RENCANA PEMBELAJARAN SEMESTER (SILABUS)

Faculty   : MIPA

Study program   : PENDIDIKAN MATEMATIKA

Course name/Code   : PSYCHOLOGY OF MATHEMATICS LEARNING/PMA202

Unit of credit   : 2

Prerequisite course   : Psikologi Pendidikan

Semester   : 3

Course convenor   : Endah Retnowati, Ph.D

Course description

This lecture discusses about the application of psychology into mathematics learning. The discussions cover the basic principles of

meaningful learning which includes the process of knowledge construction and automation, effective strategies of encoding and retrieval of knowledge, why some materials are difficult to understand, social-cognitive factors on learning, mathematics problem solving procedures as well as the challenges of learning mathematics problem solving.

Learning Outcomes

This lecture is proposed to assist students understand the basic principles of meaningful learning in mathematics and the challenges students faced when learning mathematics themes. Accordingly, students can offer critical psychological considerations when assisting students during learning mathematics.

Meeting:	Learning outcomes in the meeting	Indicator	Learning content	Learning methods	Learning experience	Assessment	Time allotted
(1)	(2)	(3)	(4)	(4)	(4)	(5)	(6)
1	Explain the meaning and significance of educational psychology for mathematics learning process	1. Explain the meaning of psychology 2. Mention learning theories developed by associationist and also cognitivists 3. Explain learning theories developed by associationist and also cognitivists 4. Explain the shift from behaviorism into cognitivism 5. Explain the perspective of cognitive psychology to define learning process	1. Introduction to psychology of mathematics learning. 2. A brief history of associationist (behaviorist) and the cognitive era. 3. New perspective of cognitive psychology in education	Question-Answer, classroom discussion and assignment to summarise the material	✓ Review the meaning of psychology through question and answer ✓ Discuss learning theories developed by associationists and also cognitivitists ✓ Analyse the shift from behaviorisme era into cognitivism ✓ Discuss the perspective of cognitive psychology to define learning process	Attitude as becoming responsible to follow the instruction and showing effort to actively involve in the discussions	100'

2	Explain how mathematics knowledge is acquired	1. Explain how students use sensory memory to give attention, perceive and pattern recognition received information 2. Explain how information is processed by sensory memory for then it is selected to be assign meaning in working memory 3. Explain the role of prior knowledge stored in long term memory that support the process in the sensory and working memory.	Information processing theory: 1. the role of sensory memory 2. working memory in acquiring information 3. The role of long term memory for storing knowledge	Classroom discussion and assignment to summarise the material	✓ Discuss information processing theory including the role of sensory memory, working memory and long term memory when organising knowledge ✓ Observe themself when processing information	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	100'
3	Distinguish types of knowledge and some conceptualizations of information stored in long term memory; and also give examples in mathematics	1. Explain types of knowledge 2. Types of mathematical knowledge 3. Explain the difference between semantic and episodic memory 4. Give example semantic and episodic memory in mathematics learning 5. Explain the building block of cognition 6. Explain why schema is commonly refer to explain knowledge structure	1. Types of knowledge: declarative, procedural and conditional 2. Semantic vs. episodic memory 3. Building block of cognition: concepts, propositions and schemata	Group discussion and assignment to summarise the material	✓ Discuss types of knowledge ✓ Categorise mathematics materials into their types ✓ Discuss the building block of knowledge	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	100'

4	Explain schema construction and automation as the main purpose of mathematics learning	1. Describe Bartlett's study 2. Describe Piaget's schema theory of assimilation and accommodation 3. Give examples of assimilation and accommodation in mathematics 4. Explain the important of schema automation for mathematics learning transfer	1. Bartlett's study and Piaget's theory of schema construction 2. How schema automation develops 3. Significant contribution of schema automation for learning transfer	Group discussion and assignment to summarise the material as well as to upload a file into besmart	✓ Role-playing as the participant of Bartlett's study ✓ Discuss Piaget's schema theory in mathematics learning ✓ Discuss the important of schema automation ✓ Observe themself as an example of the use of schema automation during learning	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	100'
5	Explain how students encode wither simple or more complex information on mathematics	1. Explain encoding strategies for simple information 2. Give example the use of encoding strategies for simple mathematics knowledge 3. Explain encoding strategies for complex information 4. Give example the use encoding strategies for complex mathematics knowledge 5. Explain metacognitive 6. Give example of metacogntive in mathematics	1. Encoding simple information: mediation, imagery and mnemonics strategies. 2. Encoding more complex information: activating prior knowledge, guided questioning and levels of processing strategies. 3. Metacognition.	Group discussion and assignment to summarise the material as well as to upload a file into besmart	✓ Discuss encoding strategies ✓ Discuss examples the use of these strategies in mathematics learning ✓ Identify which strategy to be used in their learning	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	100'

6	Explain how students retrieve mathematics related information already stored in their memory	1. Explain retrieval process that is to remember knowledge already learned 2. Give example how to assist students retrieve their prior knowledge to learn new material or solve mathematics problems.	1. Retrieval processes: encoding specificity, recognition and recall, reconstruction, recalling specific events, and relearning	Group discussion and assignment to summarise the material as well as to upload a file into besmart	✓ Discuss retrieval strategies in mathematics learning ✓ Identify which retrieval strategy can be used during this lecture	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	100'
7	Explain some social-cognitive factors influencing to mathematics learning process	1. Explain self-efficacy as a factor that influences mathematics learning 2. Explain attribution as a factor that influences mathematics learning 3. Explain autonomy and control as a factor that influences mathematics learning	1. Self-efficacy (Social-cognitive theory of Bandura) 2. Attributions 3. Autonomy and control	Group discussions, presentations and assignment to upload a file into besmart (**Project-1**)	✓ Discus several social-cognitive factors influencing to mathematics learning process ✓ Discuss how to create conditions that always support these factors for effective mathematics learning	✓ Assessment of summary assignment ✓ Assessment towards the presentation skills ✓ Attitude of responsibility and effort to actively involve in the discussions	100'
8		4. Explain self-belief about intelligence as a factor that influences mathematics learning 5. Explain self-belief about knowledge as a factor that influences mathematics learning	4. Belief about intelligence 5. Belief about knowledge				100'

9		6. Explain theory of Vygotsky (zone of proximal development, scaffolding) as a factor that influences mathematics learning	6. Vygotsky's theory: Role of classroom discourse and collaboration with peers in knowledge construction				100'
10			Mid-term exam		○		100'
11	Explain how students solve mathematics problems	1. Explain the meaning of problem solving 2. Give example of mathematical problem solving 3. Explain general procedure of problem solution 4. Explain the difference between mathematics novice and experts when solving problems 5. Draw the pre-requisite for students learning through problem solving	1. What is problem solving 2. Problem solving procedures 3. Difference between mathematics novice vs. expert problem solvers	Group discussion and assignment to summarise the material	✓ Discussion the meaning of problem solving ✓ Demonstrate general procedures of problem solution ✓ Identify the difference between mathematics novice and expert problem solvers	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	100'
12	Explain why some material are difficult to understand	1. Give examples of difficult mathematics material 2. Explain why some materials are difficult to understand 3. Explain intrinsic cognitive load	1. Example of difficult materials in mathematics 2. Factors contributing to difficulty in understanding a	Group discussion and assignment to summarise the	✓ Discuss examples pf difficult mathematics material and explain the	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively	100'

		4. Explain extraneous cognitive load	mathematics material (intrinsic and extrinsic cognitive load)	material	possible reasons	involve in the discussions	
13	Draw principles of meaningful learning Explain the concept of creativity	1. Explain principles of meaningful mathematics learning 2. Explain the concept of creativity 3. Explain Taxonomy Bloom 4. Explain how to foster creativity growth	1. Principles of meaningful mathematics learning 2. Creativity	Group discussion and assignment to summarise the material	✓ Draw conclusion from the material learned previously, what principles of meaningful mathematics learning ✓ Discuss the concept of creativity as the last stage in taxonomy bloom	✓ Assessment of summary assignment ✓ Attitude of responsibility and effort to actively involve in the discussions	
14	Identify the challenge of arithmetic problem solving	1. Give example of problem solving in arithmetic 2. Identify challenges of solving arithmetic problems using research results 3. Explain possible solutions	How students solve arithmetical problems such as number representations, computations	Group discussions, presentations and assignment to upload a file into besmart (**Project-2**)	✓ Discuss examples of problem solving in arithmetic, algebra and geometry ✓ Discuss challenges that students may deal when solving these problems ✓ Discuss possible solutions	✓ Assesment of summary assignment ✓ Assessment towards the presentation skills ✓ Attitude of responsibility and effort to actively involve in the discussions	100'
15	Identify the challenge of algebraic problem solving	1. Give example of problem solving in algebra 2. Identify challenges of solving algebraic problems such is in word problems or modeling 3. Explain possible solutions	How students solve word problems or equations				100'

16	Identify the challenge of geometrical problem solving	1. Give example of problem solving in geometry 2. Identify challenges of solving geometrical problems 3. Explain possible solutions	How students solve geometrical problems				100'

Assessment

Assessment includes aspects of attitude, knowledge, and skills which are weighted as below.

No	Component	Weight (%)
1	Attitude toward learning	20
2	Individual assignments	20
3	Group-project assignment (2 projects) - Summary of project materials - Presentation skills	20
4	Mid-term exam	20
5	End-term exam	20
	Total	100

References

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Mengetahui

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