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The Construction and Development of the Mathematics Curriculum for Excellence (Mathematics Programs from Kindergarten to Senior High School to Foster Students' Mathematics Excellence)

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Abstract

This research aimed to 1) study the basic information in order to construct and develop the mathematics curriculum for excellence consisting of: (1) a mathematics curriculum and study plans; (2) teacher's manuals and lesson plans; (3) textbooks and course books and (4) mathematics tests, 2) construct and develop the mathematics curriculum for excellence, 3) implement the mathematics curriculum for excellence and 4) evaluate the mathematics curriculum for excellence. The curriculum was piloted and evaluated before and during the implementation and revision of the mathematics curriculum for excellence. The data were collected by quantitative and qualitative methods. The research instruments included: 1) content analysis form of related literature and research; 2) interview forms/topics for focus group discussions; 3) mathematics teachers' teaching behavior observation form; 4) needs analysis questionnaire on students' mathematics learning; 5) evaluation form of the mathematics curriculum for excellence; 6) mentoring form for teaching and learning based on the mathematics curriculum for excellence 7) teachers' opinion towards mathematics curriculum for excellence and curriculum-related documents interview form and 8) students' opinion towards learning and teaching management and documents related to the mathematics curriculum for excellence

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interview form. The data were analyzed by percentage, mean, and standard deviation as well as content analysis. The results revealed that:

1. The math curricula consisted of contents, numbers and operations, measurement, algebra, geometry, data analyses and probability**.** The process skills comprised problem solving, reasoning, communication, communication of mathematical concepts, linking mathematics with other disciplines and creative thinking. The mathematics learning activity management focused on activities that supported knowledge construction, processes, knowledge application, questioning strategies, problem solving emphasizing on students' mathematical competencies, mathematising and mathematical processes as well as emphasis on positive attitude, instructional materials in mathematics, a blend of technology, measurement and evaluation for mathematical excellence, assessment for learning, authentic assessment, evaluation of knowledge, process skills and mathematical attitude**.**

2. The mathematics curriculum for excellence was comprised of: 1**)** a mathematics curriculum; 2**)** lesson plans and teacher's manuals; 3**)** mathematics textbooks/course books; 4**)** mathematics tests for 13 levels of students ranging from kindergarten to upper secondary level. Mathematical excellence in early childhood was fostered by learning activities based on creative arts (Art Math). For elementary levels, English vocabulary and mathematics were integrated **(**Integrated Math**)**. Junior high school students were required to think creatively (Creative Math) and senior high school students were expected to be excellent in mathematics **(**Excellence Math**).**

3. The implementation of the K-12 curriculum at 11 municipal schools in 5 regions in the second semester of the academic year 2016. The teachers implemented the curriculum based on the lesson plans. The results of the implementation revealed that the curriculum enabled the students to be outstanding or excellent in mathematics and they achieved the expected learning outcomes. They also gained more mathematics skills and processes.

4**.** The evaluation and revision of mathematics curriculum for excellence showed that the teachers' overall opinion was at the high level. Their opinion towards the curriculum in general was at the high level. The mean score of their opinion towards the congruence of strands and standards was the highest and at the high level. The second highest mean score was on the opinion towards accuracy and precision of the strands and standards and it was at the high level. The opinion towards lesson plans in general was at the high level and their opinion towards the lesson plans consisting of learning activities that challenged the students to fully use their mathematics skills had the highest mean score and it was at the high level. The second highest mean score was on the opinion towards the precision and accuracy of measurement and

evaluation stating in the lesson plans and it was at the high level The course books in general was at the high level. The mean score of the opinion towards the congruence of course books, curriculum and lesson plans were the highest and it was at the high level. The second highest mean score was on clear explanations and easy-to-follow directions in the course books and it was at the high level and the students found learning through the curriculum beneficial. They could apply it to their everyday life. They considered learning activities enjoyable. Providing students opportunities to participate and learning with other students who had the same level of mathematics skills helped them learn better.

Key words: Construction and Development, Mathematics Curriculum for Excellence

Introduction

Mathematics had importance to develop the people thought that made their creative thinking,logical thinking, systematic, discipline. They could analytical thinking problems and situations in the carefully ways, plan, decision making and solving problems in the correct way. The mathematics helped to develop the people to be the perfect human, had balanced; body, mind, brains and emotion. They could thought, made and solved problems by themselves and lived in happily with other people **(**Ministry of Education**,** 2008**)** The objectives of 21 century focusing on development learners to solve problems, critical thinking and high order thinking, that the necessary skills for the learners in the information age (Farrington & Small, 2008: 5) Therefore, the development of knowledge and mathematical ability of learners, it was the main point because the mathematics helped to develop solving problems ability, logical reasoning including indicators for success of Thai educational system to prepare people have quality in the future.

Mathematics were the basic knowledge that had importance to explore and develop new knowledge. The country had many potential staffs about mathematics knowledge that the important indicator that the country had more progress than other country so that every countries interested in mathematics study branch, but in Thailand; Manpower development that had mathematics excellence not enough so that made the country was short of manpower about mathematics.

Education in Thailand would change course in group learning mathematics for Learners have knowledge mathematical process skills and desirable features (Bureau of Academic Affair and Educational Standards, 2008: 1) according to promote learning in the 21 st century.

Nowadays, Thailand will come to ASEAN community and global community affected moving free services, fund and labor that had engagement between ASEAN member countries for free labor about seven careers; engineering, nurse, architecture, survey, doctor, dentist and accountant. But from fact found that some learners from the school that affiliation local administration had not English, mathematics and science excellence. They were basic learning objectives to lead some careers. So that the local administration had necessary to construct and develop mathematics curriculum for excellence, mathematics programs from kindergarten to senior high school to foster students' mathematics excellence for maturing learners to mathematics excellence and be basic to go to the careers in the future.

Research Objectives

1. To study basic information for construction and development the mathematics curriculum for excellence.
2. To construct and develop the mathematics curriculum for excellence.
3. To implement the mathematics curriculum for excellence.
4. To evaluate the mathematics curriculum for excellence.

The Scope of Research

Schools under local administration from kindergarten to senior high school

Population, samples and important information

1. Information group in basic education included local administration consultants, mayor of Photharam Municipality, director of education division, director of school, deputy director of academic and mathematics group leader, professional teaching mathematics, mathematics teachers that had the best practices about mathematics, 40 mathematics teachers from 13 levels, 983 students that studied in mathematics from 13 levels.

2. Information group about construct and develop course included 15 curriculum experts about learning mathematics and mathematics measurement and evaluation,

3. Information group about pilot study curriculum included 667 mathematics teachers from kindergarten to senior high school; school from Photharam Municipality, Ratchaburi, school from Ratchaburi Municipality, Ratchaburi, in the academic year 2016.

4. Information group about implement, evaluation and improvement curriculum included 799 mathematics teachers from kindergarten to senior high school; schools under local administration in 2016 academic year at 11 municipal schools in 5 regions included 1) Anuban

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Mueang Mai School, Chonburi from kindergarten to grade 6, 2) Phlu Ta Luang School, Chonburi from grade 7 to grade 12, 3) Tessaban 4 (Chao Pricha Uthit), Nakhon Pathom from kindergarten 3, 4) Anuban Prapa School, Nakhon Pathom from grade 1 to grade 3, 5) Tessaban 2 School Wat Sanaeha (Samakpolpadung) from grade 4 to grade 6, 6) Tessaban 3 School (Sa Kratiem), Nakhon Pathom from grade 7 to grade 9, 7) Tawarawadee School, Nakhon Pathom from grade 9 to grade 12, 8) Plukpunya Municipal School, Phuket from kindergarten to grade 12, 9) Tessaban 3 School (Yommarat Samakkni) from kindergarten to grade 9, 10) Triamudomsuksanomklao School, Nakhon Ratchasima from grade 9 to grade 12, 11) Chiangrai Provincial Administrative Organization School, Chiangrai from kindergarten to grade 12.

Research methodology

This was research and development research employing mixed methods. The data were collected by quantitative and qualitative methods**.** There were 4 phases**.** Phase 1 Research (R_1) : The study of basic information on the construction and development of mathematics curriculum for excellence; Phase 2 Development (D_1) : The construction and development of mathematics curriculum for excellence; Phase 3 Research (R_2) : The Implementation of the mathematics curriculum for excellence and Phase 4 Development (D_2) : The evaluation and revision of the mathematics curriculum for excellence**.**The research instruments included: 1) content analysis form of related literature and research; 2) interview forms/topics for focus group discussions; 3) mathematics teachers' teaching behavior observation form; 4) needs analysis questionnaire on students' mathematics learning; 5) evaluation form of the mathematics curriculum for excellence; 6) mentoring form for teaching and learning based on the mathematics curriculum for excellence 7) teachers' opinion towards mathematics curriculum for excellence and curriculum-related documents interview form and 8) students' opinion towards learning and teaching management and documents related to the mathematics curriculum for excellence interview form. The data were analyzed by percentage, mean, and standard deviation as well as content analysis. The results revealed that:

The results of the data analysis

1. The results of the study of basic information on the construction and development of the mathematics curriculum for excellence showed that math curricula consisted of contents, numbers and operations, measurement, algebra, geometry, data analyses and probability. The process skills comprised problem solving, reasoning, communication, communication of mathematical concepts, linking mathematics with other disciplines and creative thinking. The mathematics learning activity management focused on activities that supported knowledge

construction,processes, knowledge application, questioning strategies, problem solving emphasizing on students' mathematical competencies, mathematising and mathematical processes as well as emphasis on positive attitude, instructional materials in mathematics, a blend of technology, measurement and evaluation for mathematical excellence, assessment for learning, authentic assessment, evaluation of knowledge, process skills and mathematical attitude.

2. The results of the construction and development of the mathematics curriculum for excellence revealed that the mathematics curriculum for excellence was comprised of: 1) a mathematics curriculum; 2) lesson plans and teacher's manuals; 3) mathematics textbooks/course books; 4) mathematics tests for 13 levels of students ranging from kindergarten to upper secondary level. Mathematical excellence in early childhood was fostered by learning activities based on creative arts (Art Math). For elementary levels, English vocabulary and mathematics were integrated (Integrated Math). Junior high school students were required to think creatively (Creative Math) and senior high school students were expected to be excellent in Mathematics (Excellence Math). The investigation of the overall quality of the curriculum was at the high level ($\overline{X}$ = 4.32, SD = 0.74). The result of the investigation of the quality of the plans and the manuals was at the high level($\overline{X}$ = 4.13, S.D. = 0.73). The result of the investigation of the quality of the mathematics textbooks/course books was at the highest level ($\overline{X}$ = 4.50, SD = 0.67) and the result of the investigation of the math tests was at the high level ($\overline{X}$ = 4.19, S.D. = 0.64).

3. The results of the mathematics curriculum for excellence were obtained from the implementation of the K-12 curriculum at 11 municipal schools in 5 regions in the second semester of the academic year 2016. These schools were Anuban Mueang Mai School, Chonburi and Phlu Ta Luang School, Chonburi in the East, Plukpunya Municipal School, Phuket in the South, Tessaban 3 School (Yommarat Samakkhi), Nakhon Ratchasima and Triamudomsuksanomklao School, Nakhon Ratchasima in the North East, Chiangrai Provincial Administrative Organization School, Chiangrai in the North and Tessaban 4 (Chao Pricha Uthit), Anuban Prapa School, Tessaban 2 School Wat Sanaeha (Samakpolpadung), Tessaban 3 School (Sa Kratiem) and Tawarawadee School, Nakhon Pathom in the Central part. The teachers implemented the curriculum based on the lesson plans. The results of the implementation revealed that the curriculum enabled the students to be outstanding or excellent in mathematics and they achieved the expected learning outcomes. They also gained more mathematics skills and processes. The overall mean score was 20.62 ($\overline{X}$ = 20.62, S.D. = 3.69). The kindergarten 3 students' mean score was the highest ($\overline{X}$ = 26.50, SD = **2.90**). Grade 1 students had the second highest mean score which was 21.75 ($\overline{X}$ = 21.75, S.D. = 4.52) and grade 10 students got the lowest mean score which was 7.65 (

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$\overline{X}$ =7.65, S.D. = 2.31). The students could develop their mathematical learning resulting in higher O-Net and NT scores in mathematics.

4. The results of the evaluation and revision of mathematics curriculum for excellence showed that the teachers' overall opinion was at the high level ($\overline{X}$ 3.78 S.D. = 0.67). Their opinion towards the curriculum in general was at the high level ($\overline{X}$ = 3.83 S.D. = 0.86). The mean score of their opinion towards the congruence of strands and standards was the highest and at the high level ($\overline{X}$ = 4.08 S.D. = 0.69). The second highest mean score was on the opinion towards accuracy and precision of the strands and standards and it was at the high level ($\overline{X}$ = 4.00 S.D. = 0.71). The opinion towards lesson plans in general was at the high level ($\overline{X}$ = 3.63 S.D. = 0.97) and their opinion towards the lesson plans consisting of learning activities that challenged the students to fully use their mathematics skills had the highest mean score and it was at the high level ($\overline{X}$ = 3.77 S.D. = 0.97). The second highest mean score was on the opinion towards the precision and accuracy of measurement and evaluation stating in the lesson plans and it was at the high level ($\overline{X}$ = 3.75 S.D. = 0.97).The course books in general was at the high level ($\overline{X}$ = 3.77 S.D. = 0.81). The mean score of the opinion towards the congruence of course books, curriculum and lesson plans was the highest and it was at the high level ($\overline{X}$ = 3.78 S.D. = 0.78). The second highest mean score was on clear explanations and easy-to-follow directions in the course books and it was at the high level ($\overline{X}$ = 3.73 S.D. = 0.79) and the students found learning through the curriculum beneficial. They could apply it to their everyday life. They considered learning activities enjoyable. Providing students opportunities to participate and learning with other students who had the same level of mathematics skills helped them learn better.

Discussion

This research "the construction and development of the mathematics curriculum for excellence" could discuss;

1. The concept of learning activities, relevant person had opinions the concept of learning activities for mathematics curriculum excellence in the kindergarten, primary education, secondary education and high school education should teaching in a model of activity that promotes mathematical excellence by focusing on thinking process development, problem-solving and rational proof for the learners in the way of self-directed learning. Role of teachers for instruction and asking to think that the learners could discover or construct knowledge by themselves and motivation learners to invent, group work skills, as a guide, activated learners thought more than told only knowledge. It should have printing media or invention media that

used for teaching. The learners could saw and understood mathematics content from abstract to concrete for example GSP, foreign country text book, math lab, technology media to motivate learners to construct thinking process such as mathematical program for kindergarten, primary education.Consistent of Chankhajorn Malichan (2011) that studied the results of the learning activities focusing on the metacognitive process the ability to solve math problems, awareness in knowing and self-directed learning of grade 11 students. That had 5 steps; 1) understand the problem, 2) create a problem agent, 3) plan to solve problems and 5) evaluation of the solution. The result found that ability to solve math problems of learners that studied by focusing on the metacognitive process passed 70 percent at the .01 level of significance and Herber (Herber 1970, Abstract cited Suphidsara Thothong, 2004: 87-88) studied about using problem-based curriculum to teach for evaluating learners skills in about self-directed learning, critical thinking skills and others skills. The result found that the using PBL group had more critical thinking skills than others. They had developed other skills. In addition, it had consistent the research of Kyle and Moor **(**Kyle and Moor, 2001) they developed mathematic teaching that linked to daily life of students by visiting family of students. They used to talk informal and structured interviews. They brought the information to develop for various problems and had steps for solving problem. They brought for students to join solving problem in group. The result found that parents of students had more mathematics knowledge. The management of mathematics learning had consistent with national education act Buddhist era 2542 (Revised edition Buddhist era 2545 and Buddhist era 2553) that focusing knowledge construction, act, focus on process skills by the way, active Learning management and all so consisted the concept of National Council Teaching Mathematics of America **(**NCTM**)**.

The evaluation based on STEM learning management would to use various techniques for evaluation such as content summary activity, student record, activity survey, troubleshooting, reporting and portfolio. Nowadays, focusing on measurement and evaluation for assessment for learning and assessment as learning. Consistency the concept of Srinakharinwirot university academic service center (2013: 49 – 54) told that measurement and evaluation of learning was one of the key elements in every subjects of learning process. Today measurement and evaluation focusing to help students had learning, controlling and stimulating by themselves.

2. The result for construction and development of the mathematics curriculum for excellence had quality at a very high level. It could to teach for development of the mathematics excellence. Because of the mathematics curriculum for excellence every level had analyzed basic information and necessary requirements through analyze the situation of teaching and learning

mathematics and fundamental before development at the next step. Consistency the concept of Taba's curriculum development (1962) told that the step of curriculum development should consider social needs. Taba presented the concept to develop curriculum called that "Grass Roots Approach" or top down to bottom up; He believed that the person who teaches in the curriculum should had participate in curriculum development.

This curriculum had focusing on the development mathematics excellence for learners to be effective by each level set the guidelines in differentiated learning management; the kindergarten level set the activities for learners by using Art base (Art Math), the primary school level set integrated approach to activities **(**Integrated Math), the secondarly school level focusing on students had creative thinking **(**Creative Math) and high school level focusing on linking and applying mathematics in everyday life, the activities that focus on excellence learners **(**Excellence Math**).** It consistent with goal of curriculum and Evaluation framework of PISA that focusing on mathematics process such as thinking and reasoning, problem posing and solving, communication and pointed out that mathematics learning focusing on thinking and problem solving. It consistent the research of Watchara Noimee (2008), Suphachai Suriyakamon (2008) and Wedcharid Ungkanaphattharakhajorn (2008) studied focus on development ability to think, reasoning and solving math problems for the mathematics curriculum for excellence in secondary school **(**Creative Math**)**. That pointed out that it was promoted creative thinking for learners to study mathematics. It could say that curriculum development had target or purpose of curriculum emphasized creative learners. It was consistency the research of Parunat Nutnarid (2010) and Chaweewan Tansuk (2013) that developed creative curriculum based on creative education for students to create a job, work piece that different from the original. The learners were planning, designing, a variety of activities, created, reflection of promotion, thinking, problem solving. It was consistency of Thorndike learning theory (1949); American educator and psychologist, he believed connectionism theory and the law of exercise or repetition. He found that repetition or exercise, if someone repeatedly would make the action accurate, complete and stable. It consistent of Singapore mathematics curriculum that emphasized with development of attitude or attitude towards learning and consistency theory of learning, happiness learning and enhancing good attitude in learning.

3. The result of try out the mathematics curriculum for excellence consistent of organizing learning activities in a focused way for learners to practice of Surachai Sariphandon (2010), Omrudee Chamubon (2010), Thanyarat Thanurat (2011), Waraporn Chodtirattanakun (2011) and Theerachet Roungsulanun (2011) that organize learning activities that focus on the students to practice had affected to students learning mathematical problem solving. Course

documents were linked and consistent had affected to the course was convenient. Moreover guidelines for teaching activities could promote the learners learnt, used knowledge, ability and ideas fully. It was promoted the learners had more mathematical skills. It was consistency the research of Katwibun (2004: online) studied satisfaction of learners toward mathematics that used problem based learning. The result of study found that the learners had satisfied with the learning activities of mathematics by using PBL learning activities. The learners had opinion about mathematics had the most essential things in everyday life and Lee and Kim 's research (2001) studied the effects of using tools to support collaborative representation. It was consistency with brain based learning theory that said learning of learners would be occur from challenged and had fun learning. Learning was promotion for students faced with an environment that stimulated learning. Brain cells were born with maximum connectivity when they were encouraged to face challenging situations for learners to learn through the play process, happy and stress-free because stress was the downfall of learning. It was consistency with students' opinion that they wanted to learn mathematics by using this curriculum. In addition to knowledge and mathematical process skills, they could be practiced of problem solving, learning English, could be applied to other subjects and improved math skills.

4. The results of evaluating of mathematics excellence curriculum found that the curriculum developed on the needs of the instructor. The research team studied the essential needs of all parties concerned such as learners, mathematics experts, development experts and mathematics teachers. The results of the study were analyzed to develop the mathematics excellence curriculum. The process was consistency with concept of curriculum development by Beach and Reinhartz (2000). They explained sources of 3 major source curriculums such as values of society, interests and needs of learners and important information from content experts. They were important resources that made the curriculum effective and met the course goals. The research team considered the development of learners at each level that were different so that the psychology of learning was so different, teaching activities and exercises were according to the class and age of learners. It was consistency theories of learning 3 theories, 1) behaviorism or S-R (stimulus-response) theory, 2) cognitive-field or Gestalt theory) and 3) humanist theory or motivation theory. (Beach and Reinhartz, 2000)**.** The lesson plans had development of teaching process to be clear to facilitate the use of the instructors. Teaching activities encouraged learners to learn. They could improve math skills for students. The measurement and evaluation reflected the potential of individual learners and the differentiated between the learners.

Suggestions

Suggestions for bringing research results onto use

1. Before applying the mathematics excellence curriculum should be study the curriculum include course materials to prepare you for the media and must be clarified the step to use curriculum to the relevant people; teachers, learners and parents.

2. Implementation of the mathematics excellence curriculum. School must be ready for the instructor to graduate in the field (mathematics) to provide knowledge transfer was clear. Because of the content in the course is intense and profound.

3. Selecting students into the mathematics excellence curriculum should be selected the students from knowledge. They were no difference in mathematics, had a good attitude and ready to study math.

4. The mathematics excellence curriculum had goal to develop the learners to mathematics excellence so that the teachers should be understand the goals of the course, learning outcome, mathematics content, teaching methodology all so mathematics measurement and evaluation, were a qualified mathematics teacher, mathematics education or through training in mathematics.

5. Taking the curriculum to use can be fine tuned, organized learning activities, method of measurement and evaluation to suit the learner and adjust mentoring and coaching suitable for school policy and affiliation.

Suggestions of further research

1. There should be a research for development model of teaching, measurement and evaluation for mathematics excellence curriculum to be used in conjunction with the mathematics excellence curriculum.

2. There should be a research for development of students' mathematical learning periodically and continuously until the students graduate and including mathematical concepts.

3. There should be a research for development of mentoring and coaching system of teachers in teaching mathematics based on the curriculum of excellence; peer coaching and expert coaching.

4. There should be development the mathematics excellence curriculum integration STEM. It led to the creation of a future innovation called Steam (STEAM).

5. There should be a research for the mathematics excellence curriculum at the other schools such as the office of the higher education commission.

Suggestions of policy

1. Municipal, Provincial Administration Organization, Department of Local Administration Ministry of the Interior should be bring the mathematics excellence curriculum applied to other schools that had readiness and willingness. It was a condition that the students should be screened for excellence in mathematics. There should be a clarification meeting with the math teachers about the goals of the curriculum and in conjunction with the mentoring system (Mentoring and Coaching).

2. School could be bring the mathematics excellence curriculum applied in the school in the form of additional courses, student development activities, reduce time to learn and camp activities excellence in mathematics. This was in keeping with the curriculum structure of the school.

3. Related agencies should be improved the mathematics excellence curriculum at various levels for suitable the context, conditions and needs of learners and schools.

4. There should be development the model of introduction to mathematics excellence curriculum by adaptation of learning activities in the form of integrated mathematics instruction; EBE EIS EP to be consistent learning management in the context of ASEAN and 21st century teaching.

Bibliography

Bureau of Academic Affair and Educational Standards, (2008). **Problem Based Learning**. Bangkok: Bureau of Academic Affair and Educational Standards.

Ministry of Education (2005) "The announcement of the Ministry of education about the standard graduate courses in 2005 " Vol.122. Special Edition 39 D. Government Gazette 25th May 2005, page 14-15.

Ministry of Education, Singapore. **(**2012**). Primary Mathematics Teaching and Learning Syllabus**. Singapore: the Ministry of Education.

National Council of Teachers of Mathematics [NCTM]. **(**1989**). Curriculum and evaluation standards for school mathematics**. Reston, VA: National Council of Teachers of Mathematics.

Noimee Watchara. 2008. The Development of Mathematics Learning Packages Throughs Inquiry on "Reasoning Mathematics Proof" to Promote Reasoning Skills of Mathayom Suksa IV

Students. Master thesis. M.ED. (Secondary Education). Bangkok: Graduate School, Srinakharinwirot University.

Taba, H. (1962). **Curriculum Development: Theory and Practice.** New York: Harcort, Brace and world.

Wood, D.; Bruner, J.; & Ross, G. (1976). **"**The role of tutoring in problem-solving**."** **Journal of Child Psychology and Psychiatry**. 17(2): 89-100.