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CURRENT STATUS OF COMPETENCY IN FORMING CONCEPTS OF SETS, QUANTITY, AND COUNTING AMONG EARLY CHILDHOOD EDUCATION STUDENTS AT THAI NGUYEN UNIVERSITY – DIEN BIEN CAMPUS

Pham Thi Thu Phuong¹ and Doan Thi Hang Nga²

¹Dien Bien Campus, Thai Nguyen University, Vietnam
Phamphuong0909@gmail.com

²Dien Bien Campus, Thai Nguyen University, Vietnam
Hangngacdspdb@gmail.com

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ABSTRACT

The formation of concepts of sets, quantity, and counting (elementary mathematics) for preschool children plays a fundamental role in developing logical thinking, intellectual capacity, and cognitive understanding of the surrounding world. This study focuses on assessing the competency of Early Childhood Education students in concept formation of sets, quantity, and counting, and proposes measures to enhance this competency to ensure professional adaptability after graduation. The competency framework includes understanding of child psychology and elementary mathematical knowledge, the ability to design and organize learning activities, preparation of educational materials, integration of technology, and evaluation of learning outcomes. The findings indicate that students at Thai Nguyen University – Dien Bien Campus have achieved certain positive results; however, several limitations remain, highlighting the need for appropriate institutional and pedagogical support to further develop students' competency in concept formation of sets, quantity, and counting.

KEYWORDS: Concept formation of sets, quantity, and counting; Competency; Competency in concept formation of sets, quantity, and counting among students

1. INTRODUCTION

The formation of concepts of sets, quantity, and counting (elementary mathematics) for preschool children plays a fundamental role in developing logical thinking, intellectual capacity, and cognitive understanding of the surrounding world. This process enables children to develop essential skills such as comparison, analysis, and synthesis, thereby creating a solid foundation for learning mathematics at the primary level. These objectives can only be effectively achieved when teachers possess the competency in concept formation of sets, quantity, and counting through the organization of educational activities. Therefore, developing this competency among Early Childhood Education students is essential in current preschool teacher training programs. Accurate assessment of students'

competency in concept formation of mathematical knowledge for children, along with the proposal of appropriate measures to enhance this competency, serves as a crucial foundation for ensuring that graduates can effectively organize educational activities and support children in becoming familiar with mathematics in an accessible and meaningful way.

This competency also enables students to design creative “learning through play” activities, fostering elementary mathematical thinking, promoting holistic intellectual development, and preparing children effectively for primary education by strengthening skills such as counting, comparison, and number recognition. However, in practice, although the development of this competency in preschool teacher training at universities and colleges has received considerable attention and achieved notable results, several limitations still exist in both lecturers’ teaching practices and students’ self-development. These challenges highlight the need for further improvement in training processes, and this paper aims to present and discuss these issues.

2. RESEARCH METHODS

2.1. Methodological Framework

The study employed theoretical research methods to examine the principles of organizing mathematics familiarization activities for preschool children, as well as teacher interventions to enhance the effectiveness of these activities, in order to assess the current status of competency in concept formation of sets, quantity, and counting among students majoring in Early Childhood Education at the Dien Bien campus of Thai Nguyen University [1][2][3][4][5][6][7][8].

Survey research methods were applied using questionnaires administered to administrators, lecturers, and students at the Dien Bien campus of Thai Nguyen University. In addition, in-depth interviews and activity-based product research methods were employed to clarify and substantiate the research findings. Quantitative data analysis was conducted using a five-level Likert scale to evaluate the results regarding the current status of competency development in concept formation of sets, quantity, and counting among students majoring in Early Childhood Education at the Dien Bien campus of Thai Nguyen University.

2.2 Theoretical Framework of Competency in Concept Formation of Sets, Quantity, and Counting among Early Childhood Education Students

In the field of early childhood education, fundamental mathematical concepts such as sets, quantity, and counting are considered essential components of cognitive development. A set is defined as a collection of objects sharing common characteristics that distinguish them from others, while natural numbers are used to represent the quantity of elements within a finite set. Counting is understood as a purposeful activity, involving specific methods and yielding measurable outcomes, conducted on a defined set [1][2]. These foundational concepts form the basis of concept formation of sets, quantity, and counting in early mathematics education.

The concept formation of elementary mathematics for preschool children constitutes a core task within the domain of cognitive education, as prescribed in the Early Childhood Education curriculum. This process is implemented by preschool teachers through diverse educational approaches, including structured mathematics lessons and the integration of concept formation of sets, quantity, and counting into various learning activities such as music, visual arts, physical education, and daily routines. Such integration not only enhances children's familiarity with mathematical concepts but also supports the development of logical thinking and cognitive abilities in a comprehensive and meaningful manner [1][2][3][4].

The concept formation of sets, quantity, and counting for preschool children is a pedagogical process in which teachers organize and guide children's activities to develop fundamental mathematical knowledge related to sets, quantity, and counting. Through this process, children acquire the ability to perform counting, recognize quantities and numerals, compare objects, and combine groups. Therefore, its implementation requires teachers to possess strong competency in designing and organizing a variety of learning and play-based activities, as well as coordinating interactions between teachers and children and among children themselves. These activities aim to stimulate children's interest in cognitive exploration and effectively support the concept formation of sets, quantity, and counting, thereby contributing to intellectual development, problem-solving ability, holistic personality education, and preparation for learning mathematics at the primary level [1][2][3][6][7].

The competency in concept formation of sets, quantity, and counting for preschool teachers should be developed during the process of teacher education at universities and continuously strengthened through professional practice in preschool settings. For Early Childhood Education students, this competency encompasses solid professional knowledge, proficient pedagogical skills (including lesson design, use of teaching materials, and organization of educational activities), and the ability to integrate mathematical content into children's daily activities. Such competency enables students to organize diverse forms of educational activities that foster children's thinking, develop skills in comparison and quantity recognition, and establish a strong foundation for elementary mathematics, thereby preparing children effectively for entry into primary school [2][3].

The competency in concept formation of sets, quantity, and counting among Early Childhood Education students consists of several interrelated components. First, it includes competency in understanding child psychology and elementary mathematical knowledge, whereby students are able to comprehend and apply characteristics of child development alongside knowledge of set theory, mathematical logic, natural numbers, and counting in designing and organizing educational activities [5][6]. In addition, students are expected to demonstrate competency in designing educational activities and preparing teaching materials, including developing lesson plans, integrating mathematical content into lessons, games, physical activities, and educational themes, as well as creating innovative teaching materials and experiential learning activities [2].

Furthermore, this competency encompasses the ability to organize activities for concept formation of sets, quantity, and counting. Students are required to guide children in counting, recognizing quantities and numerals, comparing, adding and subtracting, grouping and separating, and arranging objects according to patterns. They should also be capable of flexibly applying various teaching methods to create engaging learning environments that promote children's active participation. Additionally, competency in integrating and applying technology plays an important role, as students are expected to incorporate STEAM-based approaches and effectively utilize technology to enhance the quality and attractiveness of educational activities [2][3].

Finally, competency in evaluating learning outcomes is an essential component, enabling students to assess children's performance in activities related to sets, quantity, and counting through lessons, play-based activities, and thematic instruction [2]. These competencies are developed through coursework on methods of concept formation of elementary mathematics, pedagogical training, internships, and practical experiences in preschool settings, and are influenced by factors such as the training curriculum, lecturers' teaching competency, students' self-directed learning, and the learning environment. Accordingly, the competency in concept formation of sets, quantity, and counting is evaluated through students' abilities in designing and preparing teaching materials, organizing educational activities, assessing learning outcomes, and integrating technology, using methods such as product-based assessment, observation, and performance evaluation.

3. RESEARCH RESULTS AND DISCUSSION

A survey was conducted with 128 lecturers and K26 college-level students at Thai Nguyen University – Dien Bien Campus to examine the competency in concept formation of sets, quantity, and counting among Early Childhood Education students. The results obtained are presented as follows:

Table 3.1 Lecturers' and Students' Evaluation of Competency in Concept Formation of Sets, Quantity, and Counting among Students

Competency in concept formation of sets, quantity, and counting for children among students	Performance Results					Mean
	Very Poor	Poor	Average	Good	Excellent	Rank
1. Competency in understanding child psychology and elementary mathematical knowledge	0	0	63	39	26	3.71

2. Competency in designing activities and preparing teaching materials for concept formation of sets, quantity, and counting	0	5	67	35	21	3.56
3. Competency in organizing activities for concept formation of sets, quantity, and counting	0	5	67	37	19	3.54
4. Competency in integrating and applying technology in the design and organization of activities for concept formation of sets, quantity, and counting	0	12	69	32	15	3.39
5. Competency in evaluating children's learning outcomes	0	7	72	37	12	3.42
Overall average score						3.52

The survey results indicate that the competency in concept formation of sets, quantity, and counting among students is generally rated at an average level, with a mean score of 3.52, corresponding to a low level of “good” performance. However, the results across component competencies are uneven. Specifically, the highest-rated competency is understanding child psychology and elementary mathematical knowledge, with a mean score of 3.71, reaching a “good” level, and no students rated at the “poor” level. The second highest-rated competency is designing activities and preparing teaching materials for concept formation of sets, quantity, and counting, with a mean score of 3.56, also at a “good” level; however, 5 out of 128 students (3.9%) were rated as “poor.” In contrast, the lowest-rated competency is integrating and applying technology in designing and organizing activities, with a mean score of 3.39, at an “average” level, with 12 out of 128 responses (9.4%) rated as “poor.” The second lowest-rated competency is evaluating children’s learning outcomes, with a mean score of 3.42, which is close to the “average” level, including 7 out of 128 responses (5.5%) rated as “poor,” while the majority of students were assessed at the “average” level.

Analysis of students' activity design products reveals that many students have not clearly demonstrated the integration of mathematical content into activities for concept formation of sets, quantity, and counting, nor have they effectively specified the methods and digital technologies used, despite mentioning the tools. Assessment components are also not clearly presented in many lesson plans. Observations of student performance further indicate limitations in communication skills with children, the ability to foster collaborative interactions among children, the use of motivational strategies to engage children in mathematical activities, and the ability to evaluate both the process and outcomes of children's learning. Interviews with several students (e.g., S1, S2, S3, S4, and S5) revealed that they encounter difficulties in organizing activities for concept formation of sets, quantity, and counting, particularly in coordinating teaching methods, integrating mathematical content into play and experiential activities, and utilizing digital technology. These challenges are partly attributed to limited practical training in preschool settings, as well as insufficient experience in applying theoretical knowledge to practice.

Overall, the competency in concept formation of sets, quantity, and counting among Early Childhood Education students at Thai Nguyen University – Dien Bien Campus has been initially developed, with fundamental component competencies established. However, these competencies remain uneven, with notable limitations in organizing activities, integrating and applying technology, and evaluating learning outcomes. The underlying causes include students' limited communication skills, particularly among ethnic minority students, the lack of sufficient practical training time in the curriculum, certain limitations in lecturers' instructional practices, insufficient collaboration between teacher education institutions and preschool settings, and students' lack of proactiveness in self-directed learning and professional development. To further clarify these issues, the study also examines the conditions for developing competency in concept formation of sets, quantity, and counting among students, as presented in Table 3.2.

Table 3.2 Current Status of Conditions for Developing Competency in Concept Formation of Sets, Quantity, and Counting among Students

Conditions for Developing Competency in Concept Formation of Sets, Quantity, and Counting among Students	Performance Results					Mean
	Very Poor	Poor	Average	Good	Excellent	Rank
1. The course “Methods of Concept Formation of Mathematics for Children”	0	0	25	55	48	4.18

ensures a balance between theory and practice.						
2. “Students participate in professional practice related to concept formation of mathematics for children in preschools.	26	102	0	0	0	1.79
3. Lecturers and preschool teachers possess the competency to teach and support students in developing competency in concept formation of sets, quantity, and counting for children.	0	27	43	38	20	3.39
4. The university organizes regular pedagogical training activities to develop students’ competency in concept formation of sets, quantity, and counting.	0	21	47	38	22	3.47
5. Students undertake internships to develop competency in concept formation of sets, quantity, and counting for children in preschools.	0	0	67	39	22	3.65
6. The university provides a supportive training environment.	0	0	56	39	22	3.65
7. Students are completely self-motivated, actively	0	12	69	32	15	3.39

engaged in learning, and self-disciplined.						
Overall average score						3.37

The survey results indicate that the conditions for developing competency in concept formation of sets, quantity, and counting among pre-service teachers of the Early Childhood Education program at the Thai Nguyen University branch in Dien Bien province are moderately met, with an overall mean score of 3.37. This shows that the competency in concept formation of sets, quantity, and counting for children among these pre-service teachers has not yet reached a high level.

Among the conditions assessed, the best-performing factor was the course “Methods of Familiarizing Children with Mathematics”, which ensures a balance between theory and practice, achieving a mean score of 4.18—approaching a “fully met” level. The second-best condition was the university providing a supportive training environment, with a mean score of 3.75. Third was pre-service teachers’ participation in internships to develop competency in concept formation of sets, quantity, and counting for children in preschools, with a mean of 3.65. Fourth, regular pedagogical training activities organized by the university to develop this competency scored 3.47, representing a low-to-moderate level of fulfillment. The lowest-scoring condition was practical professional experience in concept formation of mathematics for children at preschools, with a mean of 1.79, indicating that the program lacks sufficient hands-on practice opportunities, limiting pre-service teachers’ experiential learning.

Lecturers and preschool teachers’ ability to support pre-service teachers in developing competency in concept formation of sets, quantity, and counting achieved a moderate mean of 3.39, suggesting room for improvement. Interviews with pre-service teachers (SV = pre-service teachers 1, 2, 3, 4, 5, and others from class K26) revealed that: “We study the course Methods of Concept Formation of Mathematics for Children before starting internships, so there is little coordination between lecturers and preschool teachers in supporting us to develop competency in organizing children’s early mathematics learning. The course mainly focuses on designing activities and practice without real children, making it somewhat artificial and lacking practical professional experience.”

Finally, the investigation also showed that pre-service teachers are not fully self-motivated, actively engaged, or disciplined in developing their competency in concept formation of sets, quantity, and counting, which contributes to the overall moderate performance level.

4. RESEARCH RESULTS AND DISCUSSION

The competency in concept formation of sets, quantity, and counting for children among K26 pre-service teachers at the Thai Nguyen University branch in Dien Bien province has initially developed the basic component competencies. However, these competencies are not yet uniform and still show limitations in certain areas that need improvement. The underlying cause is that some training and

practice conditions have not fully met the requirements. The university and lecturers need to organize professional practice opportunities for pre-service teachers, allowing them to implement methods for introducing children to sets, quantity, and counting in preschools. Lecturers should further enhance their teaching and professional guidance competencies, while pre-service teachers need to actively promote their self-motivation, engagement, and independent practice in developing their skills.

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