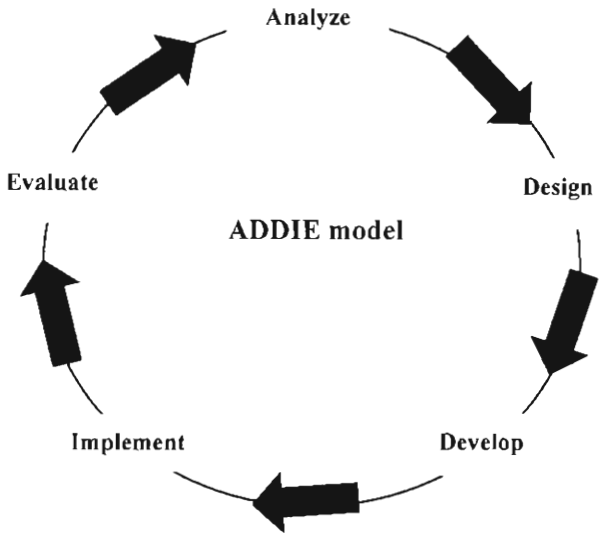

Figure 2 the ADDIE model (Richey, Klein & Tracey, 2011, p. 3)

3) Instructional System Model

There are many instructional system models proposed by authorities in the field such as Dick and Carey Model (Dick, Carey & Carey, 2001). The Dick and Carey Model comprises of 10 elements, they are: 1.Problem Analysis, 2.Instructional Analysis,3. Identifying learner's Entry Behaviors and Characteristics, 4.Writing Performance Objective. 5. Developing Criterion Reference Tests, 6. Developing Instructional Strategies,7. Developing and Selecting Instructional Material, 8. Designing and Conducting Formative Evaluation, 9. Revising Instruction and,10. Designing and Conducting Summative Evaluation

Gerlach and Ely Model (Gerlach & Ely, 1971) offers another instructional system that is slightly different from Dick and Carley model. The Gerlach & Ely model is designed as a prescriptive model that effectively illustrates the fundamental principles of teaching and learning. It also supports student-centered learning, as follows: 1. Specification of Content, 2. Specification of Objectives, 3. Measurement of Entering Behaviors, 4. Determination of Strategy, 5. Organization of Groups, 6. Allocation of Time, 7. Allocation of Space, 8. Selection of Resources, 9. Evaluation of Performance and, 10. Analysis of Feedback.

Seels and Glasgow Model (Seels & Glasgow, 1990) offers a practical guidelines for the instructional designers to use. The Seels and Glasgow Model consists of: 1. Problem Analysis, 2. Task and Instructional Analysis 3.Objective and Tests 4. Instructional Strategy 5. Media Decision 6. Materials Development 7. Formative Evaluation 8. Implementation Maintenance 9. Summative Evaluation 10. Dissemination Diffusion.

3.4 Kemp's Instructional Design Model (Kemp, 1985)

The Jerold Kemp Instructional Design Model consists of nine key elements. 1. Identify instructional problems, and specify goals for designing an instructional program. 2. Examine learner characteristics that should receive attention during planning. 3. Identify subject content, and analyze task components related to stated goals and purposes. 4. State instructional objectives for the learner. 5. Sequence content within each instructional unit for logical learning. 6. Design instructional strategies so that each learner can master the objectives. 7. Plan the instructional message and delivery. 8. Develop evaluation instruments to assess objectives. 9. Select resources to support instruction and learning activities.

4) Cognitive Development Theory

4.1 Piaget's theory of cognitive development

Jean Piaget believed that the childhood plays a vital and active role to growth of intelligence and child learns through doing and actively exploring. The Key Concepts of Piaget's theory: Schemas - A schema describes both the mental and physical actions involved in understanding and knowing. Schemas are categories of knowledge that help us to interpret and understand the world. Assimilation - The process of taking in new information into our previously existing schemas is known as assimilation. Accommodation - Another part of adaptation involves changing or altering our existing schemas in light of new information, a process known as accommodation. Equilibration - Piaget believed that all children try to strike a balance between assimilation and accommodation, which is achieved through a mechanism Piaget called equilibration. As children progress through the stages of cognitive development, it is important to maintain a balance between applying previous knowledge (assimilation) and changing behavior to account for new knowledge (accommodation). Equilibration helps explain how children are able to move from one stage of thought into the next. Final Thoughts - One of the most important elements to remember of Piaget's theory is that it takes the view that the creation of knowledge and intelligence is an inherently active process.

4.2 Bruner's theory of Cognitive Development

Jerome Bruner is primarily in the cognitive tradition, although he is very heavily influenced by Piaget. A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current/ past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structure provides meaning and organization to experiences and allows the individual to "go beyond the information given". The instructor should try and encourage students to discover principles by themselves. The instructor and student should engage in an active dialog. Principles instruction based upon the study of cognition:

4.2.1. Instruction must be concerned with the experiences and contexts that make the student willing and able to learn (readiness).

4.2.2. Instruction must be structured so that it can be easily grasped by the student (spiral organization).

4.2.3. Instruction should be designed to facilitate extrapolation and or fill in the gaps (going beyond the information given).

4.3 Robert Gagne's theory of Cognitive Development

Gagné's work (1985) focuses on intentional or purposeful learning, which is the type of learning that occurs in school or specific training programs. He believed that events in the environment influence the learning process. His theory identifies the general types of human capabilities that are learned. These capabilities are the behavioral changes (learning outcomes) in a learner that a learning theory must explain. Once the learning outcomes are identified, an analysis of the conditions that govern learning and remembering can occur (Gagné, 1985, p. 15). Gagné numbers the instructional events from one to nine, showing a sequential order. Robert Gagne's 9 Events of Instruction are as follows: 1) Gain Attention 2) Inform Learner of Objective3) Stimulate Recall Prior Knowledge 4) Present The Material 5) Provide Guidance For Learning 6) Elicit Performance 7) Provide Feedback 8) Assess Performance 9) Enhance Retention & Transfer

4.4 Vygotsky's theory of cognitive development

The major theme of Vygotsky's theoretical framework is that social interaction plays a fundamental role in the development of cognition. Vygotsky (1978) states: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals." A second aspect of Vygotsky's theory is the idea that the potential for cognitive development depends upon the "zone of proximal development" (ZPD): a level of development attained when children engage in social behavior. Full development of the ZPD depends upon full social interaction. The range of skill thatcan be developed with adult guidance or peer collaboration exceeds what can be attained alone.

5) Constructionism and Meaningful learning

5.1 Constructionism(PhetRuk, S.,2011)

Constructionism is a Theory of Education in which children learn by doing and making in a public, guided, guided, collaborative process including feedback from peers, not just from teachers. Important ideas that are addressed within the constructionist perspective include: Learning is an active process and the constructionist learning environment should be a place where inquiry such as asking questions and seeking own answers is encouraged. Knowledge is constructed from experience and students should be encouraged to create and experiment with objects and materials wherever possible. Learning should occur in context and be relevant.

Ideally learning should occur in a realistic setting where the learner is engaged with relevant activities and strategies that enable knowledge to be constructed. As the teacher, consideration should be given to the idea of empowering students to become self-directed learners.

5.2 Meaningful Learning

David Ausubel, (1963) believes that learning is meaningful to students. If learning, it can be associated with any of the known before. Principles of teaching the theory is presented concept or concept maps or concept in the matter to the students before teaching materials that will help students learn the content. it significantly, indicating that learning significantly depends on three variables as follows: 1. What will be learned (Materials) to be meaningful. This means that there must be something with the relationship. What was

learned and stored in the structure of intelligence (Cognitive Structure) 2. Students must be experienced. And are thought to be associated or group learning something new in relation to knowledge. Or what they learn old 3. Intentions of learners and learners with the knowledge - thought to be linked to what is learned to have a relationship with the wisdom that is already in memory.

6. Analytical Thinking and Synthesis Thinking

6.1 Analytical Thinking (Chareonwongsak, 2003)

Analytical thinking is the ability to distinguish the various elements of something which could be the object of an event or story into smaller sections that comprise a complex relationship and find out what the reason between those elements that have a related links. It causes complete and in-depth views on matters that will lead to decisions and resolutions based on the objectives defined, which is important and helpful to a person or participants, because in the social environment in the current era, there are things that have the rapid evolution and diversity; it is essential to develop the students ability to think, analyze things around and choose to be fully utilized towards ourselves and society.

6.2 Synthesis Thinking (Chareonwongsak, 2011)

Synthesis thinking is the dimension of thinking which relies on the ability to gather information and skills to pull the issues involved. Which may have as many and scattered along the various sources only the link to what to think. Be assimilated / knitting / blend. Under the same scheme to meet the objectives set. Allows us to innovate, be it material or ideas to give up a lot. Synthetic thinking skill is an important skill of all. Deserves a promotion in order to be a qualified individual to create something good for themselves, their families, communities and nations.

Research Methodology

Table 1 Research Methodology based on the ADDIE model

STAGE	ACTIVITY
1. Analysis	-Gather information and collect data - In- depth Interview: In the analysis of the problems there were 6 people who were qualified specialists, school administrators, teachers and supervisors - Write and prioritize instructional goals - Write need-analysis report
2. Design	-Draft the 1st prototype model for analytical thinking and synthesis thinking development - Focus Group: improvement of the prototype model by 24 qualified educational specialists - Make a synthesis of the specialist, opinions for improving the system of the 1st drafted prototype model to be the 2nd prototype model of learning system -5 qualified assessors of system -Design of learning management plans for the subject group of social studies, religion and culture for Prathomsuksa 6 studentsas a system trial

STAGE	ACTIVITY
3. Development	Development of learning management plansfor 3 trials: individually with 3 students, in a small group of 12 students, and a big group of 32 students, totaling 47 students -5 qualified assessors of learning management plans
4. Implementation	Finding the efficiency and studying the learning achievement, the samples used were 34 Prathomsuksa 6 students of NakhonSawanRajabhat University Demonstration School consisting of 10 good level students, 17 fair level students and 7 poor level students*
5. Evaluation	- analytical and synthesis thinking abilities - learning achievement

*The samples for experimental group were 34 different learning abilities students divided on the basis of the results of a retrospective study of grade 3 levels: 1-1.5 grade level are poor 7students, 2.5-3 grade level are fair 17 students and grade level 3.5-4 are good 10 students.

Data Collection

The Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Defferent Learning Abilities was implemented by using 16 learning management plans for the subject group of social studies, religion and culture as a system trial with 16 Prathomsuksa 6 students of NakhonSawanRajabhat University Demonstration School in semester 2 of the 2013 academic year for 1 semester. Data collection was as follows:

Pretesting of learning achievement of Prathomsuksa 6 students before learning the subject group of social studies, religion and culture with a 60-item test.

Pretesting of analytical thinking ability of Prathomsuksa 6 students before learning with a 20-item test.

Pretesting of synthesis thinking ability of Prathomsuksa 6 students before learning with a 2-item test.

Implementing learning according to the 16 learning management plans to develop analytical thinking and synthesis thinking with the students of different learning abilities.

After finishing learning every plan the students were given the same tests (as in 1, 2, 3) to do and the results were kept as post-test scores.

Results

1. The development of the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Learning Abilities found that it comprises a Macro System with 4 parts as follows:

Part 1: Input which are purposes, students, teachers, and learning resources.

Part 2: Process which consists of 6 Micro systems which are 1) environmental and readiness preparation, 2) analysis and readiness preparation of learners, 3) analysis of

curriculum and learning plans preparation, 4) learning management, 5) supplementary teaching and activities, 6) evaluation.

Part 3: Output which are 1) learning achievement, 2) analytical thinking ability, and 3) synthesis thinking ability.

Part 4: Control and feedback.

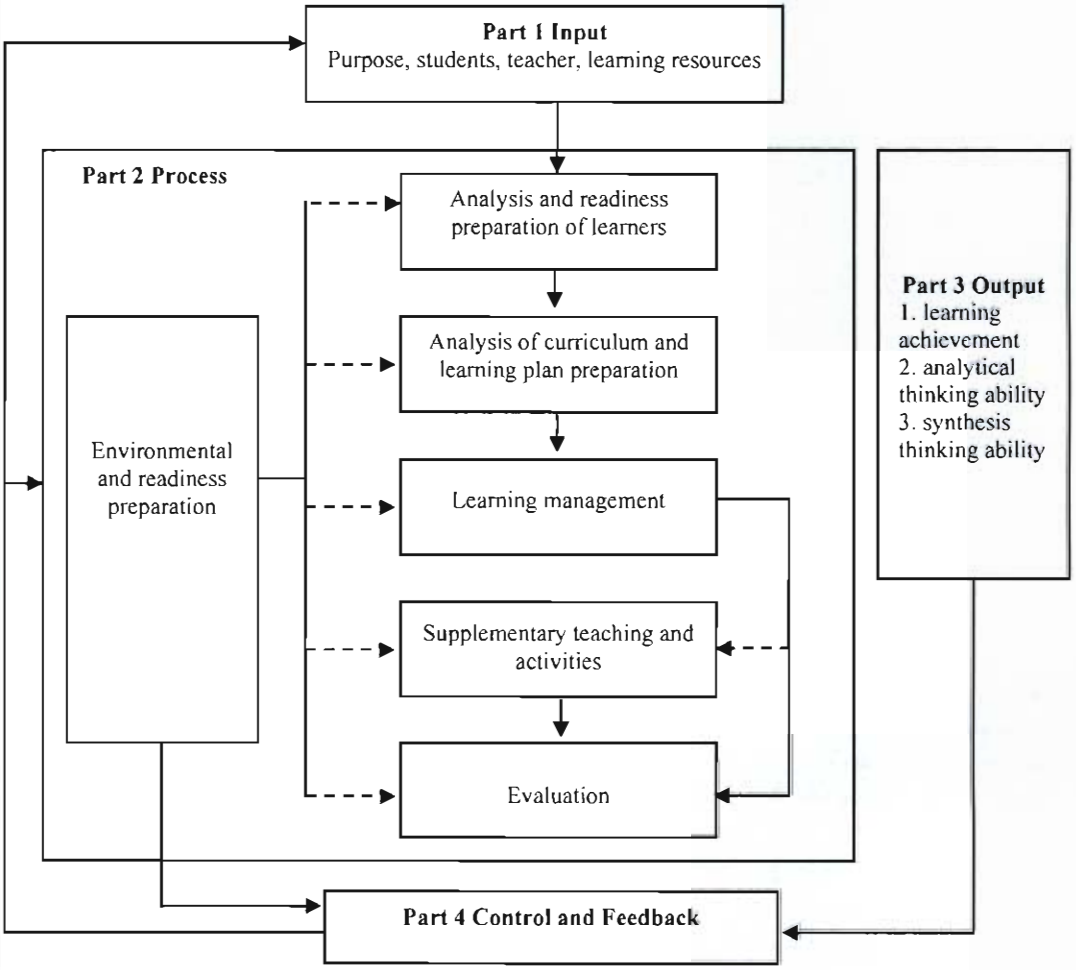

Figure 3 Shows the Development of Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Learning Abilities.

2. Suitability assessment result of the Instructional System for students with different learning Abilities by the connoisseurs revealed that, overall, it is at a high level (= 4.50, S.D. 0.54).

3. The instructional system consists of input which are purposes, learners and learning management plans leading to the Micro Process of 5 steps which are 1) introduction to the lesson, 2) presentation, 3) practice, 4) giving practice results and suggestion, and 5) evaluation as shown in Figure 4.

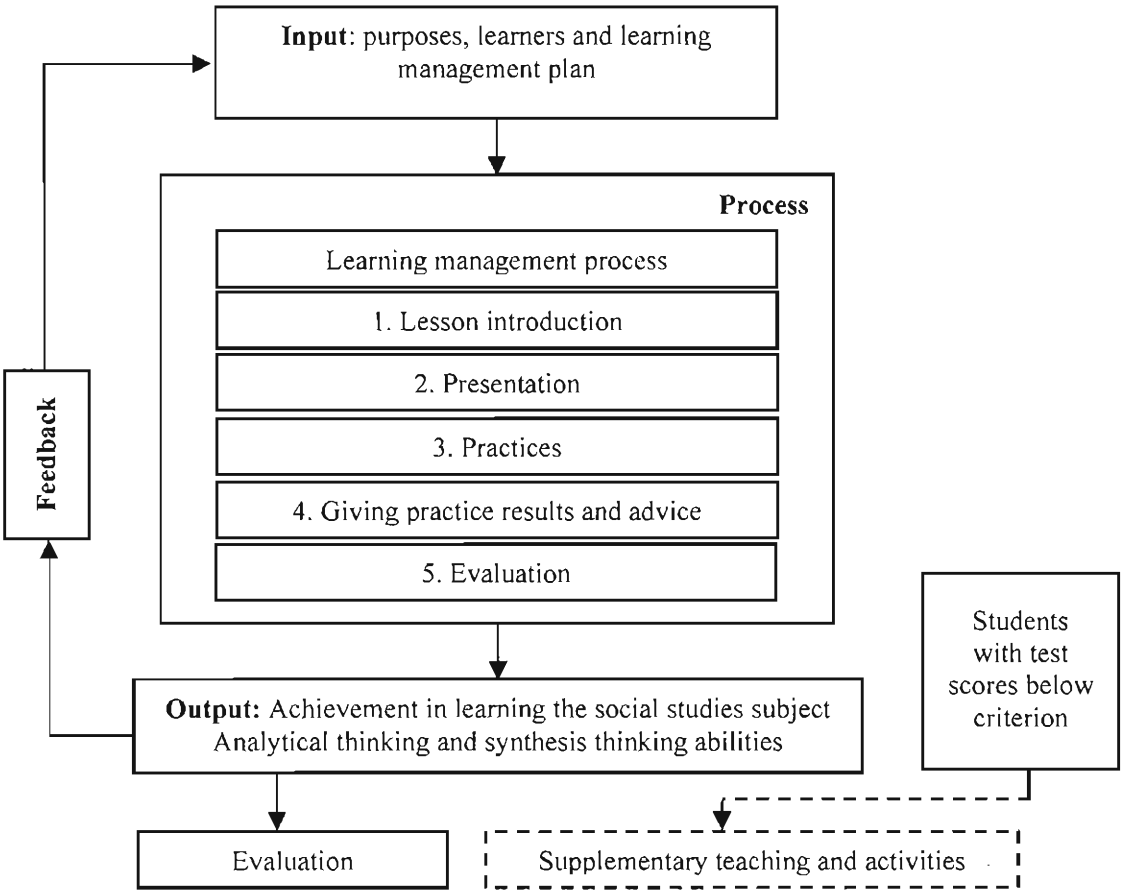

Figure 4 Shows the Instructional System Management

4. A comparison of learning achievement between before learning and after learning social studies, religion and culture of 34 Prathomsuksa 6 students of NakhonSawanRajabhat University Demonstration School.

Table 2 Comparison results of learning achievement before learning and after learning social studies, religion and culture subject group of Prathomsuksa 6 students

Test	Number	Full score	$(\overline{X})$	(S.D)	t	df	p-value
Before learning (pre-test)	34	60	27.41	5.99	27.83*	33	0.000
After learning (posttest)	34	60	43.91	6.16			

*p≤ .05

From data analysis it was found that the mean score of learning achievement before learning the subject group of social studies, religion and culture according to the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach was 27.41, with standard deviation of 5.99, whereas that after learning was 43.91, with standard deviation of 6.16. From finding the differences between means using t-test, the results were $t = 27.83$, and $p = 0.000$ showing that the learning achievement of the learners after learning was higher than that before learning at the significance level of .05.

5. Percentage of progress in learning according to the Instructional System to Develop Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities

5.1 Percentage of progress of learners in the big group.

Table 3 Percentage of progress of learners in the big group according to the Instructional System to develop analytical thinking and synthesis thinking with constructionism approach for students with different abilities

Test	Number	Full score	$(\overline{X})$	Percentage increased
Before learning (pretest)	34	60	27.41	27.50
After learning (posttest)	34	60	43.91	

From table 3 it was found that the mean score before learning was 27.41 and that after learning was 43.91 showing that the percentage of knowledge increased was 27.50.

5.2 Percentage of progress in learning of learners in the high, middle and low groups after being treated with the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities.

The learners were divided into 3 groups according to the 60-item pretest of achievement of the social studies, religion and culture subject group results and previous learning results in semester 1/2013. Accordingly the numbers of students in the high group, middle group and low group were 10, 17 and 7 respectively with the percentages of learning progress as shown in Table 4.

Table 4 Percentage of progress in learning of learners in the high, middle and low groups from the learning according to the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities

Group of learners	Number students	Mean before learning	Mean after learning	Percentage increased
High	10	34.10	50.30	27.00
Middle	17	26.18	42.47	27.15
Low	7	20.86	38.29	29.05

From Table 4 it was found that the mean score of the high group before learning was 34.10, that after learning was 50.30, and the percentage increased was 27.0. The mean score of the middle group before learning was 26.18, that after learning was 42.47, and the percentage increased was 27.15. The mean score of the low group before learning was 20.86, that after learning was 38.29, and the percentage increased was 29.05.

6. Learning achievement comparison results among the high, middle and low groups of learners after learning according to the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities.

The statistics used by the researcher in testing analysis were One-Way ANOVA or F-test and the results were as in Table 5.

Table 5 Testing analysis results of learning achievement after learning to see whether it depended on the group of learners

	Sum of Squares	df	Mean Square	F	Sig.
Between group	664.971	2	332.486	15.252	.000
Within group	675.764	31	21.799		
Total	1340.735	33			

From the table the F-test value was 15.252 with p-value = 0.000 > .05 showing that there was a difference between means of learning achievement results after learning between at least 1 pair of learner groups. Therefore, a Post-hoc Comparison pair by pair was applied to find which groups had the difference by using Least Significant Difference Test: LSD. Data analysis results were as in Table 6.

Table 6 Comparison of the difference between means after learning pair by pair of group

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
High group	Middle group	7.82941*	1.86069	.000
High group	Low group	12.01429*	2.30087	.000
Middle group	Low group	4.18487	2.09676	.055

*p≤.05

From Table 6 it was found that the mean of learning achievement result after learning of the high group was different from that of every other groups at the significant level of .05, whereas there was no difference between that of the middle group and that of the low group.

7. Comparison result of analytical thinking ability of learners before learning with that after learning

Table 7 Comparison of analytical thinking ability learning with that after learning

Test	Number (n)	Full score (X)	$\overline{X}$	S.D	t	df	p-value
Before learning (pre-test)	34	20	10.38	1.50	12.51*	33	0.000
After learning (posttest)	34	20	15.21	2.27			

*p≤ .05

Data analysis result revealed that mean score of analytical thinking ability of learners before learning according to the instructional system to develop analytical thinking and synthesis thinking with constructionism approach for students with different abilities, was 10.38 with standard deviation of 1.50, whereas that after learning was 15.21 with standard deviation of 2.27. From testing the difference between means with t-test at the significance level of .05, the result was t = 12.51, p = 0.000 showing that the learners had analytical thinking ability higher than that before learning at the significance level of .05.

8. Comparison result of synthesis thinking ability of learners before learning with that after learning

Table 8 Comparison of synthesis thinking ability of learners before learning with that after learning

Test	Number (n)	Full score (X)	$\overline{X}$	S.D	t	df	p-value
Before learning (pre-test)	34	10	5.26	1.24	14.23*	33	0.000
After learning (posttest)	34	10	7.68	1.32			

*p≤ .05

Data analysis results revealed that the mean score of synthesis thinking ability of learners before learning, following the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities, was 5.26 with standard deviation of 1.24, whereas that after learning was 7.68 with standard deviation of 1.32. From testing the difference between means with t-test at the significance level of .05, the result was t = 14.23, p = 0.000 showing that the learners had synthesis thinking ability higher than that before learning at the significance level of .05.

Discussion

The results of implementing the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Learners with Different Abilities are discussed in order of the research objectives as follows:

1. The developed Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities made the learners have higher learning achievement maybe because the researcher had designed the system by strictly following the steps of the ADDIE Model and brought it to the dissertation advisor

for consideration and advice periodically. A focus group discussion among connoisseurs was held to get comments and advice on the system in the drafting edition so as to be improved to become the instructional system prototype 1 with complete Macro system and Micro systems. After that the system was given 3 trials with pilot experiment groups. Based on the results of the trials improvement was made so as to become the instructional system prototype 2. Then it was presented to the connoisseurs for assessing its suitability. It was found that its suitability was at the high level which accorded with the system assessment for Yahakorn (2010) who studied and develop the system of teaching and learning by children's families during the layers 1 and 2 which obtained suitability at a high level from the connoisseurs' assessment. Furthermore, it accorded with the satisfaction towards the instructional system for fundamental physics of higher education level students investigated by Thewasutharasakul (2011) whose suitability assessment result was at a high level. The systems mentioned had similar components; each used the system theory and designed the system by following the steps of the ADDIE Model. Moreover, this maybe because during the actual experiment the researcher had made improvement periodically by using the methods of observing the students, consulting the homeroom teachers and informal conversation with students to get comments for system improvement. And when finishing learning according to the learning management plans (16 plans), the learners put on the exhibition of their individual work and group work resulted from learning. Then the researcher held a meeting with the students in the form of group discussion to get comments and advice from them for final improvement of the system.

In addition, the researcher had written out working details of the systems consisting of needs, objectives, working steps of the system, and preparation lists in implementing the system which will enable the teachers or related people to put the system into use correctly and suitably with each school. Besides, it may be because the researcher had made improvement during the experiment in weeks 2,4,6 and 8 by observing and interviewing the learners about suitable learning conditions for system improvement.

2. For the efficiency of the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities, it was found that the learners had learning achievement, learning progress, analytical thinking ability, synthesis thinking ability as a whole higher than the level before learning. This may be because the instructional system was designed to make the working systems correlate and enhance each other making each micro system run smoothly with efficiency. In particular, the researcher had brought into account the theoretical approach of self knowledge building process under constructionism of Papert, S., & Harel, I.(1991) with learner-centered learning process emphasizing on the learner's self-practice. The activity as such brought about the knowledge created by the learners themselves. The researcher had also applied educational science in making the learning plan in Unit 3 and had conducted learning management according to the plan set in Unit 4. These learning management plan had passed the suitability assessment of the connoisseurs as a whole at the highest level, having the steps of learning activities arrangement principles as introduction, practice, telling the practice results and giving suggestion, and evaluation.

The steps of learning activities arrangement principles of the researcher were consistent with the study of Tubsree, Suratruangchaiand Thongsorn (2005) on Development of the Basic Education Curriculum in Accordance with the Constructionism, and the study of

Intarasanee (2007) on the Development of Sixth Grade Students' Analytical Thinking and Synthesis Thinking with 5 steps of learning management process of introduction, doing activities, presentation of work results, knowledge improvement and summary resulting in the learners having analytical thinking ability and synthesis thinking ability after learning higher than before learning at the significance level of .05.

Furthermore, with efficiency the system resulted in the learners having more development. Especially the 1-1.5 grade level who are poor 7 students have the mean score after learning increased 29.05 percent over the previous average and over those of the fair and good learners. It maybe because the researcher carried out learner's readiness to analyze and prepare learners in unit 2 and used the data in preparing of the learner's learning activities and segmenting the group with mixed appropriate skills, namely the group consists of good, poor, fair learners. It is an opportunity for the poor group to be learning how to learn and work of other students, and has been assigned a job and educational guidance from the group. This may because the poor group students improve themselves and the percentage of the posttest mean score is increased over the previous average and also over those of the good and the fair group students.

In addition, the Macro System consisted of Micro Systems consistent with the principles of learning, teaching and management. That is the Micro Systems or The general facilitators did the duty of supporting every system to work orderly and smoothly by preparing in advance before other units would start their missions. Learners analysis and readiness preparation for learning management data would lead to the system laying out the learning management plans suitably. And after finishing learning each learning unit if the learner did not pass the test criterion, there would be supplementary teaching and actives to improve the learner to meet the criterion. The specified and clear functions of the Systems resulted in the learners who experienced through this Instructional System having higher learning achievement, learning progress, analytical thinking ability and synthesis thinking abilities, indicating that the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Learning Abilities has efficiency.

Conclusion

1. The developed Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Learning Abilities has 4 components which are 1) Input, 2) Process with 6 Micro Systems, 3) Output, and 4) Control and Feedback.

2. Evaluation of the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities revealed as the following:

1. The learners had learning achievement after learning higher than that before learning at the significance level of .05.

2. The learners passed the post-test with the scores increasing before learning for 27.5 percent or having the learning progress for 27.5 percent.

3. The learning progress of the learners in the high group, middle group and low group after going through the learning process showed that the percentage of learning progress of the high group was 27.0, that of the middle group was 27.15, whereas that of the low group was 24.05.

4. The comparison of learning achievement of the learners among the high group, middle group and low group after learning found that the mean after learning of the high group was significantly different from that of the middle group and of the low group at the level of .05. However, there was no difference between means of the middle group and the low group.

5. For analytical thinking ability after finishing learning it was found that the learners had analytical thinking ability higher than that before learning at the significance level of .05.

6. For analytical thinking ability after finishing learning it was found that the learners had higher synthesis thinking ability than that before learning significantly at the level of .05.

In conclusion, as a whole it was found that the Instructional System for Analytical Thinking and Synthesis Thinking with Constructionism Approach for Students with Different Abilities has efficiency, making the learners have higher learning achievement, learning progress, and higher ability in both analytical thinking and synthetic thinking.

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