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Research Article

METHODS THAT DEVELOP THE DIDACTIC STRUCTURE OF STUDENTS' COGNITIVE ACTIVITY IN THREE STAGES OF A MATH LESSON

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Yunusova Gulnoza Abduxalikovna
Phd, Associate Professor, Department Of Natural Sciences Of The Academy Of The Armed Forces Of The Republic Of Uzbekistan

ABSTRACT

In the article we will consider the problem relevant in higher educational institutions, namely: what stages should constitute a mathematics lesson, also, at each stage, what methods should be used in order to develop students' cognitive activity.

KEYWORDS

Phases (or parts), introduce, investigate, explore, wrap-up, learning task, intriguing problems, math concepts, planned discussions and activities, ways of learning, problematic question, conjectures, misconceptions, alternative explanations, conclusions, organize information, mathematical language, observing, classifying, communicating, measuring, predicting, interpreting, organize information, develop, extend, connect, instructional step.

INTRODUCTION

When teachers nurture a safe learning community within their classrooms, students respect each other's ideas, are patient with one another, recognize there can be multiple perspectives and ways of learning, and recognize the value of individual contributions to group learning [1]. With their anxiety lowered, students are physiologically more able to accept new challenges and grapple with new concepts and problems. Notwithstanding high education, in particular math' community has not reached consensus about what to call them, it is common practice among research-based math curricula to organize lessons into three phases (or parts).

During the first phase, often called "introduce", the teacher encourages students to draw on their prior knowledge in order to engage with a new concept. In phase two, "investigate" or "explore," students work with the new concept in the form of a meaningful problem [2]. During the third phase of a mathematics lesson, "summarize" or "wrap-up," students and

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teachers draw conclusions and make connections to related concepts.

MATERIALS AND METHODS

According to John Carr, Catherine Carroll, Sarah Cremer, Mardi Gale, Rachel Lagunof, and Ursula Sexton in this article, we use introduce, investigate, and summarize to label the three phases, as reflected in Figure 1.1.

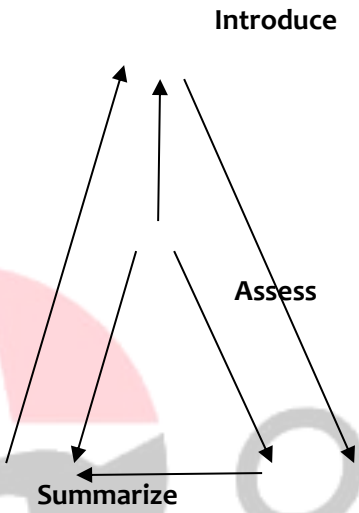

Figure 1.1. THREE PHASES OF MATHEMATICS INSTRUCTIONS

Note that student assessment is continuous throughout the three phases because teachers use feedback from assessment to adjust instruction during all phases [3]. Each of the three phases is described below, followed by an except of a teacher's vision for implementing that phase in the classroom.

RESULT AND DISCUSSION

Introduce. The learning process begins as the teacher guides students to make connections between the learning task at hand and their past academic, personal, and cultural experiences. The goal is to engage students in learning by sparking their curiosity, posing intriguing problems, or asking thought-provoking questions. This phase also offers the teacher opportunities to identify students' preconceptions and misconceptions about a mathematical concept. When misconceptions arise, they are simply acknowledged along with other brainstorming ideas, but the teacher mentally notes these misunderstandings to ensure that they are explicitly addressed at the proper time [1].

As part of this phase, it can also be useful for a teacher to make explicit the goal math concepts of theme and that are the focus of the lesson. For example,

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teacher presents these objectives to students orally and in writing. Doing so makes it crystal clear to students how the planned discussions and activities.

When the teacher makes learning objectives explicit, it helps all students focus on the "bull's eye" from the start of the lesson; and it sets the basis for students to reflect on how well they achieved those objectives at the end of the lesson. The teacher plans a lesson that targets those specific content and language objectives, and reflects after the lesson on how well the instructional strategies and learning activities stayed on course and met the objectives.

In my class . . . I begin my lesson with an intriguing idea, image, or problematic question (for example like 'branch storm') to engage students. I pose questions about what my students (nowadays cadets) already know, make conjectures about how to solve a problem, and encourage them to pose questions about what they want to learn. This alerts me to what my cadets already know, their misconceptions, and areas of potential confusion [4].

Investigate. The teacher guides students as they investigate a mathematical task, work toward a common understanding of specific concepts, and acquire problem-solving and computational skills. The teacher designs activities that encourage students to construct new knowledge or skills, propose preliminary ways of thinking about a problem, "puzzle" through problems, and try alternatives to get a solution. As students engage with the mathematics, the teacher encourages them to demonstrate or explain their conceptual understanding of the problem and the process skills they used to arrive at their conclusion. Students debate alternative explanations for their conclusions and use new facts to correct their prior misconceptions. As appropriate, the teacher directs students' attention back to helpful points from the introduce phase of instruction. Students are guided to organize information supporting their ideas or conclusions into evidence-based statements, using mathematical language.

In my class . . . Rather than telling my cadets the concepts I want them to learn, I expect them to think critically about the concepts by experimenting, investigating, observing, classifying, communicating, measuring, predicting, and interpreting. This active engagement arouses their curiosity and leads them to discover new ideas or reconsider their earlier thinking.

I guide cadets to explain their thinking by asking questions and facilitating peer discussions, by giving them time to think, and I facilitate active discussions to correct misconceptions. I provide time to question and justify answers. I do not just answer questions that students pose, nor do I simply decide for them which answers are right or wrong.

Summarize. The summarizing phase involves more than just revisiting what has been learned. During this phase, the teacher engages students in activities and discussions that challenge and extend their conceptual understanding and problem-solving skills. Students apply what they have learned to new mathematical tasks and experiences to develop, extend, connect, and deepen their understanding of the concepts [5].

In my class . . . At the end of an instructional step, I help cadets compare, contrast, combine, synthesize, generalize, and make inferences by asking them to solve a problem or perform a task that introduces a somewhat different context from those they have just experienced. I want cadets to be able to apply new knowledge, make connections, and extend ideas.

Assess. Throughout the three phases of inquiry-based mathematics instruction, the teacher assesses

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students' progress and asks students to evaluate themselves. Feedback may come from quick, on-the-spot checks for understanding (e.g., expressed with hand gestures, white boards), quizzes, student discussions, journals, or other techniques [6]. The teacher uses the feedback to reflect on how effective a class was, and to make mid-lesson adjustments to better meet students' needs and interests. Students use the feedback to reflect on what they understand, what they still need to learn, and what they want to learn next [7].

In my class . . . I test cadets on more than just factual knowledge; during an assessment, I challenge cadets to construct ideas and explanations, just as I do during class instruction. I want assessments to reflect both my objectives and the content standards. As a facilitator, the teacher nurtures creative thinking, problem solving, interaction, communication, and discovery. Finally, as a guide, the teacher helps to bridge language gaps and foster individuality, collaboration, and personal growth. The teacher moves flexibly into and out of these various roles, as appropriate for each lesson [8].

CONCLUSION

One of the promising directions of monitoring the quality of knowledge as a condition of personality-oriented continuous education can be active methods of education, the analysis of which showed that the cognitive interests of students manifested in a particular subject area are proportional to the results in the relevant academic disciplines [9], and at the same time revealed that the formed cognitive interest regardless of, in which subject area it is formed, has a positive impact on the overall effectiveness of training, providing-higher level of both natural-mathematical and humanitarian education; and also to increase the effectiveness of cognitive activity of students in subjects not related to the sphere of their professional interests, which ensures the effectiveness of the organization of personality-oriented continuing education [7,9].

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