

Instructional Strategy for Critical Thinking Disposition: Preparing Prospective Elementary

By by by

Instructional Strategy for Critical Thinking Disposition: Preparing Prospective Elementary Teachers in the Twenty-first Century

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Abstract

Applying active learning to promote students' critical thinking disposition is one of a current educational goal. However, it is very rare to find the research that explores the critical thinking disposition, particularly for the students who are prospective elementary school science teachers. This study aims to investigate the effects of collaborative inquiry learning on the critical thinking disposition. A quasi-experimental design with a pre-test/post-test control group was used. The total of 149 students of primary school teacher education programs participated in this study. They were divided into two groups, namely the experimental group who received treatment with the collaborative inquiry learning strategy (experiment) and the control group received treatment with the conventional strategy. The critical thinking disposition data were obtained through the critical thinking disposition inventory test and analyzed by using paired t test. The findings of this study indicate that the students in the experimental class who were exposed to collaborative inquiry learning obtained higher critical thinking disposition scores than the students in the control class. The findings of this study reveal that collaborative inquiry learning can be an effective strategy to improve critical thinking disposition.

Keywords

Collaborative Inquiry Learning, Critical Thinking Disposition, Prospective Science Teachers

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Introduction

Nowadays, collaboration and critical thinking have been recognized as the 21st century skills. Almost all countries have included these two skills as the determining factor for educational success (Ahonen & Kinnunen, 2015; van Laar, van Deursen, van Dijk, & de Haan, 2020). In Indonesia, a competency-based curriculum has long been introduced by the Ministry of Education and Culture, with an emphasis on the character building and scientific attitudes such as logical, creative and innovative thinking. However, the facts show that in the college graduates, collaboration and critical thinking are found to be very limited, including the student teacher candidates who are prepared to teach in the future (Brevik, Gunnulfsen, & Renzulli, 2018; Irwanto, Rohaeti, & Prodjosantoso, 2018; Straková & Cimermanová, 2018). At the same time, these attitudes and skills are necessary in the field of work.

This problematic dichotomy presents the need to better understand how collaboration and critical thinking are taught especially to aspiring primary school teachers who are ready to teach their students in the future. Facione (2000) recommends that critical thinking can be improved through developing the critical thinking disposition. Students who have the awareness and attitude to think critically have the opportunity to hone the critical thinking skill.

Many studies have focused on efforts to improve the critical thinking skill through the application of learning strategies (Erdogan, 2019; Mahanal, Zubaidah, Sumiati, Sari et al., 2019; Saputra, Joyoatmojo, Wardani, & Sangka, 2019; YASIN, JAUHARIYAH, MADIYO, RAHMAWATI et al., 2019). However, only a few studies focus on efforts to improve the critical thinking disposition, such as Owen (2019) research which applies the Problem-Based Learning approach to determine students' critical thinking disposition. Another study by Arsal (2017) uses an inquiry-based learning approach for critical thinking disposition in mathematics class students. Dehghanzadeh, Jafaraghaie, and Khordadi (2018) compared the effect of traditional learning with the flipped classroom approach on the critical thinking skill and disposition for nursing students. This study focuses on the efforts to improve the critical thinking disposition of science teacher candidates through the application of a collaborative inquiry approach. As far as our knowledge, there has been no study that applies a collaborative inquiry approach to promote the critical thinking disposition of elementary school teacher candidates.

Research shows that there is a significant relationship between learning activities for prospective teachers and teaching activities in the school (Vries, Jansen, Helms-Lorenz, & van de Grift, 2014; Desimone, Porter, Garet, Yoon et al., 2002; Stokking, Leenders, De Jong, & Van Tartwijk, 2003). The prospective teacher students who are involved in active learning activities will inspire them to apply it in school (Agyei & Voogt, 2014; Desimone et al., 2002; Schwarz, Reiser, Davis, Kenyon et al., 2009). It indicates that teachers need to instill a positive attitude towards the critical thinking. They must first be aware of their critical thinking disposition and take responsibility for their students' work and critical thinking skill. Teachers who do not have the critical thinking disposition automatically do not have the ability to teach the critical thinking disposition to their students (Mohamad, Rahim, Sulaiman, & Baki, 2015). This statement is supported by Abrami, Bernard, Borokhovski, Wade et al. (2008); Facione (2000); Sahika (2018) who argue that the best way to improve the skill and critical thinking disposition is to apply them explicitly through the academic activities such as training and faculty development.

This is considered necessary to be investigated, given the scarcity of literature on the critical thinking tendencies of elementary school teacher candidates. Thus, to fill the gaps in the literature, this study aims to determine the critical thinking disposition of elementary school teacher candidates by implementing inquiry collaborative learning strategies.

Collaborative learning is not only learning and working in groups with the teacher instructions; however, it is a process by which two or more people interact to activate their cognition (Dillenbourg, 1999). In collaborating, students must engage together, recognize the differences in knowledge, unite the perceptions, and find the solutions. The individual success in collaboration based on the joining intellectual activities and efforts (Laal & Laal, 2012; Lou & Kim MacGregor, 2004). Many researchers have focused on collaborative learning. This is influenced by the characteristics of collaborative learning that emphasize the social interaction, intellectual engagement, and shared responsibility. The term collaborative inquiry is a sub-category of collaborative learning and inquiry. The word inquiry comes from the word to inquire which means the involvement in asking questions, seeking information, and conducting investigations. It is a

collaborative approach to solving problems in a reflective and interactive way where the individuals construct meaning and together confirm the understanding (Garrison, 2015). Combining the collaborative learning with inquiry learning can enhance the performance leading to the development of new knowledge (Okada & Simon, 1997; Springer, Stanne, & Donovan, 1999; Van Boxtel, Van der Linden, & Kanselaar, 2000). There is a very important relationship between inquiry collaborative learning and critical thinking disposition. Both are based on the students' willingness to take the responsibility and have the ability to construct the meaning and validate the information. The disposition of critical thinking is the spirit of the soul and self-motivation to be active and systematically involved in the problem verification, understanding the problems, looking for and considering the evidence, and evaluating. In the context of learning, the word disposition leads to self-regulation and active involvement in truth seeking while the term of critical thinking contributes to the students' ability to examine, evaluate, criticize, and promote the concepts based on valid facts. The critical thinking disposition is needed to lead elementary school teacher candidates to think critically. This is not only for their personal needs but it also for their future generations. This can be achieved if they are trained to be involved together in planning, designing and conducting the investigations. Therefore, this study aims to investigate the effect of collaborative inquiry learning on critical thinking disposition of elementary school science teacher candidate students. The research questions are:

- RQ1: Is there any significant difference between the pre-test and post-test scores of the experimental group in terms of critical thinking disposition?
- RQ2: Is there any significant difference between the control group's pre-test and post-test scores in terms of critical thinking disposition?
- RQ3: Is there any significant difference between the post-test scores of the experimental group and the control group in terms of critical thinking disposition?

Literature Review

Critical Thinking (CT) and Disposition of Critical Thinking (CTD)

Critical thinking is an individual asset to understand and solve problems holistically. Ideally, a person is considered as a critical thinker if he is able to utilize the intellectual intelligence to think or act in a reflective and reasonable manner (Ahrari, Samah, Hassan, Wahat et al., 2016; Beavers, Orange, & Kirkwood, 2017; Ennis, 2013). This includes two dimensions of thinking, namely the cognitive dimension (critical thinking skill) and the disposition dimension (critical thinking disposition). The cognitive dimension deals with the process of reasoning, problem solving and decision making based on the evidence and/or values. The disposition dimension relates to the motivation or enthusiasm for critical thinking. These two dimensions need each other; critical thinking skills can be improved through the encouragement of internal motivation (critical thinking disposition). Conversely, to foster the critical thinking disposition requires the critical spirit. The term of critical spirit refers to the characteristics of individuals who often make use of critical thinking skill.

The critical thinking skill is needed in the field of work so that it attract a lot of attention from researchers to investigate it. The researchers and educators have found that there is other dimension within individuals that is able to foster the critical thinking skill, namely the disposition dimension. This finding diverts the attention of the researchers to improve the critical thinking disposition, including student teacher candidates who are ready to teach their students in the future. Research conducted by Demirhan and Köklükaya (2014) shows that science teacher candidates have the ability to think critically at the middle and low levels. The results of this study recommend that there is a need for models, strategies, approaches and methods to improve the critical thinking skill of science teacher candidates. The results of this study are in line with previous research conducted by (Kezer & Turker, 2012), related to the critical thinking disposition of science teacher candidates in Turkey. Research conducted by Aرسال (2017) concerning the effect of inquiry learning towards the critical thinking disposition of prospective teachers using the quasi-experimental method shows that there is no significant effect between inquiry-based learning and teacher candidate critical thinking disposition, even though there is an increase in critical thinking disposition. This result contradicts several previous studies such as Desimone et al. (2002) which

found that inquiry-based learning positively affects the critical thinking disposition of prospective teachers. Therefore, we suspect that critical thinking disposition can be improved by providing opportunities for students to plan and conduct investigations in groups through a collaborative inquiry learning approach.

Collaborative Inquiry Learning

Collaborative learning is not only learning and working in groups by the teacher instruction but it is a process by which two or more people interact to activate their cognition (Dillenbourg, 1999). In collaborating, students must engage together, recognize the differences in knowledge, unite the perceptions, and find the solutions. Individual success in collaboration based on the joining intellectual activities and efforts (Laal & Laal, 2012; Lou & Kim MacGregor, 2004).

In the current era where the collaborative learning is found to be more prominent, many pedagogical researchers are focusing on the collaborative learning. This is influenced by the characteristics of collaborative learning that emphasize the social interaction, intellectual involvement, and shared responsibility - along with the development of the term collaborative education research, which is then combined with several learning methods, for example inquiry learning collaborative. The term of collaborative inquiry is a sub-category of collaborative learning and inquiry. The word inquiry comes from the word inquiry, which means involvement in asking questions, seeking information, and conducting investigations. Investigation is a collaborative approach to solving the problems in a reflective and interactive way in which individuals construct the meaning and together confirm the understanding (Garrison, 2015).

Combining the collaborative learning with the inquiry learning can improve the performance which leads to the development of new knowledge (Okada & Simon, 1997; Springer et al., 1999; Van Boxtel et al., 2000). When students collaborate, they can exchange ideas, ask questions, provide explanations, and negotiate. In carrying out the collaborative inquiry learning, learning requires preparation from students. The role of the teacher is as active as the role of students, and the teacher must be active in fulfilling the student needs. As long as the activities of collaborative inquiry such as lesson plan create the collaboration situation, encouragement, and motivation is the main task of the students (Urhahne, Schanze, Bell, Mansfield et al., 2010). The students who design the learning before teaching can contribute to the student understanding (Van Uum, Verhoeff, & Peeters, 2017). They must ensure that the learning environment including media and learning resources is according to the inquiry activities. They also need to master all of the devices or the materials used include the tools, teaching materials, and learning steps.

Hypotheses Development

There are three hypotheses proposed in this study as follows:

Hypothesis 1: There is a significant difference between the experimental group's pre-test and post-test scores in terms of critical thinking disposition.

Hypothesis 2: There is a significant difference between the control group's pre-test and post-test scores in terms of critical thinking disposition?

Hypothesis 3: There is a significant difference between the post test scores of the experimental group and the control group in terms of critical thinking disposition?

Research Method

1 Research Design

Quasi-experimental with pre-test / post-test control group design was used in this study. Four parallel classes were given intervention for 12 weeks from August to November 2019. Two parallel classes as the experimental groups were taught by collaborative inquiry learning. Meanwhile, the other two classes as the control group were taught using conventional inquiry. The inquiry and conventional collaborative learning were as the independent variables while the critical thinking disposition was as the dependent variable. The critical thinking disposition instrument was adapted to assess the critical thinking disposition of elementary school science teacher candidate students before and after the intervention.

Population and Sample

This study involved 149 students of the Elementary School Teacher Education program at Khairun University, Ternate, Indonesia. They are first year students who are taking the basic science courses. They were divided into two groups, namely the experimental group (N = 74) and the control group (N = 75). This division is based on data which obtained through the personal identity form and the pre-test score of critical thinking disposition. The results of the t-test sample of the independent sample of pre-test data showed that these two groups had the same critical thinking disposition ($t(149) = -0.528; p > 0.05$).

Data Collecting Instrument

In measuring critical thinking dispositions, an assessment instrument is used in the form of a questionnaire with a multilevel scale. The instrument was arranged in the form of a statement with a total of 45 items. The questionnaire statement originated from the seven habits of thought put forward by Facione, namely truth-seeking, open-mindedness, analytics, systematic curiosity, self-confidence and maturity. The instrument was arranged using a Likert scale (1 = "strongly disagree; 2 = disagree; 3). This instrument was developed by adapting from instruments that have been developed by Sosu (2013) and Shin, Park, and Kim (2015) but adapted or adjusted in the context of collaborative inquiry learning for student teacher candidates. This is because Sosu (2013) and Shin et al. (2015) focus more on critical thinking disposition in general. The research instrument can be seen in Table 1.

Table 1

List of statements/questions used to measure critical thinking disposition Sosu (2013) and Shin et al. (2015)

No.	Questions/Statements
1	I think of quality ideas when discussing
2	I rarely think of new ideas in solving problems
3	I use more than one source to find information
4	I immediately accept other people's ideas without considering them
5	I like intellectually challenging things
6	I justify the choices that I make even without evidence
7	I try to understand how investigation works
8	I avoid negative things that affect my mind
9	I think that any opinion does not need any reason or evidence
10	I often think about my actions to see if I can fix them
11	I wisely take the decisions
12	I solve the problem based on systematically managed data
13	I lack of confidence in solving the problem
14	I am considering several alternatives to solve the problem
15	I defend the truth based on the evidence
16	I give reasons if I disagree with other people's opinions
17	I use appropriate reasons in taking the decisions
18	I often think about my actions to see if I can fix them
19	I immediately answer questions / solve problems before examining them first
20	I look for solutions based on various aspects
21	I am active in thinking
22	I express doubts about other people's ideas in a wise way
23	It bothers me a lot if I can't solve a problem
24	I usually check the source of information before making any judgments
25	I stick to my idea even though I don't have good reasons
26	I look for new ideas from various points of view
27	I feel it is important to justify the choices I make
28	I doubt the answers / ideas that I convey despite the evidence
29	I believe I can get through the tough problems
30	I feel it is not important to review what I have done
31	I turn my mistakes into opportunities to continue learning
32	I am quick in making the decisions without the support evidence
33	I am willing to accept the truth with the support evidence
34	I defend my own interests without considering the interests of others
35	I accept the different views
36	I reflect on and acknowledge other people's ideas
37	I justify the choices that I make even without evidence
38	I work based on the defined procedures / steps
39	I make my conclusions based on evidence
40	I think of difficult things so I forget things that are easy to do
41	I think of the answers to specific things
42	I reevaluate my experience so that I can learn from it
43	I am willing to accept the criticism of my opinion
44	I have my own way in solving the problems
45	I believe the ideas that I express can provide solutions

Procedures

This research begins with a focus group discussion (FGD) between lecturers, researchers and observers. FGD was conducted to ensure that all equipment, tools and media as well as supporting facilities had been prepared. The timing of the research and the division of tasks for the research team was also agreed upon during the FGD activities. After conducting the FGD, the researcher then contacted the students and took the initial action, namely making an agreement through filling out the study contract form, filling in the personal data instrument including name, place of birth date, gender, origin and so on. Furthermore, participants from the experimental group and the control group were given brief training on the procedures and steps of inquiry collaborative learning. The researcher also provides an explanation of the principles of teamwork.

The research process was set at an odd semester of 16 meetings, starting from the pre-test stage, the treatment stage until the post-test stage. The pre-test activity was carried out the first week by distributing a critical thinking disposition questionnaire to students one week before the treatment was carried out. Then, the treatment stage was carried out in the experimental group and the control group. At the first meeting, the teacher provided reinforcement of scientific method steps to strengthen the inquiry skills. A 14-week recovery session with a total of 340 lesson hours was conducted face-to-face, non-face-to-face, and field or laboratory investigation. Inquiry collaborative learning activities were designed to involve students in learning the concepts, designing investigations, carrying out the investigations in the laboratory or in an open environment and making the reports in groups. Each group member was given the time to prepare each unit of investigation activity by studying the information before lectures begin at the next meeting. The initial conceptual knowledge of each group member was used as material for group discussion in designing and conducting the investigation. The researcher designed the intervention and provided the instructor with all the necessary materials.

In this study, the collaborative inquiry learning steps were adapted from several sources such as Cash, Dekoninck, and Ahmed-Kristensen (2017); Khine and Saleh (2010); Pedaste, Mäeots, Siiman, De Jong et al. (2015). There are five phases of collaborative inquiry learning, namely the orientation phase, conceptualization, investigation, conclusion and discussion. The orientation phase is a process to identify and encourage students' curiosity about the topics being taught. In this phase, the instructor divides students into small groups heterogeneously, gives investigative tasks, and delivers instructions. They work in groups, share assignments, brainstorm, determine problems to solve and set common goals. Furthermore, in the conceptualization phase students discuss in groups to formulate the problems or questions and formulate hypotheses based on theory. This process is carried out by sharing common understanding of topics through communication and social interaction. The team members from each group describe the context of the investigation and their ideas to improve and develop the design plan. This process is called the investigative phase which briefly begins with the exploration activities, continues with experiments and ends with interpretation.

After the investigation phase, the next phase is the process of making the conclusions based on the data and comparing the conclusions based on the data with hypotheses or research questions. The findings are presented in the form of a report which will be discussed with other groups in the discussion phase.

Results and Discussion

Data Analysis

The Kolmogorov-Smirnov normality test was carried out for the first time in data analysis to test the normal distribution of the data. The test was continued with the variance homogeneity test using Levene to test the homogeneity of variance between groups. Based on the results of the normality test and the homogeneity test of variance, it will be determined whether the parametric test can be used or not. Parametric testing used paired t-test to compare the pre-test and post-test, then the independent t-test to compare between the groups.

The result of the Kolmogorov-Smirnov normality test in Table 2 shows that the data used is normally distributed ($p > 0.05$) for all components of critical thinking disposition in each tested group, both

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 on the pre-test and post-test scores. Table 2 presents the result of the Levene test on the pre-test and post-test scores obtained by the experimental and control groups from CTD. 25

Table 2
 The Result of Normality Test with Kolmogorov-Smirnov

Component			K-S	P
Anlility	Pre-test	Experimental	0.095	0.094
		Control	0.097	0.079
	Post-test	Experimental	0.085	0.200
		Control	0.094	0.095
CT-Self Confidence	Pre-test	Experimental	0.100	0.064
		Control	0.085	0.200
	Post-test	Experimental	0.091	0.200
		Control	0.088	0.200
Mature Judgement	Pre-test	Experimental	0.098	0.076
		Control	0.090	0.200
	Post-test	Experimental	0.096	0.090
		Control	0.093	0.171
Inquisitiveness	Pre-test	Experimental	0.091	0.200
		Control	0.094	0.098
	Post-test	Experimental	0.096	0.089
		Control	0.081	0.200
Open-mindedness	Pre-test	Experimental	0.094	0.176
		Control	0.097	0.075
	Post-test	Experimental	0.091	0.200
		Control	0.091	0.199
Systematicity	Pre-test	Experimental	0.097	0.079
		Control	0.083	0.200
	Post-test	Experimental	0.100	0.065
		Control	0.100	0.061
Truth-seeking	Pre-test	Experimental	0.087	0.200
		Control	0.092	0.184
	Post-test	Experimental	0.083	0.200
		Control	0.091	0.198
Total	Pre-test	Experimental	0.094	0.168
		Control	0.094	0.168
	Post-test	Experimental	0.090	0.200
		Control	0.090	0.200

Table 3
 The Result of Variance Homogeneity Test with Levene

Component		F	df1	df2	P
Anlility	Pre-test	0.001	1	147	0.973
	Post-test	3.522	1	147	0.063
CT-Self Confidence	Pre-test	1.035	1	147	0.311
	Post-test	0.385	1	147	0.536
Mature Judgement	Pre-test	0.066	1	147	0.797
	Post-test	0.354	1	147	0.553
Inquisitiveness	Pre-test	0.156	1	147	0.693
	Post-test	0.007	1	147	0.932
Open-mindedness	Pre-test	0.166	1	147	0.684
	Post-test	3.463	1	147	0.065
Systematicity	Pre-test	2.640	1	147	0.106
	Post-test	1.349	1	147	0.247
Truth-seeking	Pre-test	1.778	1	147	0.184
	Post-test	3.491	1	147	0.064
Total	Pre-test	2.766	1	147	0.098
	Post-test	3.492	1	147	0.064

As shown in Table 3, the variance in the pre-test and post-test scores of the experimental and control groups of the total CTD component shows homogeneous data. In general, the results of the Kolmogorof-Smirnov goodness of fit and the Levene test reveal that the parametric test can be used to analyze data obtained from research. Table 3 presents the result of the independent sample t-test on the pre-test scores of the experimental and control groups of CTD. 25

The comparison result of the pre-test scores between the experimental group and the control group in Table 4 shows that there are no significant differences between all components tested (df=147; $p < 0.05$).

Table 4

The Independent t-test Result on the Pre-test Scores between the Experimental Group dan Control Group

Component		N	M	SD	t
Anlility	Experimental	74	2.498	0.377	1.386
	Control	75	2.413	0.366	
CT-Self Confidence	Experimental	74	2.703	0.370	0.680
	Control	75	2.658	0.431	
Mature Judgement	Experimental	74	2.270	0.355	0.472
	Control	75	2.242	0.373	
Inquisitiveness	Experimental	74	2.516	0.406	-0.225
	Control	75	2.531	0.428	
Open-mindedness	Experimental	74	2.541	0.441	-1.039
	Control	75	2.618	0.466	
Systematicity	Experimental	74	2.523	0.363	-1.572
	Control	75	2.627	0.440	
Truth-seeking	Experimental	74	2.511	0.455	-1.525
	Control	75	2.617	0.393	
Total	Experimental	74	2.509	0.214	-0.528
	Control	75	2.529	0.241	

* $p < 0.05$

The comparison of the pre-test and post-test scores in the experimental group in Table 5 shows that there are significant differences in all components tested (df=73; $p < 0.05$).

Table 5

The Results of Paired t-test on the Pre-test and Post-test Values in the Experimental Group

Component		N	M	SD	t
Anlility	Pre-test	74	2.498	0.377	-14.105
	Post-test	74	3.329	0.437	
CT-Self Confidence	Pre-test	74	2.703	0.370	-10.504
	Post-test	74	3.387	0.450	
Mature Judgement	Pre-test	74	2.270	0.355	-18.723
	Post-test	74	3.421	0.439	
Inquisitiveness	Pre-test	74	2.516	0.406	-13.880
	Post-test	74	3.547	0.450	
Open-mindedness	Pre-test	74	2.541	0.441	-14.847
	Post-test	74	3.504	0.442	
Systematicity	Pre-test	74	2.527	0.367	-13.798
	Post-test	74	3.493	0.492	
Truth-seeking	Pre-test	74	2.511	0.455	-14.230
	Post-test	74	3.509	0.461	
Total	Pre-test	74	2.509	0.214	-21.146
	Post-test	74	3.456	0.338	

* $p < 0.05$

The comparison result of the pre-test and post-test scores in the control group in Table 6 shows that there are significant differences in all components tested. The post-test mean score which was higher than the pre-test mean score indicated that the treatment carried out in the control group had a significant effect on the increase in the value of each component.

Table 6
The Paired t-test Result on Pre-test dan Post-test Scores in the Control Group

Component		N	M	SD	t
Anlificity	Pre-test	75	2.413	0.366	-14.668
	Post-test	75	3.151	0.355	
CT-Self Confidence	Pre-test	75	2.658	0.431	-9.077
	Post-test	75	3.124	0.426	
Mature Judgement	Pre-test	75	2.242	0.373	-16.181
	Post-test	75	3.211	0.489	
Inquisitiveness	Pre-test	75	2.531	0.428	-13.763
	Post-test	75	3.353	0.451	
Open-mindedness	Pre-test	75	2.618	0.466	-12.458
	Post-test	75	3.316	0.361	
Systematicity	Pre-test	75	2.627	0.440	-11.893
	Post-test	75	3.324	0.426	
Truth-seeking	Pre-test	75	2.618	0.393	-15.044
	Post-test	75	3.356	0.372	
Total	Pre-test	75	2.529	0.241	-25.480
	Post-test	75	3.263	0.271	

* p<0.05

The results of the comparison of post-test scores between the experimental group and the control group in Table 7 show that there are significant differences in all components tested. The average value of the experimental group which is higher than the average value of the control group indicates that the treatment carried out in the experimental group has a better effect on increasing the value of each component.

Table 7
The results of the Independent t-test on the Post-test Scores between the Experiment Group and the Control Group

Component		N	M	SD	t
Anlificity	Experimental	74	3.329	0.437	2.722
	Control	75	3.151	0.355	
CT-Self Confidence	Experimental	74	3.387	0.450	3.665
	Control	75	3.124	0.426	
Mature Judgement	Experimental	74	3.421	0.439	2.760
	Control	75	3.211	0.489	
Inquisitiveness	Experimental	74	3.547	0.450	2.629
	Control	75	3.353	0.451	
Open-mindedness	Experimental	74	3.504	0.442	2.858
	Control	75	3.316	0.361	
Systematicity	Experimental	74	3.493	0.492	2.242
	Control	75	3.324	0.426	
Truth-seeking	Experimental	74	3.509	0.461	2.237
	Control	75	3.355	0.372	
Total	Experimental	74	3.456	0.338	3.857
	Control	75	3.263	0.271	

* p<0.05

Theoretical Implication

This study reveals the results that in basic science courses, collaborative inquiry learning has a significant impact on the achievement of students' critical thinking dispositions. The collaborative inquiry learning approach makes students' critical thinking dispositions more accessible than conventional approaches. This may be triggered by the collective involvement of learners in the

meeting common goals. As a pedagogic approach, collaborative inquiry emphasizes the constructivist paradigm, in which learners obtain the new information from their peers and encourage the recall of knowledge and subject matter so as to contribute to the academic performance and more effective learning attitudes (Cooper, 2006). Several studies suggest that collaborative learning combined with the investigative and problem-solving activities contributes to the cognitive and affective learning outcomes (Pramusinta, Setyosari, Widiafi, & Kuswandi, 2019; SUKMAWATI, SETYOSARI, SULTON, & PURNOMO, 2019).

In the collaborative inquiry learning strategy, the learners engage collectively in exploring the material with their peers, acquire the new knowledge, compare their opinions with peers, evaluate the various perspectives and improve their problem-solving skills. This involvement encourages the students to develop analytical attitudes and teamwork, thereby enhancing their ability to think critically. This is consistent with Piaget (2002) and in line with Fung (2017) research. Piaget (2002) showed that cognitive dissonance, which is usually caused by peer social interactions, plays an important role in the cultivation of cognitive growth and amplifies the effects of learning. In this sense, the collaborative group work can be thought of as peer to peer interactions that promote the decision-making and shared the responsibility through the cognitive conflict. Fung (2017) proves that collaborative learning environments can help the learners in developing new ideas by emphasizing the important role of arguments in stimulating the critical thinking disposition.

In addition, Cheng and Wan (2017) also argued that the active involvement of learners in the exchange of contextual ideas to plan, design and conduct experiments can have a positive impact on the critical thinking attitudes. This practice reflects the application of constructivist theory, in which learners independently engage in collective work and experimental studies to require high-level abilities.

The results of the data analysis confirmed that the post-test mean score was higher than the pre-test mean score, indicates that the treatment carried out in the experimental group had a significant effect on the increase in the value of each component. The total average pre-test and post-test scores obtained from the experimental group $t(74) = 0.000$; $p < 0.05$. The total post-test mean score of the experimental group ($M = 3.456$, $SD = 0.338$) was found higher than the pre-test average score ($M = 2.509$; $SD = 0.214$). These findings indicate that the science course carried out with collaborative inquiry is effective in increasing the critical thinking disposition of science teacher candidate students. The results of data analysis also show that there are differences in critical thinking dispositions between students involved in collaborative inquiry strategies and conventional strategies.

On the other hand, although the average score for the seven components of critical thinking disposition was not much different in the experimental group, the inquisitiveness component obtained an average score higher than the other components while the lowest was the analyticity component. The high of inquisitiveness component is because the students are enthusiastic about designing their investigative activities, they intensely ask questions and discuss. Conversely, the analyticity component was lower than the other components because the students were less encouraged to develop arguments based on the evidence.

Practical Implication

Inquiry collaborative learning helps the learners to solve the problems while developing awareness and increasing their success through experiences ultimately contributing to a productive mindset. During the inquiry exercise, the learners' awareness will be increased as they are directly involved in developing content, finding problems, designing investigations, and finding answers. Students in the collaborative inquiry learning strategy group engaged in collaborative inquiry are very interested in creating and building the arguments. They seek to find the evidence of their friends' opinions by sharing claims and input the statements and participating in the discussions.

This performance is inseparable from the instructor's role in regulating and encouraging the learners' cooperation during the investigation. The learners have designed the collaborative spaces for them to create their own experiences and ideas, which ultimately regulates the need for a more targeted scaffold to address challenges that experienced by the learners and direct them in specific directions in a phase with the structure. Learner assistance such as providing structure and space in the collaborative inquiry phase can increase learners' willingness to collaborate. In a broader sense, the learner's role in inquiry collaborative learning is very important.

Learners can guide the students towards open-mindedness and self-confidence in the face of differences, sometimes even conflicting opinions. For example, when a student is a bit too enthusiastic in denying the opinion of his classmate, it results in a tense group atmosphere, thus requiring the learner's role to break the atmosphere, minimize the tension and encourage the group to continue the discussion. Furthermore, when the learners acknowledge one student's informative comments with a tone of agreement, other students are motivated to contribute thoughtful responses to get the similar treatment.

On the other hand, although taught using conservative and learner-centered methods, students in the control class had a pessimistic attitude. This can happen because large classes reduce the involvement of learners in the learning process. Researcher considers that the students-focused teaching is less successful because of the minimal interaction between student and student and between learner and students and also between students and the surrounding environment. The conventional learning environment does not provide opportunities for students to share, criticize or review the arguments. Many researchers argued that attitudes with views of cognitive, affective and individual behavior organized through previous experiences shape one's perspective on a particular problem. This means that attitudes are related to good experiences for students, whether they find the investigative activity interesting or not and how much activity they can do (Baseya & Francis, 2011). When students do not enjoy learning, they tend to negatively affect their academic performance. Therefore, it can be stated that the learning environment determines the students' attitudes in both groups.

Conclusion

Collaborative learning integrated with inquiry can encourage prospective elementary school teacher students to hone scientific skills such as critical thinking, collaborative thinking and problem solving. This also has an impact on developing the critical thinking dispositions and improving the quality of primary school teacher education. The results of the study prove that the collaborative inquiry learning strategy is effective in increasing the critical thinking disposition than the conventional learning. Thus, the contribution of this study is to fostering teacher candidates who are ready to teach their students to think critically. Given the educational needs of primary school teachers, adopting a collaborative inquiry strategy can have a central role in developing analytical, systematic, transparency, maturation and open skills. The limitation of this study is using small sample size, so it will be a consideration to generalize the results. Besides, this study only focus on elementary school teacher. Future research can be carried out by including larger sample size and also applying the research regarding the collaborative inquiry learning to the other school such as secondary school or high school. Furthermore, it is necessary to study the utilization of computer technology to assist online collaborative inquiry learning activities to guide prospective teacher students towards longlife learners.

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