CHEMISTRY ONLINE COURSE: ITS IMPLEMENTATION FOR PRESERVICE CHEMISTRY TEACHERS' PROFILE OF COLLABORATION SKILLS AND COMMUNICATION CONFIDENCE

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Abstract

This study seeks to reveal the profile of collaboration skills (CS) and communication confidence (CC) of pre-service chemsitry teacher (PCT). Designed as a descriptive quantitative study, convenience sampling technique was adopted for this study. A total of 26 PCTs were involved as research samples. Data were obtained through two closed-ended questionnaires: the Collaborative Skill Questionnaire (CS-Q) and the Communication Confidence Questionnaire (CC-Q). Descriptive statistics were used to analyze the profile levels of the PCT-CS and PCT-CC. The level criteria were divided into five categories. Based on these results, the PCT-CS was generally at a good level. Meanwhile, the PCT-CC level was sufficient. Based on the research results that have gone through the data analysis stage, learning activities need to implement methods that are capable of training PCT-CS and PCT-CC such as collaborative learning methods.

Keywords: online learning, chemistry learning, collaboration skill, communication confidence

INTRODUCTION

Interpersonal skills are essential in the era of the Industrial Revolution 4.0. One of these is collaboration skills, which are essential in the 21st century (Wagner, 2010; Bernie, 2009). Along with interpersonal skills, developments in science and technology also demanding the development of preservice teachers, enabling them to survive and adapt to rapid change (Blizak, et al., 2020). This demonstrates that the rapid pace of innovation demands the importance of collaboration skills for preservice teachers, as they serve as the foundation for developing their teaching abilities. Improving collaboration skills can begin at any time, including during student teacher education. Students need to go beyond their intellectual understanding and assess how effective their role is in collaborative tasks (Johnson, et al., 2012). These skills require collaborative exploration of new ideas, fostering communication confidence and collaboration skills that synergize and impact preservice teachers' careers.

Collaboration skills are specifically pillared on the principles of mutual trust, communication, and goals which are inter-intrapersonal qualities and competencies to support one's work in solving problems or completing common goals. In the 21st century, these skills top the list of skills most needed for companies, schools, and all occupations (Bernie, 2009; Greenstein, 2012). This is relevant to work in the field of education, where interpersonal skills are concerned with direct interactions with others, whereas intrapersonal is about interactions with oneself. Individuals who have collaboration skills can effectively communicate their ideas, appreciate differences in their group, and are able to take part in discussions to solve complex problems (Cheng, et. al., 2015).

Good communication habits of preservice teachers can influence their students' attention to learn (Skagen, et. al., 2018; Holmes, 2013). Communication as a process of understanding and sharing information involves listening activities as an important role. Educators communicate with students not only verbally, but with beliefs and actions (Skagen, 2018; Cakirog and Aksoy, 2017). In a learning interaction, educators continue to send messages in the form of subject matter, so the focus of communication must be managed properly. Communication confidence as a process of receiving, interpreting, and believing in oneself

to convey a message, requires more preparation than just speaking, reading, or writing. The misunderstanding of students in capturing a message or material is one of the consequences of an error in interpreting more than half of what students hear (Skagen, 2018; Nicholson, et. al., 2013; Cheng, et. al., 2015). The factor that makes learning interactions inefficient is because human habits think faster than can be discussed so that a lot of focus is spent on thinking about what to say next if an educator does not have the readiness and confidence Cakirog and Aksoy, 2017; Cheng, et. al., 2015). Effective communication confidence can build positive learning interactions, awareness of one's own abilities, confidence to be able to convey material well, complete, relevant, and congruent, as well as feedback and self-reflection about what has been conveyed (Holmes, 2013).

As preservice teachers, communication confidence will build learning effectiveness because educators will have positive attitudes towards each other, students, and the school (Diikstra, et. al., 2008). Communication confidence plays an important role in learning interactions where educators must be confident and able to convey messages effectively so that they are believed by students. When educators convey messages that are contrary to their nonverbal behavior, are not confident, and confused, it will cause students to believe more what they see instead of what they hear from the educator (Kelley, et. al., 2017). In the field of education, self-confidence for communication is very important so as to form effective learning interactions (Thobroni, 2016). Communication does not only convey information, but also the belief that the interactions that occur can encourage the effort or enthusiasm of students to learn, modify students' attitudes, and stimulate students' thinking abilities. If an educator does not have communication confidence, the message to be conveyed through learning activities will be distorted and hampered (Nicholson, et. al., 2013).

Based on this background, it is important to examine the collaboration skills and communication confidence of students as preservice chemistry teachers. Several studies have shown the skill orientation of preservice teachers from the early stages of training will be useful in understanding the abilities and skill development of preservice teachers in learning orientation (Listiani, 2023; Capdaferro, 2012). It has covered online collaboration, but few have focused specifically on preservice chemistry teachers. This statement shows the urgency of providing education that is able to improve the collaboration skills of preservice teachers. The research questions guided this study as follows:

- How was the profile of preservice chemistry teachers' collaboration skill (PCT-CS)?
- How was the profile of preservice chemistry teachers' communication confidence (PCT-CC)?

RESEARCH METHOD

The research methods covering the research design and participants, data collection, and data analysis conducted in this study explained in this section.

2.1. The Research Design and Participants

This study adopted descriptive quantitative research, thus there was no experimental manipulation given toward the participants in this research. The participants in this research were preservice chemistry teachers in one public university in Yogyakarta (N=26). These samples established following convenience sampling technique since all of the preservice chemistry teachers in Chemistry Online Course (COC) were enrolled in the data collection process. Online learning is carried out through the assistance of Zoom Meeting by utilizing its features, such as breakout rooms for group discussions and presentation activities through sharing icons.

2.2. Data Collection Techniques

To answer the research questions, data were obtained through two closed questionnaires namely Collaborative Skill Questionnaire (CS-Q) and Communication Confidence Questionnaire (CC-Q), and open-ended questionnaire, as a research instrument. The CS-Q and CC-Q instrument was adopted through several relevant research. Using five Likert scale, the scoring was varied from 1 (strongly disagree) to 5 (strongly agree), it is reverse for the negative item statement. The validity of was carried out through two steps. First, the theoretical validity has reviewed by two expert judges in the fields of education and psychology. The expert was reviewed the CS-Q and CC-Q on the suitability of the statement with each indicator, the composition of the sentence, and the content of CS-Q and CC-Q. Advice from the experts was considered and revised to improve

the quality of the instrument. This theoretical validity assessment is considered for the improvement of the CS-Q and CC-Q instruments which will be tested empirically on non-sample students. Meanwhile, the empirical validity was conducted through Google Forms to easily accessed by students. A total of second-year undergraduate chemistry students were participated as the subject of the empirical validation. The result of empirical validation on CS-Q and CC-Q werer analyzed through Pearson Correlation. Thus, the value of estimation reliability of CS-Q and CC-Q was obtained from Cronbach's Alpha value. In total of 20 statements describe 5 aspects from Greenstein (2012) of collaborative skills as aown in Table 1, namely productivity (4), mutual respect (5), flexibility of compromise (2), responsibility (5), and participatory (4). Based on the results of the validity and reliability test, 13 items were valid, with a reliability estimate of 0.753.

Table 1. Number of CS-Q item

Aspect	Item Number	Number of Item
Productivity	1, 2*, 3, 4	4
Mutual respect	5*, 6*, 7, 8, 9	5
Compromise	10, 11	2
Responsibilty	12, 13*, 14, 15*, 16	5
Participatory	17, 18, 19, 20*	4

*) invalid items

Meanwhile, the CC-Q instrument consist of 30 statements adapted from Fair (2017) to describe 4 aspects of communication confidence as shown in Table 2, namely communication participation (7), awareness of communication rights (6), achievements towards results (5), interventions communication (7), contribution to needs (5). Based on the results of validity and reliability test, 23 items were valid with reliability estimate 0.804.

Table 2. Number of CC-Q item

Aspect	Item Number	Number of Item
Communication participation	1, 2, 3, 4*, 5*, 6, 7	7
Communication awareness	8*, 9, 10, 11, 12*, 13	6
Achievement of results	14, 15, 16*, 17, 18	5
Communication intervention	19, 20, 21, 22*, 23, 24, 25	7
Contribution to needs	26, 27, 28*, 29, 30*	5

*) invalid items

2.3. Data Analysis

Descriptive statistics are used to answer the categories of collaboration and communication confidence level of students. The category criteria are divided into 5 categories, namely very good, good, sufficient, less and very less. Calculation of category criteria is carried out as follows.

Table 3. Criteria for the level category

Profile Level	Score Criteria
Very good	$\bar{X} > Mi + 1{,}8\ SDi$
Good	$Mi + 0{,}6\ SDi < \bar{X} \leq Mi + 1{,}8\ SDi$
Sufficient	$Mi - 0{,}6 < \bar{X} \leq Mi + 0{,}6\ SDi$
Low	$Mi - 1{,}8 < \bar{X} \leq Mi - 0{,}6\ SDi$
Very low	$\bar{X} \leq Mi - 0{,}6\ SDi$

The analysis of the student's ability level was carried out based on the acquisition of the average score of collaboration ability and communication confidence on the pretest and post-test. Students' ability levels are grouped based on the scores obtained by their suitability to the category score criteria. In addition, the frequency and percentage of students in that category is calculated for each category.

RESULT AND DISCUSSION

3.1. Results

The research findings presented in this section will shows the results of descriptive statistic analysis. The results are shown to compare PCT-CS and PCT-CC. The statistical data displayed includes the number of students (N), the mean score, and standard deviation, in the initial meeting of COC course. The PCT-CS descriptive statistics results are presented in the Table 4.

Table 4. PCT-CS descriptive statistics results

Parameter	A1	A2	A3	A4	A5
N	26	26	26	26	26
Max score	15	15	10	15	15
Mean	11.12	12.85	4.50	13.42	12.38
Highest	14	15	5	15	15
Lowest	9	9	3	11	10
Std. Dev	1.107	1.488	0.648	1.301	1.359

*PCT-CS aspect:
A1 Productive

A2 Mutual respect
A3 Compromise and flexibility
A4 Responsibility
A5 Parcipatory

PCT-CS level analysis was carried out on the scores for each aspect of collaboration ability. Based on the results of the analysis, it is known that the overall PCT-CS level is in the good category. The level of each aspect can be seen in Table 5.

Table 5. PCT-CS profile level on each aspect

Aspect	Ideal Score Max	Mean	Level
Overall	65	54	Good
A1	15	11,12	Good
A2	15	12,85	Good
A3	10	4,50	Sufficient
A4	15	13,42	Very good
A5	15	12,38	Good

*PCT-CS aspect:
A1 Productive
A2 Mutual respect
A3 Compromise and flexibility
A4 Responsibility
A5 Parcipatory

Based on Table 5, it is clear that the overall profile of PCT-CS in COC courses is in the good category. In addition, the overall student profile and every aspect of the PCT-CS, ranging from very good to very poor, were also analyzed. The results of the PCT-CS level analysis are presented in percentage form as shown in Table 6. When viewed from the overall PCT-CS level percentage, as many as 53.8% of students are at a very good level, and 46% have a good level.

Table 6. The percentage of the number of students in each aspect of PCT-CS

Aspects	VG	G	S	L	VL
Overall	53,8	46,2	0	0	0
A1	3,86	73,08	23,08	0	0
A2	57,69	38,46	3,846	0	0
A3f	57,69	34,62	7,692	0	0
A4	53,85	46,15	0	0	0
A5	11,54	88,46	0	0	0

*PCT-CS aspect:
A1 Productive
A2 Mutual respect
A3 Compromise and flexibility
A4 Responsibility
A5 Parcipatory

The same analysis process was also carried out on PCT-CC. Descriptive analysis was performed to identify the mean score, highest score, lowest score, and PCT-CC standard deviation. The results of the descriptive analysis are shown in Table 7.

Table 7. PCT-CC descriptive statistics results

Parameter	B1	B2	B3	B4	B5
N	26	26	26	26	26
Max	20	20	20	20	15
Mean	16.81	12.96	15.42	22.88	11.92
Highest	20	15	19	30	15
Lowest	14	11	12	19	9
Std. Dev	1.575	1.076	1.653	2.903	1.324

*PCT-CC aspect:
B1. Participation
B2. Communication awareness
B3. Achievement of results
B4. Communication intervention
B5. Contribution to needs

PCT-CC level analysis was carried out on the scores for each aspect of communication confidence. Based on the results of the analysis, it is known that the overall CTCC level is in the sufficient category. The level of each aspect can be seen in Table 8.

Based on Table 8, it is clear that the overall PCT-CC profile in COC courses is in the sufficient category. In addition, the overall student profile and every aspect of the CTCC, ranging from very good to very poor, were also analyzed.

Table 8. PCT-CC profile level on each aspects

Aspect	Ideal Score Maximun	Mean	Level
Overall	105	80,2	Sufficient
B1	20	16,81	Good
B2	20	12,96	Sufficient
B3	20	15,42	Good
B4	30	22,88	Good
B5	15	11,92	Good

*PCT-CC aspect:
B1. Participation
B2. Communication awareness
B3. Achievement of results
B4. Communication intervention
B5. Contribution to needs

The results of the PCT-CC level analysis are presented in percentage form as shown in Table 9. When viewed from the overall PCT-CC level

percentage, 15.385% of students were at a good level, and 84.615% had a sufficient level.

Table 9. the percentage of the number of students in each aspect of PCT-CC

Aspects	Very Good	Good	Sufficient	Low	Very Low
Overall	0	15,385	84,615	0	0
Communication participation	38,46	61,54	0	0	0
Communication awareness	0	42,30	57,5	0	0
Achievement of results	11,50	69,20	19,20	0	0
Communication intervention	19,23	57,69	23,08	0	0
Contribution to needs	0	96,15	3,84	0	0

3.2. Discussions

The findings of this study relate to the collaboration skills and communication confidence of preservice chemistry teacher at Chemistry Online Course (COC) meetings. These two abilities are analyzed at their level so that the research results used as a basis regarding the selection of appropriate learning methods for chemistry learning. In addition, it is expected to support the development of their skills as future chemistry teacher candidates. This is important because collaboration skills that are specifically pillared on the principles of mutual trust, communication, and goals are a manifestation of inter-intrapersonal qualities and competencies to support their work in solving problems or accomplishing common goals. Meanwhile, communication confidence as a process of understanding and sharing information involves learning interaction activities. Educators communicate with students not only verbally, but with beliefs and actions (Skagen, 2018; Cakirog and Aksoy, 2017).

Based on the results of the PCT-CS data analysis in Tables 4 and 5, it has been seen that the student collaboration ability profile is in the good category. The results of this study illustrate that students have been able to perceive themselves based on self-confidence related to their contribution to collaborative activities. In this context, students try to analyze their beliefs and the value of being in a collaborative group with active involvement. They discuss, collaborate with their group mates to design ideas and communicate ideas to build problem solving (Sinex and Chambers, 2013). Furthermore, the contribution can be in the form of initiation to encourage discussion, find references and facilitate opinions from group members (Dewi, et. al., 2020). The findings in this study are supported by other empirical evidence in Mathematics and Natural Sciences education. As it is known that the chemistry learning process pays attention to aspects of the tiered characteristics of science, one of which is the identification of chemical concepts that are considered abstract. This allows the conception that the study of complex facts, laws, rules in chemistry gives rise to interdependence among learners to discuss and cooperate (Sinex and Chambers, 2013). These results are supported by open-ended question sheet that recorded the collaborative activities PCTs engaged in during online learning. The following is a breakdown of PCT responses based on their collaborative experiences in the COC conducted via Zoom Meetings.

activities that have been carried out to be able to contribute to the group (N=26)

“brainstorming, looking for references, giving suggestions and evaluation”	(N=8)
“participate in the discussion by actively giving opinions”	(N=8)
“initiate group mates to speak up to give suggestions and ideas”	(N=4)
“create a timeline for groups regarding study discussion schedules, deadlines for collecting assignments, intensively through virtual conference platforms, initiating meetings, and listening to other people's opinions on thoughts about the topics studied”	(N=2)
“do my homework in groups”	(N=4)

contributive actions to discussion groups (N=26)

“submit reference findings”	(N=4)
“provide responses to the ideas, understanding, and ideas of group mates”	(N=9)
“convey the concepts that I understand to the group”	(N=9)
“prepare a page or place for study discussions with friends and write down topics presented by discussion group friends”	(N=2)
“just present in the discussion room”	(N=2)

The results of the profile-level analysis on each aspect of the PCT-CS in this study are supported by empirical evidence from survey studies that report the collaborative ability of the scientific community. Individuals who have collaboration skills can effectively communicate their ideas, appreciate differences in their group, and are

able to take part in discussions to solve complex problems (Cheng, et. al., 2015). The participatory aspect is indicated by their ability to express ideas, solutions, and/or ideas in group discussions. This can be seen from the activities they carry out to be able to discuss in groups, namely looking for references, giving opinions. Individuals who have collaboration skills will encourage themselves to convey ideas, suggestions, and solutions that are expressed effectively so that they become useful in discussions. The next aspect that is productive is also in the category of good profile level. This means they are able to use their time efficiently by staying focused on their task without waiting for orders from other members. This is shown from their activities to do the tasks given in their respective groups, as well as exploring ideas from references that can be found. Unfortunately, on the aspect of flexibility compromise, they have not been able to understand, negotiate, and take into account the differences in individual characteristics to achieve collaboration goals, especially in heterogeneous groups. This understanding is shown through the inability to follow each individual's passive learning style to complete the task. This resulted in a number of students having to be more patient to receive suggestions and feedback in order to reach a common decision. However, in terms of responsibility, as a form of their readiness to study and work, they are at a good profile level. This means, students have the provision of information on the topic that is the subject of discussion as well as evidence that strengthens their ideas during the discussion. Consistently, they will be able to communicate without being asked and complete tasks on time. Although there are individual differences, the aspect of mutual respect is shown at a good profile level. They are willing to listen to the opinions of their group members and take the initiative to ask passive group members for opinions (Greenstein, 2012; Cheng, et. al., 2015; Dewi, et. al., 2020). These results are in accordance with the results of previous research that online learning has a positive impact in supporting student collaboration during learning activities (Anazifa, 2023).

As a support for the future career of PCT, communication skills are at the top of the list of skills most needed for all fields of work, one of which is education (Bernie, 2009; Greenstein, 2012). Work in the field of education, interpersonal skills related to direct interaction with other people, namely between teachers, students, and the learning environment. In a learning interaction, educators continue to send messages in the form of subject matter, so the focus of communication must be managed properly. Communication confidence as a process of receiving, interpreting, and believing in oneself to convey a message, requires more preparation than just speaking, reading, or writing. The misunderstanding of students in capturing a message or material is one of the consequences of an error in interpreting more than half of what students hear (Skagen, et. al., 2018; Nicholson, et. al., 2013; Cheng, et. al., 2015). The factor that makes learning interactions inefficient is if an educator does not have the readiness and confidence (Cakirog and Aksoy, 2015).

The research findings in Tables 7 and 8 show that the overall level of the PCT-CC profile is in the sufficient category. The results of this study illustrate that students need to practice to always suspend belief in expressing the right opinion. Of course, the opinions expressed must prioritize facts and scientific procedures that are in accordance with the principles of chemistry. In addition, in the learning process, students get feedback from members of their group or other groups so that mutual respect and acceptance needs to be suspended (Holmes, 2013). The results of this CTCC analysis can be made possible because human habits think faster than can be spoken so that a lot of focus is spent thinking about what will be said next (Cakirog and Aksoy, 2017). In the aspect of achievement of results, communication interventions, and contribution to the needs of goals, students managed to be at a good profile level. For example, in the aspect of communication participation, students are able to communicate in groups. They are confident that their opinions can be understood by their group members. It is relevant to the results of the students' entries on the observaation sheet that they also conveyed their ideas about the chemistry topic being discussed even though they did not read well. This is one of the obstacles, that even though their communication participation is good, it is still possible to believe that it cannot be fulfilled due to the lack of facts and data that support the ideas being communicated (Cakirog and AKsoy, 2017; Holmes, 2013). The aspect of awareness of the right to communication is at a sufficient level. Activities that support this aspect include

respect for group opinions and openness to criticism. Heterogeneous individuals make it possible for students to not be able to understand differences of opinion and mindset. Chemical concepts that are considered abstract are a matter of debate for group members who have different understandings. Therefore, empirical facts about the chemical concepts studied should be presented in the discussion. PCT-CC will be better if the delivery includes five phases, namely the process of listening, paying attention, conveying messages or materials, determining the meaning of the messages conveyed, and evaluating them against the learning experience (Cheng, et. al., 2015).

Based on the results of the research that went through the data analysis stage, learning activities should start promoting PCT-CS and PCT-CC. These two skills take an important role in learning interactions. Educators must be confident and able to convey messages effectively so that they are believed by students. When educators convey messages that are contrary to their nonverbal behavior, are not confident, and confused, it will cause students to believe more what they see instead of what they hear from the educator (Kelley, et.al., 2003). Effective PCT-CS and PCT-CC can build positive learning interactions, self-awareness, confidence to be able to convey material well, complete, relevant, and congruent, as well as feedback and self-reflection about what has been conveyed (Holmes, 2013). As preservice chemistry teachers, these two skills will build learning effectiveness because educators will have positive attitudes towards each other, students, and the school (Dijkstra, et.al., 2008). From the explanation of PCT-CC and PCT-CS obtained from the literature and research results, learning activities including chemistry need to be carried out with methods that can train PCT-CS and PCT-CC to bridge their careers as educators in the future. The methods that can be used in chemistry learning are group discussions, presentations, projects, problem-based learning (Mulyani & Arif, 2021) or other collaborative methods. Through collaborative learning, preservicechemistry teachers are facilitated by collaborative interaction activities between students so as to allow their implications for confidence and self-confidence to communicate their ideas.

CONCLUSION

Based on the results of research through analysis and discussion, it can be concluded that the overall profile of PCT-CS is in the good category. In this capability, the aspect that still needs to be improved is the flexibility of the compromise. As for the PCT-CC profile as a whole, it is sufficient. That is, the ability to positively influence the communication made by students as preservice chemistry teachers still needs to be improved. For example, by designing learning methods for group discussions, projects, presentations, and other collaborative learning.

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