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Description of Students' Collaboration Skills Chemistry Education Department of FKIP UNTAN in Basic Chemistry Practicum

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Abstract: Collaboration Skills (CS) are important to master in 21st century and must be developed for academic and career success in the real world. The study aims to describe the collaboration skills of Chemistry Department students at FKIP UNTAN through practicum learning activities in the laboratory. The research method is a quantitative descriptive research. The Research participants were 63 students who took basic chemistry practicum courses. Data collection was carried out using observation techniques with the help of two observers and collaboration skills observation sheets, that had been validated by two experts in the field of evaluation. The results showed that, the average of percentage value obtained for each indicator such as: contributing to group discussions (96.83%) is at very high criteria, working effectively in groups (99.40%) is at very high criteria, communicating in group activities (75%) is at high criteria, and having responsibility for completing group assignments (93.25%) is at very high criteria. Therefore, collaboration skills can not only be honed through teaching and learning activities in class, but also can be honed through practicum learning activities in the laboratory.

Keywords: Collaboration Skills; Basic Chemistry Practicum; 21st Century Skills

Introduction

The learning process is always evolving. The 21st century learning process is designed with the focus on students (Zakirman, 2017). 21st century learning integrates literacy, knowledge proficiency, skills, and attitudes, and mastery of technology (Ongardwanich et al., 2015). Students are demanded to have skills such as communication, collaboration, problem solving, critical thinking, creative, and innovate (Yani & Ruhimat, 2018). Collaboration Skills (CS) should be developed as they are important for both academic and career success of students (Spies & Xu, 2018). Collaboration is the process of learning in groups to discuss some differences in perspectives and knowledge through discussions (Trisdiono et al., 2019). Collaboration skills make students participate in activities to nurture relationships with others, appreciate mutual relationships, and teamwork to achieve goals (Le et al., 2018). Collaboration is defined as a partnership that shares responsibility, accountability, and roles within a group to achieve a common understanding of a problem being discussed and its solution (Da Fonte & Barton-Arwood, 2017; Davis et al., 2018). Collaboration relates to working effectively, responsibility attitude, and commitment to achieve goals together (Hidayati, 2019). Thus, collaboration skills are the process of learning in groups where students can exchange ideas, share responsibilities, work effectively, commit, and communicate with each other to solve problems efficiently and achieve a common goal.

Many benefits can be gained if students master collaboration skills. In the opinion of Istiyono et al. (2014), collaboration skills can be trained through

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education. Collaborative learning will run effectively through various approaches that involve the fields of attitude, knowledge, and skills (Cholis & Yulianti, 2020). Collaboration helps students become part of the group and increases the quality of group performance (Anggelita et al., 2020). Students who collaborate will obtain more knowledge (Ulhusna et al., 2020). Collaboration in a group can make better decisions than individuals (Le et al., 2018) and develop social skills. Collaboration make group move in harmonious unity, making it easier to solve problems, especially group internals. Fundamental problems such as differences in opinion and innate factors such as ethnicity, sect, race, and religion will be resolved quickly and not hamper the group discussion (Indrawan et al., 2021). Students' collaboration can support many things and make them become the part of society.

Collaboration skills have been applied to classroom learning, both in schools and colleges. Research from Saenab et al. (2019) successfully improved students collaboration skills by using Project Based Learning method. Students do the assigned tasks and manage their time to stay focused on the task and get the job done. Students also respect opinions in group discussion and do their best and do exactly what has been assigned (Anantyarta & Sari, 2017). Meanwhile, Firmansyah et al. (2022) measured students' communication, collaboration, critical thinking, and creativity skills through project-based lab (PJB – Lab). Students' collaboration skills increased as they became more actively involved in project completion. Creating a product with a combination of different perspectives and ideas, and having more or less equal contributions from each member are important criteria in collaboration. The more often students are trained to complete projects, the more skilled they are in collaboration. The research that has been done mostly measures 21st century skills in the classroom.

When learning chemistry, students are expected not only to master concepts in theory but also to be able to use scientific methods to prove existing concepts. To realize that, students can do practicum activities in the laboratory. Practicum can practice students' process skills and work skills (Candra & Hidayati, 2020). Practicum makes students actively involved, provides further understanding of concepts, and trains science process skills and critical thinking (Ulfah et al., 2021). In addition, practicum also trains various other skills such as the application of scientific methods, inquiry, problem solving, creative thinking, decision making, collaboration, communication, social interaction, and ICT literacy (Deacon & Hajek, 2011; Hofstein & Lunetta, 2004; Tobin, 1990). Collaboration in practicum can be proven by supporting data in the form of practicum report made after practicum (Junita et al., 2021). Thus, practicum in the laboratory can be an alternative option in training and developing skills through proving existing theories and concepts in chemistry learning.

The preliminary study was conducted in March – April 2022 by observing students who took practicum courses in advanced semesters. Students still have not distributed assignments equally in one group so that there are still members who work individually. Moreover, students are less alert and often communicate outside the context of practicum. Whereas in good collaboration, there are at least 3 major elements, namely communication, cooperation, and responsiveness (Hesse et al., 2015). It is clear that students collaboration in practicum is still deficient. Basic chemistry practicum was chosen in this study because it was first practicum course taken by Chemistry Education Department students of FKIP UNTAN. In basic chemistry practicum, students begin to be trained to distribute assignments equally before experiment, be responsible for completing tasks on time, compromise if there are differences of opinion, and focus when doing practicum in the laboratory.

The Chemistry Education Department students of FKIP UNTAN are mostly heterogeneous and come from different regions. Therefore, students must habituate themselves to collaborate with each other. Collaboration can form the students' mentality and personality (Pujiati et al., 2022) before they entering the real world. Students who are trained to collaborate make them well prepared when joining the world of work and facing the 21st century globalization era (Muiz et al., 2016). There has been no research that leads to measuring the students' collaboration skills in practicum activities in the laboratory. This attracts researchers to get an overview of the collaboration skills of Chemistry Education Department students at FKIP UNTAN, when doing basic chemistry practicum in the laboratory.

Method

The quantitative descriptive research with survey method is used to analyze data by presenting or describing something as it is. The participants in this study were 63 students who participated in Basic Chemistry practicum in the laboratory. Data collection was carried out in November 2022 using observation techniques assisted by two observers. The data collection instrument used was a collaboration skills (CS) observation sheet that contains indicators, aspects to be measured, and assessment rubrics. The instrument has been validated by two experts in the field of evaluation and calculated using the Gregory formula (Retnawati, 2016), with a value of 0,79. This value states

that the instrument can measure students' collaboration skills. Students were observer with four different score categories from one to four in each aspect measured. Each score category contains statements that are designed like a rubric. Students were given a check mark based on the rubric in the observation sheet. The indicators and aspects measured were adapted from Hairida et al. (2021) which are presented in table 1. The statements of each aspect can be seen in table 2.

Table 1. Collaboration Skills Indicators and Aspects

Indicators	Aspects measured
Contribute to group discussions	1. Providing suggestions in group discussions to complete group tasks. 2. The seriousness to do the best for the group in achieving group goals.
Work effectively in groups	1. Work as a team in completing tasks to achieve the same goals. 2. Working on tasks by sharing tasks and containing elements of positive interdependence to achieve the same goals.
Communicate in group activities	1. Respect each other's opinions among group members in completing tasks. 2. Ask friends if you find problems. 3. Compromise in making decisions if there are differences of opinion in decision making.
Having responsibility to complete group assignments	Group members were responsible for completing tasks on time according to the provisions.

Table 2. The Statement and The Score of Each Aspect on Rubric

Aspect measured	Statement and score
Providing suggestions in group discussions to complete group tasks	Not giving suggestions or responses to other members' suggestions in the group. (1)
	Respond to other members' suggestions in group discussions. (2)
	Give suggestions, but not used in group discussions. (3)
	Give suggestions and used in group discussions. (4)
The seriousness to do the best for the group in achieving group goals.	Not serious from the beginning to the end of the practicum. (1)
	Lack of seriousness during practicum. (2)
	Serious, but lost focus several times during practicum. (3)
	Serious and focused from the beginning to the end of the practicum. (4)
Work as a team in completing tasks to achieve the same goals.	Work as individuals. (1)
	Sometimes work as a team, but more often as individuals. (2)
	Working as a team, but sometimes as individuals. (3)
	Work as a team. (4)
Working on tasks by sharing tasks and containing elements of positive interdependence to achieve the same goals.	Not doing tasks as distributed and not giving positive interdependence reactions. (1)
	Doing tasks as distributed, but not giving positive interdependence reactions. (2)
	Doing tasks as distributed and sometimes giving positive interdependence reactions. (3)
	Doing tasks as distributed and giving positive interdependence reactions. (4)
Respect each other's opinions among group members in completing tasks.	Not respect group members' opinions. (1)
	Difficult to respect group members' opinions. (2)
	Respect group members' opinions at certain times. (3)
	Respect group members' opinions. (4)
Ask friends if you find problems.	Not asking group members when finding problems in the group. (1)
	Afraid to ask group members when finding problems in the group. (2)
	Asking group members when finding problems in the group. (3)
	Ask group members when finding problems and ask if there are problems in the group. (4)
Compromise in making decisions if there are differences of opinion in decision making.	Not used to compromise when there is a difference of opinion. (1)
	Motivated to compromise when group members compromise. (2)
	Able to compromise when there is a difference of opinion. (3)
	Used to compromise when there is a difference of opinion. (4)
Group members were responsible for completing tasks on time according to the provisions.	Irresponsible to the task so as not to finish on time. (1)
	Responsible to the task, but did not finish on time. (2)
	Responsible for finishing task on time. (3)
	Responsible for finishing task on time and helping group members to complete their task. (4)

The data analysis activity is carried out by grouping the data based on the distribution of students' collaboration skills and the aspects measured. The data was obtained from observation, in the form of numbers

from the rubric in the observation sheet. The distribution data of students' collaboration skills is calculated as a percentage using the formula (1). Then the data on students' collaboration skills based on the aspects measured, is calculated as a percentage using the formula (2). The percentage values of the aspects in the indicators obtained were totaled and then divided by the total aspects in the indicator to get the average percentage value of the indicator. The percentage results were matched with the collaboration skills criteria in table 3.

$$\% \text{ Students' CS} = \frac{\text{Score}}{\text{Max. Score} \times \text{Total Aspects}} \times 100 \quad (1)$$

$$\% \text{ CS Aspect} = \frac{\text{Aspect Score}}{\text{Max. Score} \times \text{Total Students}} \times 100 \quad (2)$$

Table 3. Collaboration Skills Criteria

Criteria	Percentage
Very High	≥ 86
High	71 – 85
Medium	56 – 70
Low	41 – 55
Very Low	≤ 40

Result and Discussion

The observation was conducted while students were doing basic chemistry practicum in the laboratory. Students are expected to collaborate in group. Observation starts when students begin practicum until completing the practicum report after doing the experiment. Thus, students' practicum reports can be completed on time, according to the provisions, and hopefully get maximum results. Students from two classes were divided into 8 groups of 3 – 5 people. They shared tasks and worked in shifts every week during the practicum. Therefore, students in each group got their own tasks and no one was not working during the practicum. Group work that consists of effective strategies to improve knowledge construction of science concepts, carried out by students together (Fung et al., 2018). The existence of collaborative work makes students more enthusiastic in constructing knowledge.

Practicum activities can build students' attitudes. The involvement of students actively can form behavioral patterns and attitudes based on scientific principles. Practicum can train the skills of experimentation, such as using tools, processing data, and so on (Kustijono, 2011). Practicum activities require students to communicate, cooperate, take responsibility, and contribute. Group members will work properly and care about each other both professionally and personally, have the same goals, and are passionate if they have collaboration skills (Cheruvelil et al., 2014). Thus, collaboration skills can help students in carrying out practicum activities. The collaboration skills data processed based on all students shows that students have good collaboration skills. There are 43 students in the very high criteria and 20 students in the high criteria. The percentage can be seen in figure 1. Furthermore, figure 2 shows the percentage of collaboration skills based on indicators. The percentage values of all four indicators are in the high to very high criteria.

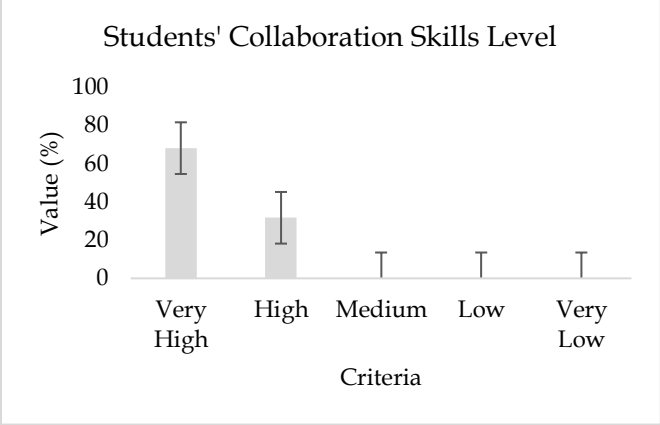

Figure 1. Students' Collaboration Skills Spread

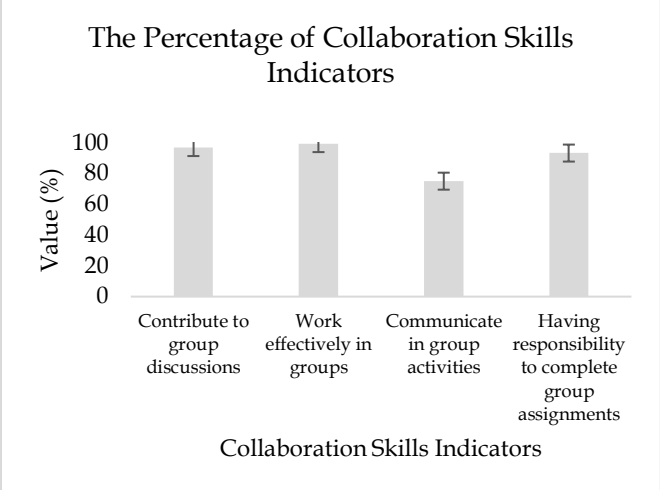

Figure 2. Collaboration Skills Indicators Value

Contribute to Group Discussions

This indicator obtained an average value of 96.83% with very high criteria. This indicator has two aspects, namely providing suggestions in group discussions to complete group tasks and the seriousness to do the best for the group in achieving group goals.

The aspect of providing suggestions in group discussions to complete group tasks gained a value of 94.05% with very high criteria. This value shows that students are able to contribute in group discussions. The observed contribution is in the form of providing suggestions or responses to suggestions that have been given by group members. Providing suggestions can

solve problems in the group. Providing suggestions, ideas, or solutions in discussions are examples of actively contributing to the group (Junita et al., 2021). Before doing the experiment, students discussed about the distribution of group tasks. The suggestions that were observed were about the results observed from the experimental procedures that had been done, as shown in figure 3.

Figure 3. Students are Providing Suggestions About the Results that will be Written in the Interim Report

The suggestions given by students came from group members who were confused about the color and texture of substances that had been mixed with solvents, which had to be written in the interim report. However, the observation also found students who only gave responses to the suggestions given by other group members. Therefore, the suggestions given by the students can be used in group discussions.

The aspect of the seriousness to do the best for the group in achieving group goals gained a value of 99.60% with very high criteria. This value shows that students are able to contribute by doing their best to achieve group goals. The contributions observed in this aspect are seriousness and focus, as a form of students doing their best for the group. The seriousness of students can be seen from not disturbing group members or not talking about things beyond the practicum context. Meanwhile, the focus of students is seen from students who do not easily lose their focus when the practicum is in progress. These two things can be seen in figure 4, students were observed to be focused and there were no students who disturbed other members in the group. All students in the group are focused on doing their tasks and showing their best for the group in order to achieve the same goals.

Figure 4. Students Focus on the Experiments

This aspect is relevant to both aspects of the indicator of working effectively in groups. The seriousness of the students can be seen from them working as a team by distributing tasks and also showing an element of positive interdependence. The observation also found students who sometimes lost their focus during the practicum. The students was reprimanded by group members. When students make a lot of noise, the practicum assistant will warn students to be kicked out of the laboratory.

Work Effectively in Groups

This indicator obtained an average value of 99.40% with very high criteria. This indicator has two aspects, namely work as a team in completing tasks to achieve the same goals and working on tasks by sharing tasks and containing elements of positive interdependence to achieve the same goals.

In the aspect of work as a team in completing tasks to achieve the same goals, all students were observed to work as a team. This aspect gained a value of 100% with very high criteria. There are no students who work as individuals, which is the key to the success of this aspect. Collaborative teamwork can make teams achieve extraordinary results (Scarnati, 2001). In figure 5, students can be seen working on their own tasks. But, it is done for their success as a team. Students who work as a team will make them interdependent on their group members. The dependence shown by students is a positive interdependence, this will make students work together in groups. The existence of good cooperation in groups (Nurhayati et al., 2021) will make students able to complete tasks more easily. The faster students complete group tasks when doing experiments, the more time they will have to complete the practicum report.

Figure 5. Students Working on Their Tasks for the Team's Success

The aspect of working on tasks by sharing tasks and containing elements of positive interdependence to achieve the same goals gained a value of 98.81% with very high criteria. This value shows that students are able to work effectively by distributing tasks equally. In

addition, the element of positive interdependence shown by students also supports the success of students to achieve their goals. The distribution of tasks was carried out by students in groups during discussion activities before doing experiments. Students distribute tasks by taking turns doing work every week. The work can be in the form of doing experiments, writing interim report, and documenting experimental activities. So each students in the group can experience all of these tasks. Thus, there will be no students who do not work during the practicum. The results of students working with the distribution of tasks can be seen in figure 6.

Figure 6. Results of Students Task Sharing

The distribution of tasks equally to all group members accompanied by positive interdependence of students, makes the group work effectively. Students who focus on tasks and make time efficient (Carrió-Pastor & Skorczynska, 2015) can be a proof of students' seriousness in doing their best for the group. The students' collaboration is related to their ability to work together with others to achieve the same goal (Dewi et al., 2020). Therefore, the group work will not be successful if not supported by good cooperation between group members.

Communicate in Group Activities

This indicator obtained an average value of 75% with high criteria. This indicator has three aspects, namely respect each other's opinions among group members in completing tasks, ask friends if you find problems, and compromise in making decisions if there are differences of opinion in decision making.

In the aspect of respect each other's opinions among group members in completing tasks, all students were able to respect the opinions of group members. This aspect gained a value of 100% with very high criteria. According to the Buck Institute for Education, listening and respecting the opinions of friends are included in the collaboration skills indicator, namely respecting the contributions of group members (respect others) (Sari et al., 2017). Students respect the opinions of group members by responding to the suggestions that have been given in the form of approval of the suggestions. So the suggestions can be used in group discussions. In figure 7, students are discussing and giving their opinions about the results of the mixing temperature of the solution in the calorimeter.

Figure 7. Students Sharing Opinions Respectfully

Respect for each other's opinions will arise from the communication in a group. Communication in groups can avoid conflicts that can appear during group discussions (Hairida et al., 2021). The character of someone who likes to respect comes from a nature that wants to think about the interests of others, has a sense of acknowledgement of the work, ideas, and contributions of others (Elfindri et al., 2012). The students' suggestions that are given responses by group members will make them feel valued in the group. This minimizes the emergence of dislike for group members. The existence of good communication activities can solve internal group problems and not prevent discussions (Indrawan et al., 2021). Students who communicate regularly, they unconsciously train their communication skills.

The aspect of ask friends if you find problems gained a value of 60.32% with medium criteria. This value shows that students dare to ask group members when they find problems in the group. However, there are still students who do not ask group members. The main reason is that students do not find problems in the group. Problems that often arise during practicum are students' lack of understanding of the experiments being carried out. This will trigger students to ask group members who understand better or to basic chemistry practicum assistants. So that students who are classified as not asking are students who have a good understanding of the experiments being carried out. In addition, when students want to ask group members, they tend to have the answers to their own questions. So that students do not ask group members. The observation also found that there were students who had been directed properly by group members who acted as group leaders. This can suppress the emergence of problems within the group.

Figure 8. Students Asking Questions to Group Members

Figure 8 shows students asking group members about the interim report. Communication in a group will be formed with questions given by group members. Students who help to answer questions will build two-way communication or even more. Communication skills are the first level of other soft skills needed by students (Patacsil & Tablatin, 2017). The observation also showed that there were students who asked if there were problems found by other group members. These students show a sense of caring for group members. Caring is an attitude and action that always wants to provide assistance to others (Listyarti, 2012). By asking if there are problems in the group, it can be known whether group members need help or not.

The aspect of compromise in making decisions if there are differences of opinion in decision making gained a value of 64.68% with medium criteria. This value shows that students are able to compromise when there are differences of opinion in decision making. Compromise is when two or more people agree to eliminate ego in imposing opinions in a way that is accepted by all parties. Everyone agrees to implement a solution that has been thought together, the result will bring stability and get the approval of all members (Meyer, 2012). Students who compromise when there are differences of opinion can make group relationships stronger. Differences of opinion followed by a respectful attitude will not damage relationships. Compromises made by students were not very visible during the observation. So that there are students who are classified into the category of not being used to compromise. Students do not compromise because there is no difference of opinion in the group. Students only follow the workflow and do their tasks without any signs that students need to compromise during practicum. In addition, the observation also found that there were students who were moved to compromise when their group members compromised. Some students have the initiative to engage group members in compromise. These students provide opportunities for group members to have opinions, think about various perspective, and follow the same agreement. Students who are able to compromise can make better decisions (Le et al., 2018) and carry them out together with group members.

Having Responsibility to Complete Group Assignments

This indicator obtained an average value of 93.25% with very high criteria. The value is gained from the aspect of group members were responsible for completing tasks on time according to the provisions. The responsibility attitude can be seen from the students who are working on the practicum report after completing the experiment. The practicum report can be a proof that there is collaboration made by students (Junita et al., 2021). The observation showed that students did not only focus on completing their practicum reports individually. Students work together in answering the discussion grid given by the assistant, lending each other stationery such as rulers, tipp – ex, and paper that has been given a margin for making practicum reports. Students in the group hel each other in working on the report in order to complete the practicum report on time and according to the provisions. Students managed to make time more efficient by being focused on doing experiments, distributing tasks equally before doing experiments, and working as a team. Thus, students managed to get more time to work on the practicum report. Practicum reports that are completed on time indicate that students have an attitude of responsibility and are able to collaborate with others.

Conclusion

Learning through practicum activities in the laboratory has been proven to make students collaborate in groups. Students' collaboration skills in the Chemistry Education Department of FKIP UNTAN who take basic chemistry practicum courses get a good average. It is shown from the average value obtained in each indicator is in high to very high criteria. The indicator of contribute to group discussions is in very high criteria (96.83%). The indicator of work effectively in groups is in very high criteria (99.40%). The indicator of communicate in group activities is in the high criteria (75%). The indicator of having responsibility to complete group assignments is in the very high criteria (93.25%).

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Author Contributions
Authors D. H. H., H., and R. R. contributed with conceptual foundation for this study. Authors H., E. E., and T. J. suggested research methodology. Authors E. E. and T. J. assisting in developing research instruments. Author D. H. H. was responsible for collecting (with observers) curating data, and writing the original manuscript. Authors D. H. H., H., and R. R. reviewing and editing the manuscript. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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