Jurnal Pendidikan Sains Indonesia
(Indonesian Journal of Science Education)
URL: http://jurnal.usk.ac.id/JPSI/index

11(4), p.808-825 (2023)
e-ISSN: 2615-840X p-ISSN: 2338-4379
DOI: doi.org/**10.24815/jpsi.v11i4.31799**

Analysis of Critical Thinking Levels of Prospective Science Teachers in Ethnoscience Learning Based on Reflective and Impulsive Cognitive Styles

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Article History:
Received date: April 18, 2023
Received in revised from: August 22, 2023
Accepted date: October 1, 2023
Available online: October 11, 2023

Citation:
Yasir, M. & Dwiyanti, L. 2023. Analysis of critical thinking levels of prospective science teachers in ethnoscience learning based on reflective and impulsive cognitive styles. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, 11(4):808-825.

Abstract. Previous research has not found the right formula to win bull races studied in ethnoscience learning so that it requires problem solving. Solving this problem requires critical thinking skills which can be viewed from reflective and impulsive cognitive styles during bull races. This study aims to determine the level of critical thinking in science teacher candidates based on reflective and impulsive cognitive styles in ethnoscience learning. This type of research is a mix method with exploratory sequential design. The research was carried out in the Science Education Study Program FIP UTM, Bangkalan Regency by taking a sample of 6 science teacher candidate subjects. Data collection was collected using tests, documentation, and interviews. The results of the cognitive style test showed that science teacher candidates were 25% reflective, 29% impulsive, 25% fast-accurate, and 21% slow-inaccurate. The results of this study indicate that reflective science teacher candidates are able to recognize images well, be careful, think deeply so that answers tend to be correct and answer questions according to questions in ethnoscience learning. Impulsive science teacher candidates are able to recognize pictures poorly, are not careful, do not think deeply so that answers are not precise and answer questions at random in ethnoscience learning. The conclusion obtained is that the critical thinking level of reflective science teacher candidates is better than impulsive in ethnoscience learning, although there are not many significant differences.
Keywords: Critical thinking, ethnoscience, impulsive reflective cognitive style, science teacher candidates

Introduction

In Indonesia, local knowledge values are deteriorating due to the high pace of globalization. Changes in cultural values and local knowledge are hence increasingly disregarded. A generation of intellectuals with traits consistent with those of the Indonesian people is being formed, printed, and developed at educational institutions, in this instance tertiary institutions. Contextual integrated learning of local knowledge and increasing the cultural environment as a resource can help achieve this goal (Seemiller & Clayton, 2019; Marhayani, 2016). Ethnoscience is characterized about local knowledge and the enhancement of the cultural environment as a source (Dewi et al., 2021; Hadi et al., 2019; Nuraini, 2018).

Science teacher candidates (SCT) can learn by doing through ethnoscience, which is meaningful learning. SCT who learn by doing are better able to relate the subject they are

studying to the context of daily life (Brenner, 2022; Murray, 2021). Learning activities will become more relevant and in line with the goals of implementing learning in accordance with the merdeka curriculum (Winarto et al., 2022; Hikmawati et al., 2020) with the use of ethnoscience-based learning. According to Kepmendikbudristek number 56/M/2022, each science teacher candidate develops their natural interest and ability to conduct research by learning about the history, customs, and local knowledge of the place they would be teaching in.

The value of ethnoscience education is in its exploration of the study of indigenous knowledge systems, which can serve as a bridge to formal science education in schools (Wati et al., 2021; Kasi, et al., 2021; Parmin et al., 2022). According to Hammond et al. (2019); Closs et al. (2021) kids can learn from their environment and society in addition to what they are taught in a classroom. With the help of ethnoscience education, the original knowledge of the community, its language, customs and culture, morals, and technology is formalized into scientific information that can be explained (Kencanawati & Angela, 2022; Azalia et al., 2020; Parmin & Savitri, 2022).

Bull races are one of the typical Madurese local wisdoms covered in ethnoscience education. Bull races can be used as a context for real examples of the application of science material concepts to everyday life to be studied further in ethnoscience learning. The concept of natural science material is applied directly to bull races such as the concept of the speed of a running cow, the distance traveled and the time the cow runs, the relationship between the mass of the cow rider and the speed of the cow when it is moving and so on (Siyati & Kamariyah, 2022).

The object in the bull race is a pair of cows, a jockey and the tools used to unite the two cows. The movement of the bull race occurs when the cow participating in the race changes at a certain time. These changes are observed based on a reference point (spectators of bull races). The trajectory of the bull race is a straight line from start to finish (Suprapto et al., 2022). The context of bull racing is closely related to the use of motion and force materials in life to win the race. Previous research has not found an exact formula for winning bull races studied in ethnoscience learning (Suprapto et al., 2022; Abrory, 2020). This requires solving a concrete problem to develop a technological formula/way to win the Madura bull race.

Meanwhile, the motion and style of the cow race contained in the school science material contains abstract concepts. Changing abstract concepts into concrete in developing a technological formula/way to win the Madura bull race requires other knowledge and skills. Other knowledge and skills needed are the use of basic mathematical concepts, multi-representation, scientific reasoning, metacognition, including critical thinking skills (CTS) (Retnawati et al., 2018; Dolo & Prodjosantoso, 2022). This skill helps students understand the concept as a whole (Uge et al., 2019).

CTS in Madura bull race are needed to find information, compare, and construct alternative solutions from a variety of different perspectives and produce decisions based on reasonable arguments (Saritas & Yenen, 2020; Adinda & Hamka, 2021; Sulaiman & Syakarofath, 2018). The ability of STC in formulating technology/how to win Madura bull race as a problem solving is strongly influenced by their respective critical thinking levels. Agree with the research of Villalba et al. (2020); Sutrisno et al. (2020); Demir (2015) that when a person has a high level of critical thinking then a person has a tendency to be able to solve problems well and will have no difficulty solving questions.

The way science teacher candidates respond to questions is also influenced by their level of critical thinking. By using analysis, reasoning, and organization to make the most of the information, responses to the questions can be categorized quickly, slowly, correctly, or inaccurately (Ozcan, 2020; Viator et al., 2019). The candidate for a science teaching position's response demonstrates a contemplative and impulsive cognitive approach. Reflective cognitive learners are more likely to take their time answering questions but

provide accurate answers. As opposed to impulsive cognitive style students, who tend to react to questions quickly yet carelessly, leading to incorrect replies (Istinabila & Fardah, 2022; Satriawan et al., 2018; Putri et al., 2017).

However, currently the cognitive style of students, university students, and science teacher candidates is still lacking in the learning process so that it will affect critical problem-solving skills. According to Kholid et al. (2020) research, it is crucial to pay attention since low problem-solving aptitude cannot be separated from low critical thinking aptitude, which is influenced by cognitive style. According to Purnomo et al. (2021), absence of criticality in problem-solving is closely associated to cognitive activity and cognitively affected thinking. According to Prayekti (2018), students should pay attention to cognitive learning styles in order to achieve the best critical learning results on each exam. According to Çakiroğlu et al. (2020) and Arifin et al. (2020), one cognitive style that is directly associated to a student's level of academic accomplishment is the capacity for critical problem-solving, which means that it must be taken into account during the learning process. This is in line with Yunfei et al.'s findings from 2023, which claim that each person has unique reference patterns and cognitive processing preferences when solving complex tasks, necessitating the use of time-based prospective memory management.

The issue of cognitive style in the capacity to solve difficult puzzles, which is not sufficiently addressed in the learning process, also appears in the study of ethnoscience. To yet, only specific learning models and media have been used to teach ethnoscience, avoiding consideration of cognitive style (Wulandari et al., 2020; Parmin et al., 2020; Parmin et al., 2022; Sumarni et al., 2022). On the basis of STEM or STEAM integration in learning and teaching (Parmin et al., 2020), as well as students' cognitive style, learning style, gender, pedagogy, and andragogy (Dewi et al., 2021), it is advised that ethnoscience learning raise the context of traditional local wisdom (Sudarmin et al., 2020); In order to increase the outcomes of scientific transformation, teachers must also stress the process of bridging indigenous knowledge to scientific knowledge through experiments, literature reviews, and experiences (Walidah et al., 2023; Fiterani et al., 2021; Wilujeng et al., 2020).

Based on the description of the urgency above, the critical thinking level of science teacher candidates in solving concrete problems, such as bull races really needs to be considered in ethnoscience learning by reviewing reflective and impulsive cognitive styles. Therefore, this research requires new information through analysis of the critical thinking level of science teacher candidates in ethnoscience learning based on reflective and impulsive cognitive styles. The results of this study contribute to the improvement of ethnoscience learning designs going forward to see from various reviews the characteristics of STC, such as reflective and impulsive cognitive styles which will have an impact on the critical thinking level of STC. This study aims to determine the level of critical thinking in STC based on reflective and impulsive cognitive styles in ethnoscience learning.

Method

This type of research is a mix method with a sequential explanatory design that is dominant-lest dominant. Qualitative data is dominant because it is used to determine the critical thinking level of prospective science teachers in solving problems, while quantitative data is dominant in order to determine the cognitive style and critical thinking of prospective science teachers. The research was conducted at the Science Education Study Program, Faculty of Education, University of Trunojoyo Madura. The research population consisted of all prospective science teachers for the ethnoscience class class of 2020, totaling 4 classes with a total of 103 people. Sampling used a purposive sampling technique with consideration of heterogeneity of origin (Campbell et al., 2020). so that a sample of 24 people was obtained as quantitative data, then 6 people were taken as qualitative data.

Instruments for obtaining quantitative data using tests and qualitative data using questionnaires. The test instruments used were (a) matching familiar figure test (MFFT) to determine the reflective and impulsive cognitive style of prospective science teachers adopted from Kagan (1966); Viator et al. (2022) with a total of 13 items with pictures and 2 questions for experimentation; (b) a critical thinking test based on Ennis indicators (2015); Leach et al. (2020) to determine the critical thinking level of science teacher candidates in solving bull race problems in ethnoscience learning in the form of essay questions consisting of 5 items and has been tested for validity, reliability, difficulty level, discriminating power, and index deceiver. The interview questionnaire contains structured questions to prospective science teachers regarding how to solve the problem, the reason why prospective science teachers use this method, the correct way that science teacher candidates should do.

This research procedure consists of 3 stages, namely preparation, implementation, and completion. In the preparatory phase, observation of the problem and study of the literature is carried out to obtain information related to the object and subject of the research, as well as to develop research designs and instruments. The research instrument was validated and revised before being used. At the implementation stage, the researcher collected quantitative and qualitative data. Quantitative data collection was carried out by distributing the matching familiar figure test (MFFT) test instruments first to prospective science teachers, then prospective science teachers were given a critical thinking test in solving the bull races problem in ethnoscience learning. Qualitative data collection was carried out through interviews with prospective science teachers after completing the two tests. At the completion stage, the results of instrument validation were calculated using Aiken's formula (Azwar, 2016; White, 2022), instrument reliability was calculated using Spearman Brown's formula (Alsaleh, 2020; De Vet et al., 2017), quantitative and qualitative data were further analyzed descriptively.

Quantitative data analysis of MFFT test results used the percentage of reflective and impulsive cognitive styles (Viator et al., 2022), while the results of the critical thinking test used percentages to categorize the critical thinking level of science teacher candidates in ethnoscience learning (Aktoprak & Hursen, 2022; Castaño et al., 2022). Analysis of qualitative data from interviews using triangulation, data reduction, and data presentation (Vogl et al., 2019; Carter et al., 2014). The results of data analysis will obtain a description of the critical thinking level of science teacher candidates in solving bull races problems in ethnoscience learning based on reflective and impulsive cognitive styles.

Results and Discussion

Cognitive Style Test Results

The cognitive style of each science teacher candidate is different. Cognitive style can be seen when science teacher candidates respond or answer questions. Science teacher candidates who can answer correctly and take a long time to answer include reflective cognitive style science teacher candidates. Prospective science teachers with wrong answers and quick answers fall into the category of impulsive cognitive style. Prospective science teachers who answered quickly and correctly were included in the fast accurate category, while prospective science teachers with wrong and slow answers were included in the slow inaccurate category.

Reflective and impulsive cognitive style tests using MFFT on science teacher candidates for class 3A were carried out over 3 meetings. The first meeting was held on Tuesday, October 11, 2022, the second meeting was held on Wednesday, October 12, 2022, and the third meeting was held on Thursday, October 13, 2022. The results of the cognitive style test are presented in Figure 1.

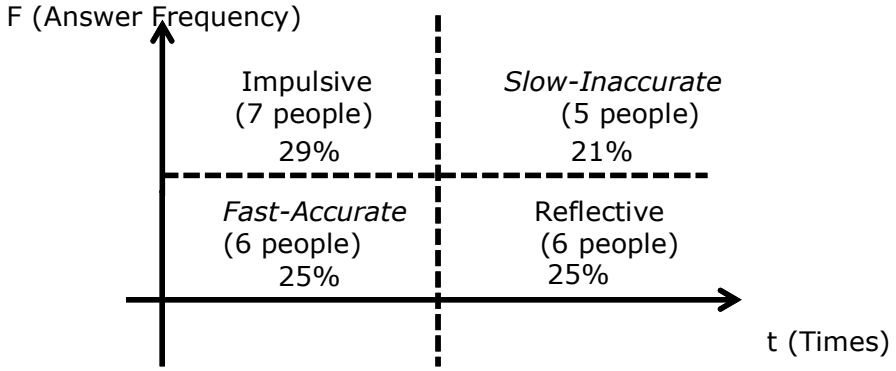

Figure 1. Group of science teacher candidates with reflective and impulsive cognitive styles

Based on the results of the cognitive style test it can be classified into 4 groups, namely science teacher candidates with reflective cognitive style, impulsive , fast-accurate, and slow-inaccurate, with a higher percentage of impulsive science teacher candidates than reflective science teacher candidates. This finding is supported by research by Azhil et al. (2018) and Vranic et al. (2019) that the results of the cognitive style test showed that there were 4 cognitive styles that emerged and there were more impulsive science teacher candidates than reflective students. The percentage results show that prospective science teachers with a reflective-impulsive cognitive style have a 54% greater proportion than prospective science teachers with a Fast Accurate-Slow Inaccurate cognitive style with a proportion of 46%. This is in accordance with the research focus in the introduction that the subject used is science teacher candidates who have a cognitive reflective and impulsive style.

The percentage of science teacher candidates in the impulsive cognitive style is greater than the reflective cognitive style due to several factors. First, the tendency of students to choose answers quickly without thinking about the correctness of the answers from various considerations (Fridanianti et al., 2018). Second, there is a tendency for the frequency of student answers to be higher with a short answer time (Marwazi et al., 2019). The type of impulsive cognitive style of Madura Science teacher candidates which is more dominant than reflective shows the habitual strategy of Madura Science teacher candidates when remembering, thinking, and solving problems quickly without considering the correctness or not of the chosen solution and has not considered many things carefully (Yunfei et al., 2023). This is in accordance with research by Margunayasa et al. (2019) concerning the effect of guided inquiry learning and cognitive style on science learning achievement which shows that students are reflective when answering questions in more detail, clearly, and carefully so that answers tend to be correct, while students are impulsive. answer questions that are not detailed and respond quickly without thinking so that the answers tend to be wrong.

Critical Thinking Test Results

The results of the critical thinking tests for science teacher candidates that have been carried out are then processed using percentages to obtain 4 categories of critical thinking levels for science teacher candidates, namely very critical, moderately critical, less critical, and not critical. The percentage of the critical thinking level of science teacher candidates is presented in Table 1.

Table 1. Percentage of critical thinking level of prospective science teachers

No.	Category	Number of People	Percentage
1.	Very Critical	0	0
2.	Enough Critical	6	25
3.	Not Enough Critical	10	42
4.	Not Critical	8	33

The results of the critical thinking test obtained show that the less critical category is the highest compared to other categories of critical thinking levels. This means that of the four groups of critical thinking levels, only three emerged based on the test results, for very critical levels not found in this study. The acquisition of critical thinking tests also shows that in each cognitive style there is the same level of critical thinking, namely the level of sufficiently critical, less critical, and uncritical. This shows that reflective, impulsive, fast accurate, and slow inaccurate students are at the same level of critical thinking. In accordance with the research of Vranic et al. (2019) that grouping types of cognitive styles with critical thinking levels can all appear based on the time of answering and the frequency of answers to answer quickly/slowly and accurately/no.

Based on the results of this study indicate that it only meets three levels of critical thinking out of four levels. This shows that the critical thinking level of science teacher candidates is low so that improvements are needed in the learning process. This is one of the weaknesses of this research. Weaknesses in this research can occur because of the researchers or science subject teachers. According to Prameswari et al. (2018); Santos (2017); Terenzini et al. (1995) students' critical thinking is low influenced by interaction factors. This interaction is important in order to create conducive conditions so that the thinking processes of prospective science teachers are good and can concentrate. Besides that, according to Iriani & Kurniasih (2019); Alsaleh (2020) the critical thinking level of prospective science teachers is also influenced by the learning methods used during the learning process, if the learning methods are still conventional then the critical thinking of prospective science teachers will not develop.

Critical Thinking Level Based on Cognitive Style

The results of the critical thinking test for science teacher candidates which have been analyzed based on the level of critical thinking will be seen based on reflective and impulsive cognitive styles. This aims to get synchronization of data on the level of critical thinking based on the cognitive style of science teacher candidates. Prospective science teachers with categories of critical thinking levels based on cognitive style are presented in Table 2.

Table 2. Critical thinking levels based on the cognitive style of prospective science teachers

No.	Level of Critical Thinking	Cognitive Style	Number of People	Percentage
1.	Very Critical	Reflective	0	0
		Impulsive	0	0
		Fast-Accurate	0	0
		Slow-Inaccurate	0	0
2.	Enough Critical	Reflective	2	0.083
		Impulsive	2	0.083
		Fast-Accurate	1	0.042
		Slow-Inaccurate	1	0.042
3.	Not Enough Critical	Reflective	3	0.125
		Impulsive	2	0.083

No.	Level of Critical Thinking	Cognitive Style	Number of People	Percentage
4.	Not Critical	*Fast-Accurate*	3	0.125
		Slow-Inaccurate	2	0.083
		Reflective	1	0.042
		Impulsive	3	0.125
		Fast-Accurate	2	0.083
		Slow-Inaccurate	2	0.083

Based on Table 2. it can be seen that prospective science teachers who are cognitive-reflective-impulsive style each have the same level of critical thinking, namely quite critical, less critical, and uncritical. From these data, the selection of research subjects for interviews was carried out as qualitative data based on the suitability of the results of the cognitive style MFFT test and critical thinking tests and the level of critical thinking. The research subjects who were interviewed are shown in Table 3.

Tabel 3. Interview Subject

No.	Cognitive Style	Subject	Level of Critical Thinking (LCT)
1.	Reflective	Y12	Enough Critical
		X16	Not Enough Critical
		Y15	Not Critical
2.	Impulsive	X2	Enough Critical
		Y1	Not Enough Critical
		X8	Not Critical

MFFT test results cognitive style, critical thinking tests, and interviews were used as references to obtain a description of the critical thinking level of SCT through conclusions from triangulation. Based on the results of critical thinking tests, interview results, and documentation results on subjects Y12, X16, Y15, X2, Y1, X8, the results of each triangulation were obtained. Subject Y12 fulfills 4 indicators of critical thinking, namely describing the main problem, explaining facts, detecting bias from different perspectives, and giving logical, relevant, appropriate opinions. Critical thinking indicators that are not fulfilled are giving conclusions. Subject Y12 includes SCT with LCT 2 (quite critical) because they only fulfill 4 indicators of critical thinking. Subject X16 fulfills 2 indicators of critical thinking, namely describing the main issues and explaining facts. Critical thinking indicators that are not met are detecting bias from different perspectives, providing logical, relevant and appropriate opinions and providing conclusions. Subject X16 includes science teacher candidates with LCT 1 (less critical) because they only fulfill 2 indicators of critical thinking. Subject Y15 did not meet all indicators of critical thinking. Indicators of critical thinking that are not met are describing the subject matter, explaining facts, detecting bias from different perspectives, providing logical, relevant and appropriate opinions and providing conclusions. Subject Y15 includes students with LCT 0 (not critical) because all indicators of critical thinking cannot be fulfilled.

Subject X2 fulfills 4 indicators of critical thinking. Critical thinking indicators that are met are describing the main issues, explaining facts, detecting bias from different perspectives, and providing logical, relevant, and appropriate opinions. Indicators that are not met are giving conclusions. Subject X2 includes students with LCT 2 (quite critical) because they fulfill 4 indicators of critical thinking. Subject Y1 fulfills 2 indicators of critical thinking. Critical thinking indicators that are met are detecting bias from different perspectives and providing conclusions. The indicators that were not fulfilled were describing the main issues, explaining facts, and providing logical, relevant and appropriate opinions. Subject Y1 includes students with LCT 1 (less critical) because they only fulfill 2

indicators of critical thinking. Subject X8 did not meet al.l indicators of critical thinking. Indicators of critical thinking that are not met are describing the subject matter, explaining facts, detecting bias from different perspectives, providing logical, relevant and appropriate opinions and providing conclusions. Subject X8 includes students with LCT 0 (not critical) because all indicators cannot be fulfilled.

Differences in cognitive styles and critical thinking levels of science teacher candidates can be seen from the way they answer the test questions. Following are the differences in how to answer science teacher candidates from each cognitive style.

1. Subjects X2 and Y12 with a fairly critical level

   Subjects X2 and Y12 wrote the answers correctly. However, subject Y12 was slightly more detailed than subject X2. This is seen in some of the answers. This statement is supported by research by Margunayasa et al. (2019) where reflective STC are more detailed and clear when solving problems than impulsive STC. This difference is also because subject Y12 who is female and subject X2 who is male has different language abilities even though the LCT is the same. Meanwhile, according to Stephen et al. (2017); Özelçi et al. (2019) male STC use more of the left brain in verbal terms, while women use more of the right and left brains. This is what causes subject Y12 to construct a better and more detailed vocabulary than subject X2. So even though the LCT of subjects Y12 and X2 is the same, both of them have differences in writing their answers.

   Subjects Y12 and X2 were subjects that met the most critical thinking indicators, where critical thinking questions were made in the form of problem solving. Problem solving is a type of intellectual development proposed by Gagne. According to Gagne, problem solving begins with identifying a problem and looking for a solution (Urhahne, 2021). Based on the test results, subjects X2 and Y12 were able to solve the problems in the questions quite well, where both of them were able to recognize abstract problems and provide solutions in the form of information. This is in accordance with Ausubel's learning theory, where science teacher candidates who have good critical thinking skills can find their own knowledge through problems that are still abstract (Van der Zanden et al.; 2020).

2. Subjects Y1 and X16 with a less critical level

   The answers written by subjects Y1 and X16, where differences are found when describing a problem. According to bottom-up and top-down processing theory, SCT in recognizing an image begin by recognizing the specific image and providing a hypothesis from that image (Fischbacher-Smith et al., 2012). This theory is in accordance with SCT who have a reflective cognitive style, where when answering a question with pictures, they first recognize the picture and then make a hypothesis (Headey, 2019). Subject X16 with a reflective cognitive style can recognize images in question no 1 well and provide the right hypothesis. Whereas subject Y1 with an impulsive cognitive style can recognize problem number 1 with pictures but cannot provide the right hypothesis. Based on this statement, it can be seen that SCT with a reflective cognitive style are better at understanding an image than SCT with a reflective cognitive style. This happens because reflective SCT think more deeply about a problem compared to impulsive SCT (Satriawan et al., 2018; Riwayati dan Cintamulya, 2017; Rozencwajg & Corroyer, 2005). In addition, impulsive SCT don't pay close attention to the pictures and questions on the questions so that the answers tend to be wrong. This is in accordance with the statement of Fuady et al. (2020); Margunayasa, et al. (2019) which states that impulsive SCT are not careful, so they tend to be wrong, while reflective SCT are more careful, so they tend to be right.

3. Subjects X8 and Y15 with a non-critical level

   The answers written by Y15 were brief but still relevant to the question, while the answers written by subject X8 were brief and not relevant to the question. This

statement is supported by Riwayati & Cintamulya's research (2017); Istinabila & Fardah (2022) that subject X8 who has an impulsive style tends to write answers that deviate from the questions. This is because the subject impulsively takes the test without paying close attention to the questions so that the answers given are random and sober. This statement is supported by research by Fuady et al. (2020); Margunayasa, et al. (2019) that impulsive SCT are not thorough and in a hurry when solving problems so they are not aware if there is an error. Based on this, it can be seen that the SCT is in a reflective style, namely subject Y15 answers the questions more according to the questions. Although the answer given is still not quite right.

Based on the above analysis regarding the differences between reflective and impulsive SCT, it can be seen that reflective and impulsive SCT have the same level of critical thinking, only differ in the writing of answers. Differences in answer writing were seen in several reflective and impulsive SCT. There are reflective SCT who are more detailed in describing a problem than impulsive SCT. In addition, there are impulsive SCT who give perfunctory short answers that don't match the questions. Meanwhile, reflective ones give short answers but are not careless. There are also reflective SCT who can recognize pictures and provide the right hypothesis, while impulsive SCT can recognize pictures but provide inaccurate hypotheses.

Based on Table 2. shows that apart from being different in writing the answers of reflective and impulsive SCT they also have the same level of critical thinking. The level of critical thinking is the same for each cognitive style, namely quite critical, less critical, and uncritical. This shows that there are reflective SCT who are in the moderately critical, less critical, and uncritical categories, while impulsive SCT are also in the moderately critical, less critical, and uncritical categories. This shows that the critical thinking level of reflective and impulsive SCT is the same. Based on the theory regarding reflective and impulsive SCT, the critical thinking level of reflective SCT should be higher than impulsive SCT. However, the results of this study indicate that the critical thinking level of reflective and impulsive SCT is the same.

The critical thinking level of reflective and impulsive SCT can be influenced by several factors. Reflective SCT think more about all information concepts so they take a long time to answer, whereas impulsive SCT need a short time to answer so that solving problems using concepts is better than reflective (Noor, 2019; Verawati et al., 2021). This can be one of the causes of the low critical thinking level of SCT because it takes a long time to think so that the time to work on the questions is also long. The time it takes for the reflective SCT to work on the questions makes the reflective SCT run out of time from what has been set to work on the questions.

Other factors that affect the critical thinking level of reflective and impulsive SCT are external and internal factors. According to Prameswari et al. (2018); Terblanche & de Clercq (2019) factors that influence critical thinking skills are physical condition factors, anxiety factors, and interaction factors. The physical condition factor is related to the decreased concentration of SCT, where reflective SCT do not fall into the low critical thinking category due to disturbed concentration when working on questions. In addition, anxiety factors can also affect a low level of critical thinking. SCT who are too anxious when working on questions can affect their thinking processes, where this anxiety can occur due to the time the questions are almost finished. The reflective SCT himself is a type of cognitive style that requires a long time to answer. In addition, the interaction factor between SCT and teachers can also affect the level of critical thinking. Good interaction between teachers and SCT can create a conducive atmosphere so that SCTcan concentrate on working on problems in the context of bull races in ethnoscience learning (Azizah et al., 2020; Saka et al., 2016).

The factors above can cause reflective SCT who should have a high critical thinking level to become low. In addition, reflective and impulsive SCT have different ways of

answering even though they have the same level of critical thinking (Hikmawati et al., 2020; Arifin et al., 2020; Sutrisno et al., 2020). The difference in how to answer reflective and impulsive SCT can be influenced by the learning process in the classroom. Research that was conducted by Rolfes et al. (2022); Yeo & Nielsen (2020) state that there is a need for a multi-representational approach in the science learning process, where multi-representation is a way to use verbal representations, images, graphics, and mathematics to develop critical thinking skills for prospective science teachers. SCT who have good critical thinking skills will be able to change questions in the form of image representations to verbal representations (Van der Zanden et al., 2020). This will result in SCT being able to analyze an image properly and then provide an appropriate statement about the image. This is the cause of the previous problem which states that reflective subjects are better at recognizing pictures and giving precise and detailed statements than impulsive SCT.

Besides that, seen from the perspective of critical thinking, where critical thinking is related to Ausubel's theory. Ausubel's theory states that a learning process can be said to be meaningful if SCT find their own knowledge through abstract information which is then processed into new information (Urhahne, 2021). This relates to reflective and impulsive SCT, both of which have differences. According to Fuady et al. (2020); Vranic et al. (2019) reflective SCT are careful and precise in giving answers, while impulsive SCT are not careful and tend to make mistakes in giving answers. This is what causes the previous problem which states that SCT are impulsive in giving perfunctory answers, answers that don't match the questions, and give inaccurate statements about a picture. This problem occurs because impulsive SCT do not pay close attention to the questions so that the answers tend to be wrong, where SCT cannot process the abstract information contained in the questions into new, appropriate information.

Therefore, based on the results of the research and discussion, during the learning process educators (teachers/lecturers) need to improve the development of critical thinking skills in the context of the environment and local wisdom in ethnoscience so that the critical thinking level of students (students, university students, SCT) tall. The cognitive style possessed by students needs further attention to see the different ways of solving problems so that it helps direct the learning process to be good and right on target. The use of problem solving questions in the context of ethnoscience, such as bull races, needs to be continuously cultivated so that students' critical thinking skills with this type of cognitive style can develop and be honed more sharply.

Conclusion

The conclusion obtained is that the critical thinking level of reflective science teacher candidates is better than impulsive in ethnoscience learning, although there are not many significant differences. Suggestions that can be given are the need for scientific reasoning abilities of students and teachers that are broad and deep regarding the madura bull races. This research has implications for ethnoscience instructional design and improves students' thinking skills.

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