



**Course Code** : **PM-6522**  
**Course Title** : **Integrating Constructivism and Meaningful Learning in Student-Centred Primary Mathematics Classrooms**  
**Duration** : **4 weeks (31 March – 25 April 2008)**  
**Participants** : **Primary teachers teaching mathematics or mathematics educators**  
**Course Supervisor** : **Mr. Teoh Boon Tat**

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## **1. Rationale**

The use of traditional approaches in mathematics classrooms has made students learn mathematics passively. They find mathematics uninteresting and they have a shallow understanding of it. In contrast, constructivist teaching will result in students learning mathematics in a more meaningful and interesting way. This is because in constructivist teaching students learn by actively constructing new knowledge by integrating the new knowledge received with their prior ones.

## **2. Objectives**

The main objective of the course is to help participants gain knowledge on constructivism and acquire skills<sup>7</sup> in applying constructivist approaches in the classroom.

At the end of the course, the participants should be able to:

- understand the theory and practice of constructivism;
- gain knowledge on meaningful learning and student-centred learning;
- gain skills in applying meaningful constructivist approaches in primary mathematics classes;
- assess student's prior knowledge, conceptions, motivation and mathematical learning;
- apply lesson study principles in improving meaningful lessons in primary mathematics; and
- design instructional activities that promote meaningful learning;
- develop and try out lessons/activities based on constructivist approaches in primary mathematics.

### 3. Content

The course will be activity-oriented and requires active involvement of participants in group discussions, sharing of experiences, demonstrations, planning and developing sessions in the area of constructivism. Lectures will be kept to a minimum.

The major areas include:

- Trends & issues in mathematics education;
  - Constructivism in education: theory, practice and research
  - Learning theories
  - How children learn mathematics:
    - Conceptions and misconceptions
    - Learning difficulties in mathematics
  - Meaningful learning: teacher-centred vs student-centred approaches
- Exemplars of approaches in constructivist teaching and learning of primary mathematics through:
  - Problem-based learning
  - Communication and values using
    - Cooperative learning
    - Manipulatives
- Exemplars of ICT approaches in constructivist teaching and learning of primary mathematics through:
  - Investigation and exploration using
    - Computer software programme
    - Hand-held technology
    - World Wide Web
- Constructivist-based holistic assessment:
  - Strategies to gather learner's prior knowledge, conceptions, motivation and learning
  - Assessment tools
  - Analysis and interpretation of data
- Lesson Study- improving meaningful constructivist lessons in primary mathematics; and
- Planning/Designing/Developing and Trialing of sample lessons/ instructional materials with emphasis on constructivist approaches for primary mathematics classrooms.

No	Topics	No. Hour	Staff	Strategies/ Activities	Expected Outcomes
<b>1.0</b>	<b>ORIENTATION AND ADMINISTRATION [10]</b>				
1.1	Welcoming ceremony, orientation, general briefing	4	AZA AR FLK CUH RO ZTT VAR	Official welcoming by Center Director, briefing by heads of division, accountant & librarian. Tour of RECSAM's facilities.	Familiarization with RECSAM administration & facilities. Acquainted with Learning Resource Center's rules & regulations.
1.2	Course briefing and pretest	2	TBT	Briefing and discussion, paper & pencil assessment	Overview of the 4-week course and objectives. Pre-instructional perception of knowledge and skills.
1.3	Course evaluation and posttest	2	R&D TBT	Evaluation, paper and pencil assessment	Feedback and comments on the learning process at RECSAM. Post-instructional perception of knowledge and skills.
1.4	Closing ceremony and presentation of certificates	2	AZA AR FLK CUH KJS VAR	Official closing & certificate presentation by guest of honor	Awarding of certificates to participants.
<b>2.0</b>	<b>GENERAL COMPONENTS [16]</b>				
2.1	Basic ICT Skills <ul style="list-style-type: none"> <li>• Familiarization with RECSAM's ICT System</li> <li>• Word Processor</li> <li>• Spreadsheet</li> <li>• Presentation</li> </ul>	8	CAN FBI	Hands-on computer lab activities	Optimize the use of RECSAM's ICT system and increased proficiency in at least 3 <i>basic/intermediate</i> ICT tools.
2.2	Multiplier Effect - initiating and implementing changes and proposal presentation	2	CUH TBT CAN	Lecture Video Discussion	Present a proposal outlining a practical plan of action to disseminate information and knowledge learned from the course.
2.3	Lesson Study - improving meaningful constructivist lessons in primary mathematics	6	R&D	Lecture Video Discussion Hands-on & minds-on activities	Understand the principles of lesson study and how they are utilized to improve meaningful mathematical learning in the classroom.

3.0	SPECIALIZATION OR CORE COMPONENTS [100]				
3.1	TRENDS & ISSUES IN MATHEMATICS EDUCATION	[10]			
3.1.1	Constructivism: theory, practice and research	2	ML	Lecture Group discussion Hands-on & minds-on activities	Explain the theory and research of constructivism and how they are practiced to enhance meaningful learning.
3.1.2	Meaningful learning in mathematics – teacher-centred and student-centred approaches	2	IDA	Group work Presentation Hands-on & minds-on activities	Compare and use appropriate teacher & student centred approaches in promoting meaningful learning.
3.1.3	Learning theories	2	ML	Group discussion Presentation Hands-on & minds-on activities	Explain contemporary theories of learning and brief comparison with traditional theories. Explain how these theories enhance meaningful learning.
3.1.4	How children learn mathematics:			Lecture	Appreciate the knowledge of conceptions, misconceptions and learning difficulties in mathematics. Demonstrate ways to enhance conception and overcome the misconceptions and difficulties.
	- Conceptions and misconceptions	2	IDA	Group work	
	- Learning difficulties in mathematics	2	IDA	Hands-on & minds-on activities	

<b>3.2</b>	<b>EXEMPLARS OF APPROACHES IN CONSTRUCTIVIST TEACHING AND LEARNING OF PRIMARY MATHEMATICS</b>	<b>[38]</b>			
3.2.1	Problem-Based Learning			Demonstration Discussion Group work	Demonstrate an understanding of the philosophy of PBL as an instructional strategy for meaningful learning. Describe a framework to integrate PBL with current primary mathematics curriculum and classroom practices. Demonstrate concepts of facilitation and distinguish facilitating strategies. Address PBL classroom management issues. Design authentic PBL assessment and lesson plan.
	Problem-Based Learning Workshop <ul style="list-style-type: none"> <li>• PBL : what and why</li> <li>• Facilitation : Abbey Grange</li> <li>• Case introductions</li> <li>• Authentic assessment</li> <li>• Lesson planning</li> </ul>	18	ANN		
3.2.2	Communication & Values			Group work Discussion Peer evaluation Conjecturing Presentation	Demonstrate knowledge and proficiency in using these approaches to enhance meaningful learning in mathematical concepts and human values. Use tools like a dynamic geometry software, simple calculator, interactive web activities and manipulatives. Emphasis is on rich mathematical tasks and content.
	<ul style="list-style-type: none"> <li>• Cooperative Learning</li> </ul>	4	TBT		
	<ul style="list-style-type: none"> <li>• Manipulatives</li> </ul>	4	IDA		
3.2.3	Investigation & Exploration through ICT				
	<ul style="list-style-type: none"> <li>• Software Programme</li> </ul>	4	TBT WAP		
	<ul style="list-style-type: none"> <li>• Hand-Held Technology</li> </ul>	4	TBT		
	<ul style="list-style-type: none"> <li>• World Wide Web</li> </ul>	4	CAN		
<b>3.3</b>	<b>CONSTRUCTIVIST-BASED HOLISTIC ASSESSMENT</b>	<b>[6]</b>			
3.3.1	Strategies to assess student's prior knowledge, conceptions, levels of interests and mathematical learning	6	MG FS	Role play Video Group / Pair work Discussion Presentation	Use holistic strategies to gather student's prior knowledge, conceptions, motivation, levels of interests and learning. Develop and use assessment tools to gather the above info. Gain skills in analyzing the data collected.
3.3.2	Assessment tools				
3.3.3	Analysis and interpretation of data				

3.4	THEORY INTO PRACTICE	[46]			
3.4.1	Planning, Designing & Developing	20	TBT	Lecture Group discussion Group work	Use instructional design principles to plan, design & develop instructional materials to enhance primary students' meaningful learning in mathematics.
3.4.2	Implementation	8	TBT	Station materials Micro teaching Peer evaluation Lesson try out	Try out teaching aids/instructional materials to support primary students' meaningful learning in mathematics.
3.4.3	Project work / Library hours	16	TBT	Self access Search work Group work Discussion	Produce a printed report of the project work, complete with a description of the theories, development of the teaching materials, worksheets, assessment, approaches, findings, suggestions and conclusion.
3.4.4	Presentation of project work findings	2	TBT	Presentation Q & A	Present project work, findings, suggestions & conclusion.
4.0	ENRICHMENT ACTIVITIES [4]				
	Out door mathematics	4	TBT	Maths Trail in Penang Hill	Enriched experience and knowledge of mathematics in nature and in natural surrounding.
5.0	HOLIDAYS [0]				
	No holiday	0			
	<b>TOTAL NUMBER OF HOURS</b>	<b>120</b>			

#### DISTRIBUTION OF HOURS

Course Components	Number of Hours	Percentage of Hours
Orientation and Administration	10*	-
General Components	16	13.33
Specialization / Core Components	100	83.33
Enrichment	4	3.33
Holidays	0	0.00
<b>Total</b>	<b>120</b>	<b>100.0</b>

- Not included

## TEACHING STAFF OR PERSONNEL INVOLVED

CODE	NAME	POSITION
AZA	Dr. Azian T.S. Abdullah	Centre Director
AR	Hj. Ahmad B. Ramli	HoD (Administration Division)
FLK	Ms. Foo Lay Kuan	HoD (Training Programme Division)
CUH	Dr. Cheah Ui Hock	HoD (R & D Division)
RO	Ms. Rashidah Bt. Hj. Othman	Accountant
ZTT	Hj. Zamani Tajudin B. Yusof Tajudin	Librarian
KJS	Ms Kalei Joethi Sahadevan	Publication Executive
DRP	Mr. Devadason Robert Peter	Senior Specialist, R&D
TBT	Mr. Teoh Boon Tat	Specialist, TPD
CAN	Mr. Chockalingam Annamalai	Specialist, TPD
NKT	Ms. Ng Khar Thoe	Specialist, R&D
WAH	Dr. Wahyudi Yososutikno	Specialist, R&D
WAP	Dr. Warabhorn Preechaporn	Specialist, R&D
ANN	Dr. Ann Lambros	Consultant, USA
MG	Assoc. Prof. Dr. Munirah Ghazali	Consultant, USM
FS	Assoc. Prof. Dr. Fatimah Salleh	Consultant, USM
IDA	Dr. Ida Karnasih	Consultant, Indonesia
ML	Dr. Michael Liau Tet Loke	Consultant, Penang
VAR	Various Persons	-

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