

Profile of Learning and Innovation Skills (4C's) of Prospective Teachers

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Abstract. This study aims to describe the profile of learning and innovation skills (4C's) of prospective teachers in Calculus I course, including creativity, Critical thinking, communication, and collaboration skills. This research is a qualitative descriptive study with the subjects of 51 students in the first semester academic year 2019/2020 majoring Mathematics Education from two universities in Malang and took calculus I course. The data is collected by using observation and test techniques. The instrument used was adapted from the rubric of the Buck Institute of Education and rubrics from assessing the 21st Century Skills. Through observation, it is concluded that prospective teachers communication skills with indicators provide an explanation of ideas, express ideas effectively, respond to audience questions properly and appropriately, and make presentations, reached 60.78% belongs to good category. Students' collaboration skills are indicated by some indicators such as working productively with other friends, participating and contributing actively, taking responsibility together to complete work, and giving respect the ideas of other friends, reached 84.8%, and it belongs to excellent category. In addition, from the test, it is concluded that the creativity of students with indicators of flexibility, fluency of thinking, originality, and elaboration reached 65.93%, and it belongs to creative enough, and students' Critical thinking skills with indicators identifying, connecting, analyzing, and solving problems reached 66.18 % belongs to critical enough. Based on the results of the study, it can be concluded that the learning and innovation skills (4C's) of prospective teachers in calculus I courses are very diverse, what needs to be improved are creativity and critical thinking skills.

Keywords: *profile, learning and innovation skills (4C's), prospective teacher students*

INTRODUCTION

Higher Education is an institution to prepare students to face the challenges of increasingly

sophisticated ICT development, as well as challenges of 21st-century scientific development [1]. One of the parties holding a strategic role is the Educational Workforce Education Institute (LPTK) which has the task of educating and producing teachers. This is in accordance with UUGD Article 1 Paragraph (14) [2], LPTK is a tertiary institution given the task of government to organize a teacher procurement program in early childhood education through formal education, basic education, and/or secondary education as well as organizing and developing education science and non-education [3]. Based on the UUGD, teachers are the spearhead of implementing learning in the field. Teachers cannot avoid the consequences of changes in the 21st-century learning paradigm because LPTK must be able to organize innovative learning so that future teachers receive the skills needed to face the challenges of 21st century [4].

Therefore, the abilities needed by prospective teachers can be achieved to the maximum, the lectures at LPTK must integrate learning and innovation skills (4C's), as provisions to become professional teachers. This is in accordance with The P21 Framework for 21st Century Learning [5] and [6], teachers or prospective teachers must be able to design learning to prepare students to face 21st-century skills. This is consistent with the statement of the American National Science Education Standards (NRC) [7], that teachers must be able to design learning with teaching methods that pay more attention to decision-making abilities, theories and reasoning. These abilities are associated with increasing the ability of teacher skills and prospective teachers in dealing with the 21st century.

Likewise, graduate teacher candidates at LPTK Malang Islamic University and Wisnuwardhana University, also need the skills needed to face the challenges of the 21st century and can later prepare professional teacher candidates. Thus lectures conducted at the two LPTKs are also designed by applying 21st-century learning by incorporating learning and innovation skills (4C's) that must be achieved by prospective teacher students as the purpose of lectures. Moreover, the characteristics of learning and innovation skills (4C's) are very relevant to mathematical characteristics. The

characteristics of mathematic are able to train how to think and reason in drawing conclusions, able to develop creative activities that involve imagination, intuition and discovery by developing divergent, original thinking, curiosity, making predictions and experimenting, able to develop the ability to solve problems, and able to develop the ability to convey information or communicate ideas among others through oral conversation, graphic notes, maps, diagrams in explaining ideas. According to the Ministry of National Education, mathematics has an important role in shaping and developing thinking skills, reasoning logically, systematically and critically [8].

Thus, learning mathematics in the 21st century is required to emphasize aspects of critical thinking, creative thinking, communication, and collaboration skills [9]. This is in line with Arifin [10] who states that learning mathematics in the 21st century has goals that are in accordance with 4C's characteristics, namely; Communication, Collaboration, Critical Thinking, Creativity and Innovation. Mathematical learning, according to NCTM [11] requires the ability to solve problems, reason and prove, communication, connections, and representation. 4C's is the keyword for preparing future human resources who are able to live in the 21st century.

METHOD

The type of research used is descriptive qualitative. According to Gall & Borg [12], that the goal of descriptive research is to describe a phenomenon and its characteristics. Therefore, observation and survey tools are often used to gather data. The research was conducted at the Mathematics Education Study Program FKIP Malang Islamic University and Wisnuwardhana University. The research subjects were 51 students consisting of 28 students of Malang Islamic University and 23 students of Wisnuwardhana University Malang in calculus I.

This study aims to describe the profile of learning and innovation skills (4C's), including Communication, Collaboration, Creativity, and Critical Thinking for prospective teacher students in calculus I subjects. Data collection techniques using observation and tests. Observation techniques to obtain data on communication and collaboration skills in the learning process. In comparison, the test is used to obtain creativity and critical thinking skills data in the form of essay questions.

Data analysis techniques refer to the research design of Miles, Huberman & Saldana [13], including (1) Data collection, collecting data from observations of communication and collaboration skills and data on tests of creativity and critical thinking skills. (2) Data reduction, summarizing, selecting and categorizing the results of

observations and tests. (3) Data display, reduce or summarize data presented in tabular form or by using bar charts. (4) Conclusion drawing/verification.

RESULT & DISCUSSION

This study aims to describe the profile of learning and innovation skills (4C) of prospective teachers in calculus I course, including Communication, Collaboration, Critical Thinking, Creativity and Innovation. In this study, calculus learning subjects were conducted with 51 prospective teachers. In calculus I course, it is integrated the learning and innovation skills in teaching materials and RPS (Semester Learning Plans), consisting of creativity, critical thinking, communication, and collaboration. Creativity and critical thinking skills are given the problem of creative thinking and critical thinking and are solved creatively and critically. While communication and collaboration skills, hold group discussions by collaborating and communicating in solving problems. At the end of the learning, creativity and critical thinking tests are given. Likewise, the results of observations to find out the achievement of communication and collaboration skills during learning calculus I.

The description of communication and collaboration skills was obtained from observations of learning calculus I subjects. The rubric for assessing communication and collaboration skills was adapted from Assessing 21st Century Skills [14]. While analyzing observational data by calculating the percentage of achievement of each indicator of communication and collaboration skills for each research subject using the formula:

$$\bar{X} = \frac{\sum x}{n} \times 100\%$$

Information :

\bar{X} = Percentage of communication and collaboration skills achieved

$\sum x$ = Number of research subjects who achieved communication and collaboration skills on each indicator

n = Number of study subjects

The results of the study are based on observations of communication and collaboration skills for each indicator, shown in Figures 1 and 2.

The results of the percentage of communication and collaboration skills are converted to a qualitative category adapted from Widoyoko [15], as in Table 1.

The results based on Figure 1 show that communication skills of 51 research subjects, for the aspect of indicators (1) provide an explanation of ideas, as many as 29 subjects or 56.86% included in the category of moderate. The indicator aspect (2) expresses ideas effectively, as many as

35 subjects or 68.63% can express ideas effectively, including the speed of delivery, volume, sound articulation, including high categories. Aspect indicators (3) respond to audience questions, as many as 33 subjects or 64.71% can respond to questions attentively, and can provide feedback appropriately, including high categories. The indicator aspect (4) made a presentation, as many as 32 subjects or 62.75% could make a presentation well, including high categories. Therefore the average number of research subjects who reached indicators of communication skills was 32 subjects or 63.24% included in the high category.

Table 1 Conversion Percentage of Communication and Collaboration Skills

Percentage	Conversion
$80,00 < \bar{X} \leq 100$	Very high
$60,00 < \bar{X} \leq 80,00$	High
$40,00 < \bar{X} \leq 60,00$	Moderate
$20,00 < \bar{X} \leq 40,00$	Low
$00,00 < \bar{X} \leq 20,00$	Very low

Based on Figure 2 shows that the collaboration skills of 51 research subjects, for the indicator aspect (1) working productively with others, as many as 27 subjects or 52.94% included in the category of moderate. The indicator aspect (2) expresses ideas clearly, as many as 49 subjects or 96.08% are included in the very high category. Indicator aspects (3) are jointly responsible for completing work, as many as 48 subjects or 94.12% are included in the very high category. The indicator aspect (4) respects the ideas of others, as many as 49 subjects or 96.08% are in the very high category. Therefore, the average number of research subjects who reached indicators on collaboration skills was 43 subjects or 84.80%, which was classified as very high.

Meanwhile, to describe the results of creativity and critical thinking skills test, the scoring technique used is answering essay questions. Data on creativity and critical thinking skills were obtained based on scoring guidelines and scoring criteria used in this study were modified from Assessing 21st Century Skills [14], Creative Thinking Value Rubric [16], and The Holistic Critical Thinking Scoring Rubric [17], and Getting to Know 4C or Learning And Innovation Skills [18]. While the analysis of the result of the creativity and critical thinking skills results from calculating the percentage of achievement scores for each indicator using the following formula.

$$P_i = \frac{A_i}{n} \times 100\%$$

Information :

P_i = percentage of achievement i^{th} indicator

A_i = total score of each i^{th} indicator

n = maximum number of scores for each indicator

The results of the study are based on the creativity and critical thinking skills test results for each indicator, as shown in Figures 3 and 4.

Furthermore, changing the test results score into a percentage was adapted from Riduwan [19], based on the benchmark reference assessment guidelines as in Table 2 below.

Table 2. Conversion Percentage of Creativity and Critical Thinking Skill Levels

Percentage	Conversion
$90 < P \leq 100$	Very critical / very creative
$80 < P \leq 90$	Critical/creative
$65 < P \leq 80$	Critical enough / creative enough
$55 < P \leq 65$	Less critical / less creative
$0 \leq P \leq 55$	Very less critical / very less creative

The results of the study are based on Figure 3, and the creative skills test results of 51 research subjects with each indicator a maximum score of 4, then the total score of each indicator, namely indicator (1) flexibility, produces variations of ideas in solving problems, obtained a score of 138 or 67.65 % is quite creative. Indicator (2) fluency of thinking, can spark many ideas in problem-solving, obtained a score of 135 or 66.18%, include creative enough. Indicator (3) originality, giving a relatively new idea in solving problems, obtained a score of 129 or 63.24% is quite creative. Indicator (4) elaboration, developing or enriching ideas and can improve the quality of ideas, obtained a score of 136 or 66.67%, include to quite creative. Of the four indicators, the average score obtained by 134.5 or 65.93% of subjects had achieved creativity skills, including the category of quite creative.

Based on Figure 4, the results of critical thinking skills tests of 51 research subjects with each indicator a maximum score of 4, then the total score of each indicator, namely indicators (1) identify facts, data, concepts and connect and conclude, obtained a score of 126 or 61.76% is quite critical. Indicator (2) links facts, data, concepts, and can do calculations, and can check the truth, obtained a score of 136 or 66.67%, include to quite critical. Indicator (3) analyzes, determines the information provided, selects important information, and chooses the strategy used to complete, and can calculate, score 151 or 74.02%, include to quite critical. Likewise, indicators (4) solve problems, identify what is known, asked, the adequacy of the elements of making and completing mathematical models, as well as re-checking the answers obtained, obtained a score of 127 or 62.257% is less critical category. Of the four indicators, the average score obtained by 135 or 66.18% of prospective teacher students

has reached critical thinking skills, including the quite critical category.

The results showed that the profile of learning and innovation skills (4C) of prospective teachers in learning calculus I, as follows, based on the observation that communication skills in learning calculus I is high. The collaboration skills are very high. Whereas based on the results of creativity skills tests, including the category of quite creative. Where creativity, the capacity to make, do or become something fresh and valuable with respect to others as well as ourselves [20] and [21]. While the achievement of the test results in creativity skills is also supported by Leen & Ying [22], that creative thinking skills are the skills needed to discover new things, are original, must be able to develop new solutions for each problem, and to produce new ideas, varied and unique. Likewise, the results of the Critical Thinking skills test are also quite critical.

Based on the results of these studies indicate that both Creativity and Critical Thinking skills

acquired by prospective teachers are still included in the sufficient category, so it needs to be improved by being trained to work on creative skills and critical thinking problems with a lot of frequency. Because creativity and critical thinking skills are needed by prospective teacher students. This opinion is reinforced by the results of research conducted by Birgili [23], that if we want to raise the learners who might be the possible young scientists of the future, both critical skills and creative thinking skills need to be developed critically in the instructional design process with the problem-based learning approach. Likewise Zubaidah's opinion [18], so that 4C's competencies can be achieved by students well, a pedagogic strategy is needed to empower 4C competencies by utilizing technology so as to build 21st-century skills, namely a) learning with ICT, (b) learning by submitting problems in real-world and (c) collaborative problem-based learning using resources through the internet.

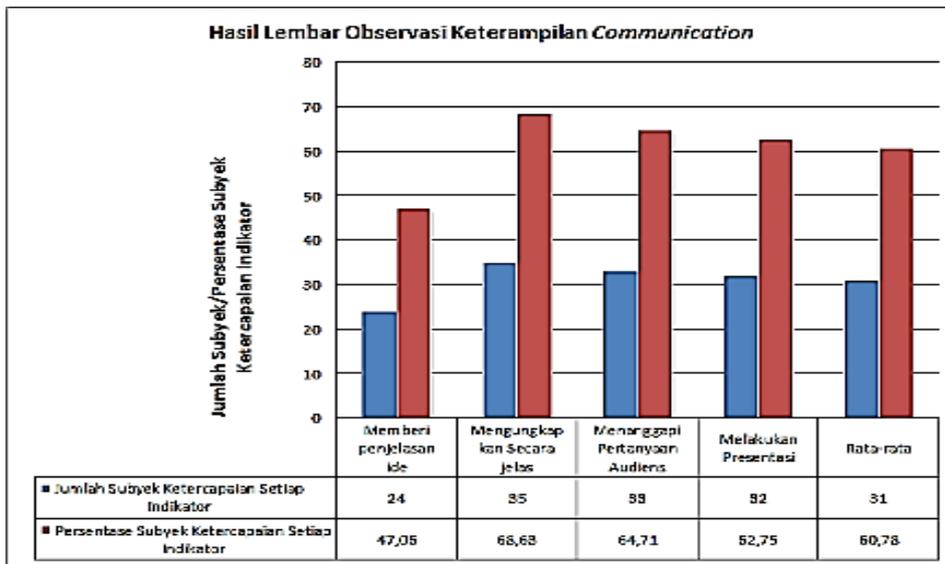


Figure 1: Observation Results of Communication Skills

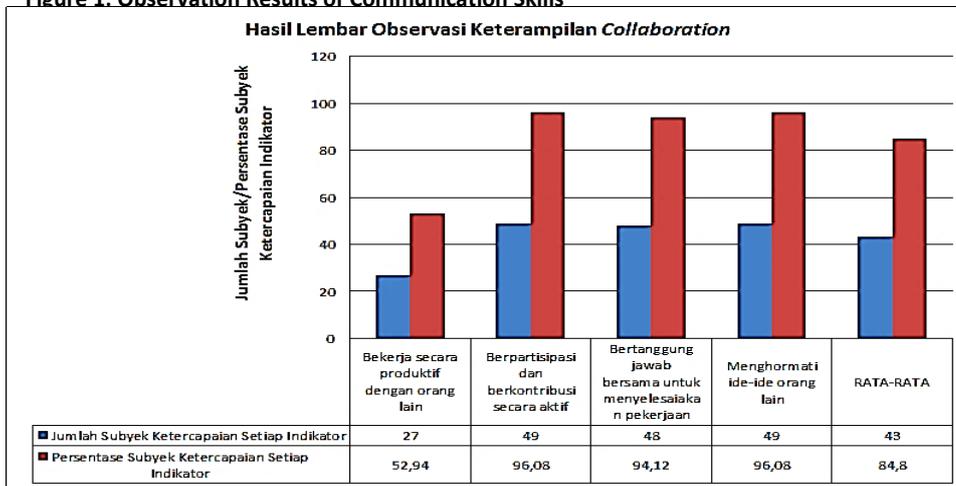


Figure 2: Results of observing Collaboration Skills

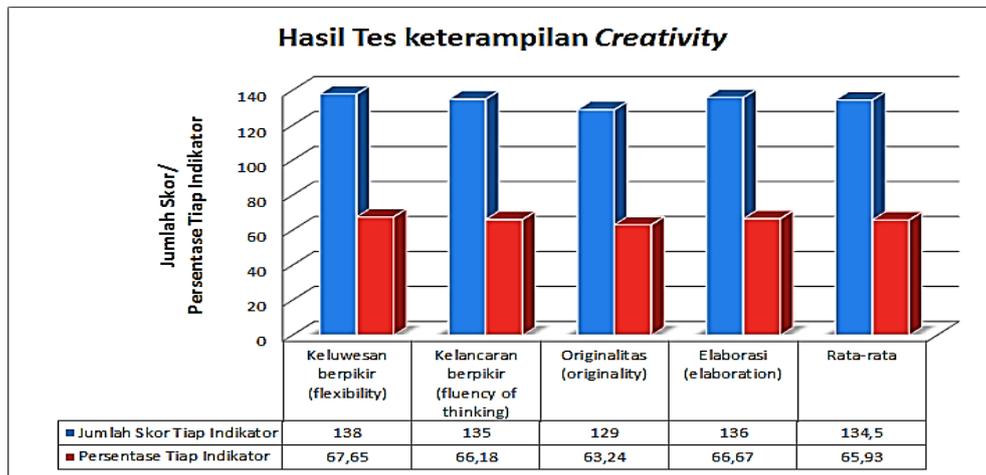


Figure 3: Results of creativity skills tests

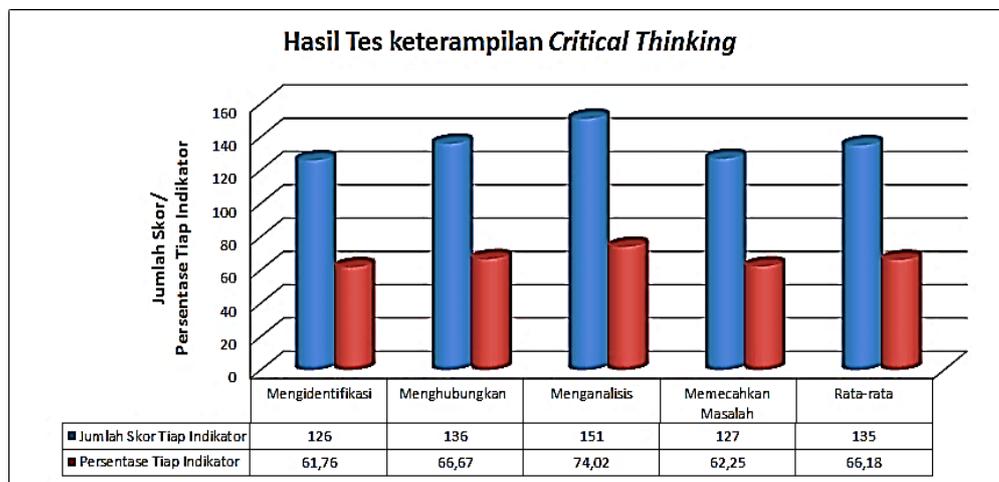


Figure 4: Results of critical thinking skills tests

CONCLUSION

Profile of learning and innovation skills (4C's) prospective teachers in calculus I with 51 research subjects, based on observations that Communication skills, as many as 32 subjects or 63.24% is high categories. Collaboration Skills, 43 subjects or 84.80% is very high categories. Whereas based on the results of the Creativity and Innovation skills test, an average score of 134.5 or 65.93% was obtained, including the quite creative category. Likewise, the results of the Critical Thinking skills test, obtained an average score of 135 or 66.18%, including the category quite critical. Based on this profile, Collaboration skills need to be maintained and developed. Whereas Communication skills with good categories, and Creativity and Innovation and Critical Thinking skills because they still have enough categories, still need to be improved.

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