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The Effect of Teacher Collaboration as the Embodiment of Teacher Leadership on Educational Management Students' Critical Thinking Skills

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Abstract: The embodiment of teacher leadership has currently shifted onto the practice of teacher collaboration due to its potential to solve students' problems such as low critical thinking skills. Accordingly, this study quantitatively aimed to examine the effect of teacher collaboration on educational management students' critical thinking skills as well as their critical thinking retention. Subsequently, it qualitatively investigated the students' perspectives on teacher collaboration. 60 students selected randomly took part in the experimentation, in which 30 students were taught with teacher collaboration, and other 30 students were taught with individual lecturing. 10 students taught with teacher collaboration were further selected purposively to be interviewed for the qualitative investigation. Descriptive statistics alongside paired and independent t-tests were deployed to analyze the experiment results, and an interactive model was adopted to analyze the qualitative findings. The experiment showed that teacher collaboration had a more positive and significant effect on students' critical thinking skills than its counterpart did. The students taught with teacher collaboration enjoyed good retention of critical thinking skills as well. The students perceived that teacher collaboration improved their collaborative skills, awareness, and metacognitive skills in learning. Implication, limitation, and recommendation are discussed.

Keywords: *Collaborative skills, critical thinking skills, learning awareness, metacognitive skills, teacher collaboration, teacher leadership.*

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Introduction

The trends of educational democracy and decentralization of authority have led to a growing interest in the issue of teacher leadership (TL). The picture of TL has currently been viewed in a different way, not from its individual nature as it was commonly discerned, but from its collaborative nature (Wan et al., 2018). In its collaborative sense, TL can be understood as the process in which teachers find ways to engage other teachers, principals, and other community members in an educational institution to enhance the pedagogical quality for the sake of supporting students' learning advancement and achievement, either individually or collectively (Chen, 2020; Ismail et al., 2018; Suyudi et al., 2022). There are a number of dimensions *vis-a-vis* TL already depicted in previous research, such as trust (Demir & Akif, 2015), collaboration with colleagues (Ronfeldt et al., 2015), and the culture of organization (Kilinç, 2014). According to these dimensions, a collaborative competence is the most important skill a teacher must develop in order to become a good teacher leader. Ronfeldt et al. (2015) supported the foregoing by emphasizing that collaboration is one of the most critical representations of TL. In the processes of teaching and learning in the classroom, the most overt portrayal of TL is embodied in the practice of teacher collaboration (TC) (Asha et al., 2022).

TC, according to Bottia et al. (2016), is a concept of work in which teachers, together with their fellows, create lessons, avoid redundancy in mapping learning concepts and teaching materials, and improve compatibility across curricular components. Good collaboration occurs when group members learn from, cooperate with, trust, respect for, help, and actively relate to one another to attain common goals (Harney et al., 2015). The practice of TC will provide many

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benefits. Previous research has shown that TC is extremely beneficial because it allows teachers to learn from one another (Ibrahim, 2020) and facilitates the process of co-creating ideal learning environments (Anderson & Guerreiro, 2016). TC can be a rich source of professional development (de Jong et al., 2019). Datnow (2018) explained that the practice of TC will train teachers to make use of their quality time to learn together in order to improve their pedagogical practices. TC is a promising predictor of student learning enhancement, teacher competency improvement, and institutional progress (Meyer et al., 2020). Also, TC, according to Ibrahim (2020), has the potential to support students' collaborative learning as well, in which Warsah et al. (2021) have emphasized in their study that such learning collaboration affects the enhancement of students' critical thinking skills (CTSs), especially for those studying at a higher education level.

As the lecturers of educational management (EM) in a small university in Indonesia, we have been dealing with an issue of which our students oftentimes find it difficult to interact with learning materials that need CTSs. Broadly defined, CTSs are the processes in which one deploys his knowledge and reflected experiences to explain a problem, understand the interrelationships of a problem with other elements, confirm and analyze facts about a problem, and draw comprehensive conclusions of how to solve the problem faced (Warsah et al., 2021). Thus far, we have been teaching them with individual lecturing. The preliminary observation we already made demonstrated that the students still found it difficult to argue a material according to its substantial basis; they still had trouble in making comparisons and synthesis to construct and reconstruct a range of materials; and they also seemed to face difficulties in mapping sources to propose solutions to the problems raised in the materials learned. Such low demography of CTSs calls for an innovation of pedagogical intervention. Drawing upon our academic background as the lecturers of EM and our academic interests in the field of TL, we eventually ended up with the attempt to examine the effect of TC as part of classroom-based teacher-leadership intervention to improve EM students' CTSs.

Prior studies have theoretically proposed a possible relationship between TC and student CTSs. Lu and Wang (2021) sought to see students' CTSs taught by teachers with high collaboration but low in autonomy and those of high autonomy but low in collaboration. Their study ended up with a result that the low-autonomy teachers with high collaboration could provide students with more real-life learning, leading to the enhancement of students' CTSs. The forgoing result is also proven in the study executed by García-Martínez, Tadeu, et al. (2020) on the usefulness of online TC. One of the interesting findings they highlighted was that such online TC could trigger the improvement of students' CTSs. In a similar vein, Harris and de Bruin (2017) found that TC, besides leading to pedagogical creativity, could promote students' CTSs.

Although prior studies have been done in the area of TC and students' CTSs, there is still limited research providing experimentation-based data to ascertain the empirical effect of TC on students' CTSs. Thus far, previous studies have been merely working on the correlational dimension of the two variables. Other studies seem to focus on the interrelationships of TC with various elements other than students' CTSs, such as teacher competence (Anderson & Guerreiro, 2016), teacher professional development (Steyn, 2017), pedagogical enthusiasm (Datnow, 2018), and students' learning development (Meyer et al., 2020). This condition calls for an empirical and experimentation-based study to examine the effect of TC on students' CTSs. Hence, in the present study, we seek to fulfill this void by conducting a quasi-experimental study to examine the effect of TC on EM students' CTSs. There are a couple of contributions this study offers. First, in our context, this study can be a solution to deal with students' low demography of CTSs. Second, this study can be a source of vicarious experience for other academicians dealing with the same issue regarding students' low CTSs. Third, this study is contributive to provide empirically experimentation-based data demonstrating the influence of TC on students' CTSs. This study is guided by the following research questions. Also, brief reviews of TC and CTSs are provided after the presentation of research questions.

1. Does TC have an effect on EM students' CTSs?
2. Are the EM students' CTSs which are affected by TC retentive?
3. What do EM students perceive of TC?

Literature Review

Teacher Collaboration

Drawing upon the social interdependence theory, collaboration occurs when the individuals involved in the collaboration process have a positive sense of interdependence (Carpenter, 2018). A collaboration process runs successfully if there is an active interaction among the members of a group, and they are mutually supportive of a common goal (Bottia et al., 2016; Warsah, 2020). Collaboration in the context of teachers can be defined as professional interactions established among teachers in both formal and informal settings (Chen et al., 2020). TC, according to Bottia et al. (2016), is a concept of work in which teachers, together with their fellows, create lessons, avoid redundancy in mapping learning concepts and teaching materials, and improve compatibility across curricular components. Collaborative teachers are also willing to share responsibility for their students' progress, and they can help each other to develop the best practice in the classroom. In practice, the ideal collaborative work for teachers is to work deeply and actively, attempting to develop teaching performances while also increasing each individual's professionalism (Stevenson et al., 2016). Several external and internal factors can contribute to the effectiveness of TC. Previous

research has highlighted a variety of external factors that support the formation of ideal TC, such as the presence of a collaborative school culture (de Jong et al., 2019), the provision of teachers' autonomy to collaborate (Ibrahim, 2020), supports from educational institutions in such a way that provide collaborative training for teachers (Gremigni, 2019), the availability of TC networks (García-Martínez, Tadeu, et al., 2020), and the presence of instigators (Datnow, 2018). Several internal factors of TC may encompass teachers' interaction skills, active involvement, seriousness in a collaborative work, reflective abilities, and commitments (García-Martínez, Ubago-Jiménez, et al., 2020).

Critical Thinking Skills

CTSs, according to one of the most widely accepted and cited concept, refer to individuals' willingness to control their own thinking and set acceptable criteria and expectations for evaluating their own thinking (Elder & Paul, 2009). Several CTS models have been adopted by researchers so far, and the model rubrics have been used to assess students' CTSs. The first model is Huba and Freed's (2000) version whose scope includes several elements, such as identifying the problem, understanding general facts about the problem, gathering information, identifying values, generating possible solutions and considering the positive and negative effects of the solution, selecting the most appropriate solution, and determining the optimal course of action in relation to the solution. The second model is Paul and Elder's (2008) version whose elements include identifying goals, questioning problems, defining problems, recognizing definitions, drawing conclusions, and comprehending related consequences and effects. This model is intended to assess both students' writing ability and their reading comprehension. The third model is Browne's et al. (2009) version whose components entail material interpretation, evidence assessment, assumption analysis, clarification of main features, and construct propositions. They employ a scaffolding strategy to assist students in developing CTSs. However, according to our analysis, none of the aforesaid models has offered an easily practical assessment of CTSs in such a way that uses a scale. Such models offer a CTS assessment in the form of rubric interpretations which are qualitative in nature. With the purpose of an accurate measurement, an instrument such as a scale is highly needed. During literature reviews, we found Honey's version of CTS model as cited in Yaiche (2021) as the fourth. This model proposes several indicators of CTSs such as analytical skills, inference, evaluation, inductive reasoning, and deductive reasoning. We considered that this model is the most relevant one to be adopted for an accurate measurement because this model has already provided an adaptable scale of CTSs.

Methodology

This study adopted a sequential mixed-method design in an explanatory way, in which it was initiated by conducting a quasi-experimental study to address the first and second research problems: the effect of TC on EM students' CTSs and the retention of EM students' CTSs. This study was subsequently continued to qualitatively work on the third research problem, investigating EM students' perspectives on TC. This study was conducted at a university in Indonesia, the institution of which we had been devoting our teaching professionalism as the EM lecturers.

Quantitative Experimentation

The quantitative experimentation was undertaken to address the first and second research problems: EM students' CTSs affected by TC and the retention of their CTSs. This study recruited 60 undergraduate students majored in EM at a university in Indonesia as the participants. They were the first semester students majored in the department of EM. We assigned a random sampling technique to select them from 110 students as the population. The 60 students were homogenous in terms of learning burden, age, and educational level. For the purpose of experimentation, the 60 students were divided into two groups, in which 30 students became the members of the experimental group, and 30 students joined the control group. The students of both groups were of our regular students who had been taking our subject named "Introduction to Educational Management". Grounded in their demographic data garnered from the preliminary study, the 60 students, on average, had been categorized as having low CTSs. Hence, this experimentation could be a good program to help solve their CTS problems.

We designed the treatment for the experimental group in a theory-to-practice way. We commenced at reviewing various credible sources addressing the practice of TC. Among the sources we reviewed, the most representatives which provided clear pictures of TC practice were the scientific articles published by Bach et al., (2020), Banerjee et al. (2017), Bottia et al. (2016), Datnow (2018), de Jong et al. (2019), Liu et al. (2021), and Meyer et al. (2020). We conducted an inter-coder reliability technique to come up with the coded themes of TC practice. In this way, each of the researchers firstly constructed his own framework of TC. Subsequently, each version of the framework was compared with one another to reach common ground so that the final and agreed framework of TC treatment was obtained. According to the finalized framework of TC, the steps of implementing TC can be seen in Table 1. Two EM lecturers, the authors of this paper, became the actors who applied TC in the experimental group. Concerning the treatment for the control group, the teaching process was held deductively and handled individually by one of our lecturer fellows from the department of EM. The principle of deductive teaching in this sense was that the learning process was initiated by the lecturer's material presentation and ended by giving feedback to students in an explicit way (see Table 1). The

treatments of both groups were executed for eight meetings with the learning materials adopted from the syllabus of introduction to EM. The materials of both groups were organized in a similar composition (see Table 2).

Table 1. Treatments for the Experimental and Control Groups

Phases	Experimental Group	Control Group
Before teaching	• Developing lesson plans together • Exchanging materials • Discussing with the colleague the learning patterns, teaching techniques, and teaching methods • Discussing the roles and parts in presenting the learning materials • Jointly formulating the measurement standards to measure students' learning progress	• Designing lesson plans individually • Preparing learning patterns, teaching techniques, and teaching methods individually
While teaching	• Teaching with a team-teaching model using the agreed strategies and methods • Presenting learning materials consecutively and in a collaborative manner • Explaining learning materials consecutively and in a collaborative manner • Jointly helping students with problems in understanding learning materials • Conducting class observations together • In tasking students, one teacher takes a role as the direction provider, and the other teacher takes a role as the feedback giver consecutively	• Teaching using the planned strategies and method individually • Presenting learning materials individually • Explaining learning materials individually • Helping students with their problems individually • Monitoring students individually • Providing feedback individually
After teaching	• Meeting to discuss students' learning progress • Mutually respecting for different ideas • Sharing successful stories, inspiring each other, and building good relationships with the fellow teacher and with students • Discussing students' learning problems • Reflecting on teaching techniques • Giving feedback to each other	• Reflecting on teaching techniques individually • Preparing the next teaching intervention

Table 2. Topics of Learning Materials during the Experimentation

Meeting	Material topics
1st	The basic concept of educational management
2nd	Educational organizations
3rd	The management of curriculum
4th	The management of students
5th	The management of teachers
6th	The management of educational facilities
7th	The management of educational budgets
8th	The management of the relationship between educational institutions and society

To measure EM students' CTSs, we adopted a CTS scale developed by Honey as cited in Yaiche (2021). According to its original version, this instrument was designed to assess students' abilities to think critically in terms of five domains composed of analysis, inference, evaluation, inductive reasoning, and deductive reasoning. The scale's blueprint in Table 3 displays the domains, concepts, number of items, and one item example of each domain.

Table 3. The Scale Blueprint of Critical Thinking Skills

No	Thinking Domains	Concepts	Number of Items Per Domain	Example of Item Per Domain
1	Analysis	The ability to identify, group, compare, and contrast various sets of information.	6 items	I distinguish between facts and opinions.
2	Inference	The ability to absorb unstated information and the ability to draw a set of conclusions from a bundle of information.	5 items	I look for what isn't there rather than concentrate solely on what is there.
3	Evaluation	The ability to consider the value or essence of information.	7 items	I test the assumptions underpinning an argument or proposition.
4	Inductive reasoning	The ability to think in detail from specific domains to generate general domains.	6 items	I break down material so that I can see how ideas are ordered and raised.
5	Deductive reasoning	The ability to think in detail from general domains to specific domains.	6 items	I establish the assumptions that an argument rests upon.
	Total items		30 items	

Each item of the scale was measured using a Likert scale format comprising the options of never (1), rarely (2), sometimes (3), often (4), and always (5). Each item was valid because the *r* value of each item exceeded 0.7 as the minimum score of item validity. The reliability of the overall items was high because the *α* value was 0.86. To guarantee such reliability, we had also conducted a piloting study to 30 EM students excluded in our research samples. Our piloting study demonstrated the α values of 0.82 for the analysis domain, 0.86 for the interference domain, 0.87 for the evaluation domain, 0.84 for the inductive reasoning domain, and 0.81 for the deductive reasoning domain. As a whole, the mean of reliability score showcased an α value of 0.84. For the purpose of data collection, this critical thinking scale was used as the pretest, posttest, and delayed posttest.

The procedure of this study took four steps. The first was to distribute the CTS scale as the pretests to both experimental and control groups. The pretests of both groups were held on March 8, 2021. Each student in both groups was given 30 minutes to work with all scale items. The second was to provide both groups with eight meetings of learning interventions (see Table 2 for the learning topic of each meeting). Learning interventions of both groups took two months from March 15 to May 3, 2021. The students in the experimental group were taught with TC, and those of the control group were taught with individual lecturing (See Table 1 for the phases of treatments in both groups). The third was to distribute the CTS scale as the posttest to all students in both groups. The posttests of both groups were held on May 10, 2021. In a similar way, each student of both groups took 30 minutes to work with all scale items. In the following month, on June 14, 2021, we proceeded to conduct the fourth step by giving delayed posttests to the students of both groups by using the same CTS scale as the previous step. This step aimed to see the retention of EM students' CTSs.

The levels of EM students' CTSs from both groups were measured descriptively on the basis of mean (M) and standard deviation (SD). We deployed the paired t-test to assess the pretest-posttest difference in CTSs of students from both groups. We proceeded to use independent t-test to find out the difference in CTSs related to the posttest results obtained by the students of both groups. Another paired t-test was computed after the delayed posttests were taken by the students of both groups. This phase was intended to see the difference in CTSs between the results of posttests and those of the delayed posttests. It was worth noting that the more proximate the paired t-test score was, the more retentive the students' CTSs would be. The test for CTS retention was conducted to students of both groups. The paired t-test was used because the data of this study's samples were normally distributed. The results of normality test could be seen in the result section before the presentation of data analysis using the paired t-test. Subsequently, the independent sample t-test was deployed because samples' data were homogenous. The results of homogeneity test could be seen in the result section before the presentation of data analysis using the independent sample t test.

Qualitative Investigation

The qualitative investigation was conducted to address the third research problem concerning EM students' perspectives on TC. 6 students who had received teacher-collaboration-based learning interventions were purposively taken as the participants. We considered a couple of criteria for participant selection. First, the participants were those who had undergone learning processes with TC interventions. Second, they were sufficiently interactive and communicative to share their perspectives. Third, they were voluntarily willing to take part as the participants. The qualitative data were garnered from interviews conducted on June 21, 2021, one week after the experimentation was completely executed. The interview data were analyzed by deploying an interactive model (Miles et al., 2014)

composed of collecting data, mapping data, presenting data, and drawing a conclusion. As explained in prior, data collection was done using interviews. Data mapping was subsequently carried out by grouping the raw data resting upon the emerging codes or themes. To ensure the reliability of qualitative data, we applied an inter-coder reliability technique to come up with relevant and shared themes coded from the raw interview data. In this way, each of the researchers firstly coded the raw data at his own pace. Subsequently, each version of data coding was compared with one another to reach common ground so that the final and shared results of thematic data were obtained. The most representative data in their theme-based groups were further selected to be presented in a well-organized manner. The data were further presented in the form of figure, selected transcripts of interviews, explanations, interpretations, and theoretical and contextual discussions. Lastly, the results of data processing were concluded in a comprehensive manner.

Results

Quantitative Results

The Effect of Teacher Collaboration on Educational Management Students' Critical Thinking Skills

The effect of TC on EM students' CTSs was examined by assigning the paired t-test to see its effect in the dimension of before-and-after each intervention. The paired t-test was used because the samples' data were normally distributed. The results of normality test using Kolmogorov–Smirnov had showed the scores higher than 0.05 as the yardstick value of normality. In detail the normality scores were 0.14 for pretest and 0.11 for posttest in the experimental class and 0.12 for pretest and 0.15 for posttest in the control class. Continuously, the independent t-test was computed to see its effect in the comparative dimension between the posttest results obtained by the students of both groups. The independent sample *t* test was used because the samples' data were homogenous. The results of homogeneity test using Levene statistic had demonstrated the means of 0.31 for the experimental group and 0.33 for the control group. The foregoing scores were higher than the threshold of 0.05. The computation results of the effect of teacher collaboration on educational management students' critical thinking skills can be seen in Table 4.

Table 4. Computation Results of the Effect of Teacher Collaboration on Educational Management Students' Critical Thinking Skills

Groups	Tests	Mean	SD	N	Sig.	Mean of d	Effect Size (Cohen's d)
Experimental Group (eight-meeting learning interventions in the form of TC)	Pretest	56.5	22.057	30	0.000	21.5	1.11
	Posttest	78	18.58	30	0.000		
Control Group (eight-meeting learning interventions in the form of individual lecturing)	Pretest	57	23.85	30	0.000	10.7	0.4
	Posttest	67.7	26.03	30	0.000		

Table 4 showcased that there was a significant difference in students' CTSs as they were taught with TC according to their pretest and posttest scores ($p=0.000<0.05$). In a similar vein, a significant difference in students' CTSs was also identifiable as they were taught with individual lecturing according to their pretest and posttest scores ($p=0.000<0.05$). Students of both groups had higher means of posttests than those of pretests. After taught with TC in the experimental group, the students' CTSs were represented by the posttest mean of 78. Such a score was higher than the pretest mean of 56.5 indicating their low CTSs before being taught with TC. The foregoing data indicated that TC had a significant effect on students' CTS with the effect size of 1.11. Such an effect size was categorized as high because 1.11 exceeded 0.8 as the minimum threshold for a high level of effect size. A comparable situation also occurred in the students taught by individual lecturing. After taught with individual lecturing in the control group, the students' CTSs were demonstrated by the posttest mean of 67.7. Such a score was higher than the pretest mean of 57 showcasing their low CTSs before being taught with individual lecturing. The foregoing data indicated that individual lecturing had an effect on students' CTS. However. the effect size was only 0.4 which was categorized as low because it did not exceed 0.50 as the minimum yardstick of moderate effect size. Broadly speaking, both TC and individual lecturing improved EM students' CTSs with different effect sizes.

Subsequently, the independent t-test showed a significant difference in CTSs after learning interventions between the students in the experimental group and those of the control group ($p=0.000<0.05$). The posttest mean ($M=78$) obtained by students taught with TC exceeded the posttest mean ($M=67.7$) gained by students taught with individual lecturing. The foregoing underlined that the students taught with TC had higher CTSs than those taught with individual lecturing in learning EM materials. The entire data meant that TC had a positive and significant effect on EM students' CTSs.

The Retention of Educational Management Students' Critical Thinking Skills

The retention of EM students' CTSs was assessed by providing those of both groups with delayed posttests in the following month after the experimentation was completely done. We compared the results of students' previous

posttests and those of the delayed posttests by deploying the paired t-test. The comparative scores can be seen in table 5.

Table 5. The Retention of Students' Critical Thinking Skills

Groups	Test	Mean	SD	N	Sig.
Experimental Group (after eight-time learning interventions in the form of TC)	Posttest	78	18.58	30	0.000
	Delayed posttest	76.35	20.2	30	0.12
Control Group (after eight-time learning interventions in the form of individual lecturing)	Posttest	67.7	26.03	30	0.000
	Delayed posttest	58.55	25.3	30	0.000

Table 5 indicated that the students taught with TC had the posttest mean of 78 and the delayed posttest mean of 76.35. Meanwhile, the students taught with individual lecturing obtained the posttest mean of 67.7 and the delayed posttest mean of 58.55. It was identifiable that the students of both groups underwent a decrease in CTSs. Nonetheless, the students taught with TC still had good retention of CTSs because no significant difference ($p=0.11>0.05$) in their CTSs viewed from the comparison between the posttest mean and the delayed posttest mean. On the other side, the CTSs of students taught with individual lecturing did not seem to be well-retentive due to a significant difference ($p=0.000<0.05$) in their CTSs viewed from the comparison between the means of posttest and delayed posttest. The foregoing data clearly emphasized that TC was sufficiently powerful to make EM students' CTSs retentive.

Qualitative Findings

Educational Management Students' Perspectives on Teacher Collaboration

The data on EM students' perspectives on TC were garnered from interviews with 6 students purposively selected from the members of experimental group who had received learning interventions in the form of TC. Data processing identified three themes representing students' positive perspectives. The coded themes can be seen in figure 1.

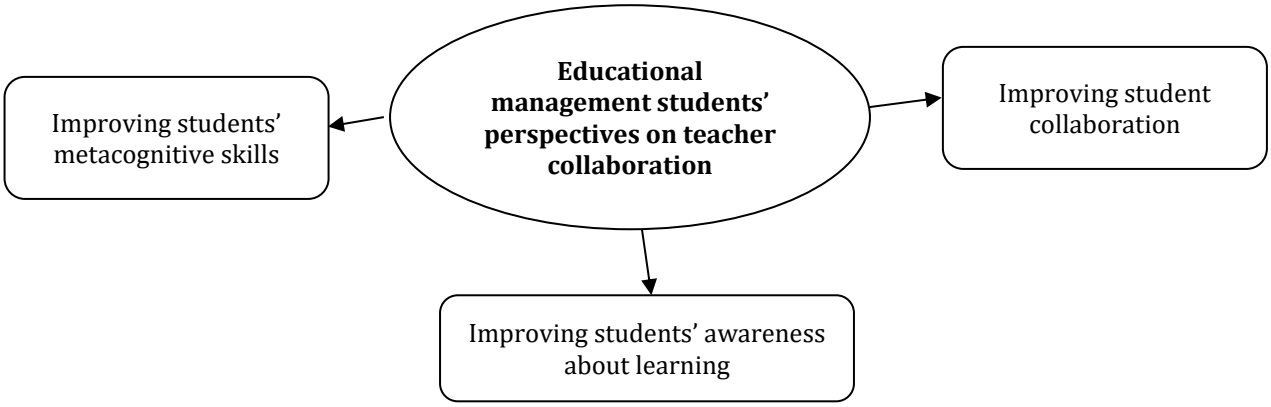

Figure 1. Coded Data of Interviews

According to figure 1, the first theme depicting students' perspectives on TC was *improving student collaboration*. During interviews, some students echoed that the collaborative teachers organized students to deal with learning materials and activities in groups, so that the students could share their viewpoints with others in a collaborative manner. This condition is portrayed in the following interview transcripts.

> *When studying with collaborating lecturers, we work in small groups to explore learning materials. This type of learning activity appeals to me because it allows my friends and me to share our perspectives and understanding of the materials (Student 3).*
>
> *Group activities must be included in one of the learning activities while studying with collaborative lecturers. When student collaboration in groups was active, the two lecturers walked around the classroom, meeting with each group to monitor the flow of our discussion (Student 6).*

Students 3 and 6 in the above transcripts perceived that collaborative learning activities embodied in the form of group discussion stemmed from the nature of TC. The students seemed to accept such collaborative learning as something novel and positive, espousing their learning improvement. The second theme coded from the interview data was *improving students' awareness about learning*. According to students, lecturers who taught them collaboratively could monitor their learning processes well, so they became more aware of the learning processes. This point is depicted in the following interview transcripts.

> *There is one interesting aspect of the learning process with collaborating lecturers that I have noticed. In my opinion, I have been more aware of the serious effort required to learn and comprehend the subject matter*

> *presented. This occurs as a result of collaborating lecturers exerting intense control over the learning process. One lecturer, for example, provided material instructions. Other lecturers would keep track of how serious students were about studying the material. This controlled pattern eventually caused me and my classmates to become more aware of the importance of learning in the classroom (Student 1).*
>
> *I was inspired by the seriousness of the lecturers who worked together to help us learn better. This made me realize how important it is to take learning seriously. Lecturers have even tried hard and been willing to put in the time and effort to collaborate for the sake of students, so my friends and I should take their class more seriously (Student 5).*

As echoed by students and 1 and 5, the intense control and the serious devotion the collaborative lecturers gave had an effect on students' awareness about learning. This is a positive effect because the more conscious and aware someone about learning, the bigger possibility the knowledge construction will take place as desirable. The third theme coded from interview data was *improving students' metacognitive skills*. The students perceived that the collaborative lecturers had stepwise phases of teaching which were well-constructed, so the students experienced well-managed processes of learning. Such experiences eventually triggered students' individual learning management as well.

> *Studying in the classroom with collaborative lecturers provided me with an opportunity to reflect on the significance of managing my independent learning process. The well-organized learning stages provided by the collaborating lecturers served as a model for me, and I was finally able to design my own independent learning at home (Student 4).*
>
> *Because I see the teaching patterns of collaborating lecturers that are highly organized by good learning designs, I feel like I get an implicit input on how to plan, execute, and evaluate my own independent learning (Student 2).*

It could be understood from students 4's and 2's transcripts above that they imprinted the collaborative lecturers' teaching-learning management, and they could try out to apply the imprinted teaching-learning management in another dimension of learning, their own independent learning. Hence, they could acquire metacognitive skills to plan, undertake, and evaluate their individual learning at their own paces.

Discussion

Drawing upon a contextual problem we found amid our students taking the EM major, in which they still had inadequate CTSs, we further conducted an experimentation that examined the effect of TC on students' CTSs alongside investigating their perspectives on TC. CTSs, as the complex processes of thinking across various cognitive dimensions to propose a solution to an issue (van der Zanden et al., 2020), became one of the important competences required by our students as the prospective educators and academicians of EM. Therefore, this experimentation was necessary to cope with problems in the context of our students. Because we aimed to reveal empirical and promising results of this experimentation, we designed to compare the results between learning interventions based on TC and those of individual lecturing. This experimentation was underlain by a couple of theoretical bases sounding the merits of TC as the realization of TL in the contexts of both teachers and students. For example, in the context of teachers, the practice of TC could be beneficial to teacher competence (Chen et al., 2020), teacher professional development (de Jong et al., 2019), and teacher pedagogical practice (Datnow, 2018). In the context of students, the practice of TC might contribute to students' learning development (Meyer et al., 2020) and their CTSs (Lu & Wang, 2021).

The experimentation revealed that both TC and individual lecturing had positive and significant impacts on EM students' CTSs. It was worth noting that learning interventions with TC positively affected students' CTSs better and in a more significant way. Grounded in the deployed construct of CTSs, the present study's data demonstrated that the students taught with TC experienced a significant improvement in the competencies of analysis, interference, evaluation, deductive reasoning, and inductive reasoning. After the experimentation was accomplished, in the following month, the EM students taught by TC still enjoyed good retention of their CTSs. Anchored in the design of TC deployed in this study, a theoretical premise can be drawn. The present study's experimentation theoretically proposes a conception that the practice of TC whose components may entail developing lesson plans and learning standards together (Bach et al., 2020), exchanging pedagogic contents, strategies, and roles, (Liu et al., 2021), applying team teaching models (Baeten & Simons, 2014), jointly providing opportunities to innovate and setting a jointly balanced work during teaching (Meyer et al., 2020), jointly engaging, monitoring, and evaluating students during learning (Liu et al., 2021), and reflecting as well as solving students' problems together (Lillo, 2018) all potentially contribute to the increase in students' competencies in terms of analysis, inference, evaluation, inductive reasoning, and deductive reasoning.

The current study's experimentation results to some degree find common ground if compared to the previous studies. For instance, Harris and de Bruin (2017) carried out a study on teacher creativity. Their study revealed that TC as a practical form of teacher creativity can boost students' creative and CTSs. However, the level of education in their study's context is secondary school, different from the present study's context at the level of tertiary education. Lu and Wang (2021) sought to see students' CTSs taught by teachers with high collaboration but low in autonomy and those of high autonomy but low in collaboration. Their study ended up with a result that the low-autonomy teachers with high

collaboration can provide students with more real-life learning, leading to the enhancement of students' CTSs. The forgoing is also proven in the study conducted by García-Martínez, Tadeu, et al. (2020) on the usefulness of online TC. One of the interesting findings they highlighted is that such online TC can trigger the improvement of students' CTSs. The aforementioned studies have been done in different contexts and at diverse levels of education. The fact that our study's results have corroborated the aforesaid studies underlines a premise that TC, across varied levels of education, can persistently improve students' CTSs in a variety of subjects learned. Nonetheless, as a conceptual reflection addressing a different viewpoint, García-Martínez, Ubago-Jiménez, et al. (2020) elucidated that not all teachers are capable of collaborating properly as desirable, so collaborative competencies among teachers must be developed. Hargreaves (2019) also emphasized that TC must follow a specific pattern or framework, or it will result in a trajectory that is off track in terms of achieving goals. In a similar vein, Chen et al. (2020) asserted that TC does not always improve students' performances if the collaborating teachers share ineffective learning methods. In our study, we already anticipated the aforesaid negative conditions in such a way that we had been devoting our serious efforts to build up collaboration during the provision of learning treatments; we had designed the theory-to-practice steps of teaching with TC principles; and we had made efforts to apply well-planned methods packed in team teaching models for the provision of learning treatments.

The present study further revealed some EM students' perspectives on TC. Their perspectives sounded positive. First, the students perceived that TC improved their abilities to collaborate with others during learning. This finding echoes a discourse addressed by Ibrahim (2020) that collaborative teachers have the potential to support students' collaborative learning as well. The essence of collaborative learning can be seen from the conditions of which, during learning, the students establish active interactions with others, engage others to negotiate the emerging issues from the learned materials, actively use learning strategies during collaboration, and take responsibilities for learning (Chatterjee & Correia, 2020). In our study's context, it was identifiable that the compatibility of teaching roles played by the collaborative teachers, by nature, led them to the design of collaborative learning activities for students. This is an effective way because prior research has proven that collaborative learning activities have a significant effect on students' CTSs (Warsah et al., 2021).

Second, the students perceived that TC improved their awareness about learning. Learning awareness can generally be identified from two domains, deliberate recognition for what is learned and conscious perceptions of learning as meaningful knowledge construction (Morrison et al., 2003). In the context of our study, students' deliberate recognition and conscious perceptions of learning processes were mostly triggered by good control the collaborative teachers took in teaching. This condition depicts what Bach et al. (2020) has delineated that TC provides a chance for teachers to make more detailed classroom observations, allowing teachers to monitor students effectively.

Third, the students perceived that TC improved their metacognitive skills. Metacognitive skills refer to students' awareness of their own thinking processes, which allows them to reflect on their knowledge, as well as the processes of effectively controlling their own cognitive or thinking activities to achieve the expected learning goals (Chen & Hapgood, 2021; Karlen & Compagnoni, 2017). Practically during learning processes, metacognitive skills represent students' independent skills in planning, monitoring, controlling, evaluating, and reflecting on the outcomes of learning evaluations (Bassett, 2016). In the context of our study, students' independent skills as such were mostly triggered by the well-organized phases of teaching that the collaborative teachers had designed and implemented. The effective management of teaching phases the collaborative teachers had applied seemed to have been a sort of vicarious experience (Bandura, 2012; Grenner et al., 2021) that the students could imprint and try out in their contexts of individual learning. Hence, TC triggered students to capably plan, implement, and evaluate their own independent learning.

This study leaves some implications. As implications, first, the practice of TC needs to be continuously done because it has a promising and positive effect on students' CTSs across educational levels. Second, the practice of TC needs to be espoused by other external factors for the sake of helping teachers to collaborate well. Some of which are the supports from the educational leaders, administrative management, and curricular system. Such external factors are critical because not all teachers manage to design their own collaborative teaching frameworks due to many problems associated with pedagogical knowledge, pedagogical experiences, and time availability. The presence of external supports can in many ways facilitate teachers' collaborative potencies in order to capably be embodied in good practice. Third, teachers across educational levels are called to keep improving their leadership competencies, especially for TC, because the practice of TC paves the way for helping students improve their CTSs, experience the controlled processes of knowledge construction, and receive meaningful learning as desirable.

Conclusion

The growing interest in TL has increased the essence of TC as a way to cope with university students' learning problems. Facing students' problems in terms of CTSs in learning EM materials, this study took a step to conduct an experiment to scrutinize the effect of TC on EM students' CTSs, examine their CTS retention, and investigating their perspectives on TC. The experiment sought to provide empirical data by also comparing TC with individual lecturing. The experiment concluded that both TC and individual lecturing positively and significantly affect EM students' CTSs.

Nevertheless, the eight-meeting learning interventions with TC have a more significant and positive effect on students' CTSs than those of the counterpart. Following the experimentation, the students taught by TC still enjoy good retention of CTSs. They also perceive TC as beneficial because it improves their collaborative skills, awareness, and metacognitive skills in learning.

Recommendation

Drawing upon the empirical effect of TC on students' CTSs and the perceived merits of TC in terms of improving students' collaborative skills, learning awareness, and metacognitive skills, it is recommended that further studies be conducted to work on the psychometric analysis incorporating the variables of CTSs, collaborative skills, learning awareness, and metacognitive skills to develop the future's concrete model of TC.

Limitations

This study is not free from limitation. This study was carried out to apply a leadership principle in the form of TC only within the dimension of teachers, excluding the leadership and structural supports which assist in the embodiment of TC framework. We admit that such a TC framework would not be as strong as the framework incorporating a combination of teacher, principal, and administration dimensions. In our context, the administrative structure and leaders of the university had not worked on the orientation towards TC. This context became such a natural limitation of this study which we could not control further. Nevertheless, we had made serious efforts to construct the TC framework in a theory-to-practice way, and we deployed an inter-coder reliability technique to reach an agreement to the TC framework as the key to learning interventions for experimentation.

Authorship Contribution Statement

Hamenghubuwono: Concept and design, data analysis / interpretation, drafting manuscript, securing funding, and final approval. Asha: Drafting manuscript, critical revision, and technical or material support. Warsah: Drafting manuscript, statistical analysis, and critical revision of manuscript. Morganna: Data acquisition, statistical analysis, and technical or material support. Adhrianti: Admin and data analysis / interpretation.

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