Development of Sharing and Jumping Task Lesson Design on the Topic of Balancing Chemical Equations to Identify Student's Collaborative Skills

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Abstract

Many students have difficulty studying balancing chemical equations due to the lack of collaborative skills, which are supported through the content of the 21st-century theme, environmental literacy. This research aims to obtain lesson design, receive information about implementation results, and the profile of collaborative skills that grow in students through the implementation of sharing and jumping tasks on the topic of balancing chemical equations. The method used in this research is a descriptive qualitative using didactical design research (DDR) conducted on 10th-grade high school students in Cimahi, Indonesia. The data were collected using observation and documentation study. The lessons recorded using cameras and audio tapes were transcribed and analysed using the transcripted-based lesson analysis (TBLA). The data were transformed into graphs. The developed sharing and jumping task lesson design comprise student issues/problems, predictions of student responses, and teacher anticipation/assistance. Overall, the results show that seven indicators were identified during the learning process. Indicator being able to work together to solve problems was the most often identified during learning, while sharing tasks of fellow group members well was the lowest recognized indicator.

Keywords: Collaborative skills · Sharing and jumping task · Balancing chemical equation

INTRODUCTION

Various global challenges – social, economic, and environmental – in the21st century continue to increase. This is driven by the accelerated pace of globalization and technological developments (OECD, 2018). Facing all the challenges in this era is not easy, so many things must be prepared. One ofthem is preparation in the education sectorby actualizing the components of 21st- century learning that are structured in such a way as to ensure the readiness of students as agents of change. This 21st-century learning component needs to contain the theme of the 21st century, namely environmental literacy to improve the quality of student skills. This is in line with the 2013 Curriculum statement, which emphasizes that students must master 21st-century skills, including critical thinking, creativity, communication, and collaboration (Verawati et al., 2020).

One of the main focuses of the author in this research is collaborative skills. Collaborative skills are fundamental life skills for students in this era. It can be interpreted broadly that these skills should be internalized in 21st- century educational products (Miharja, 2021). It is very important for students to develop collaborative skills through the learning process in schools, to remain competitive in responding to today's global challenges (Verawati et al., 2020).

Collaborative learning environments challenge students to express and defend their positions and generate their ideas based on reflection. They can discuss to convey ideas, exchange different points of view, seek clarification, and think at higher levels, such as analyzing and solving problems (A'yun, 2021). This makes collaborative skills the most important position in education with more student-centred learning (Ghavifekr, 2020). However, despite the mentioned benefits of collaborative learning, student's ability to apply collaborative culture in learning in Indonesia is undervalued. This is evident because many of the students listen to what is conveyed by the teacher without any desire to know more

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about theinformation. Students rarely ask and answer questions from the teacher, so the learning interaction goes in the same direction as teacher-centred learning (Purnamawati, 2021).

In line with this research, many students have difficulty in studying thetopic of chemistry, one of which isbalancing chemical equations, and difficulties in studying chemistry include the inability of students to write and balance chemical equations correctly. (Yusuf, 2014). Therefore, to integrate environmental literacy in chemistry subjects and help student's with difficulties on the topic of balancing chemical equations is to develop sharing and jumping task lesson designs loaded with environmental literacy to foster student's collaborative skills.

According to Pheeraphan (2013), collaborative skills are the ability to work effectively with others, respect fellow group members, and also takeresponsibility for group tasks (Putri & Qosyim, 2021). The purpose of collaborative learning is to ensure all students get the same quality of learning or equality (Rahdiyanta et al., 2017).

In learning activities involvestudent's various understanding abilities. Therefore, it is necessary to design a lesson using two types of tasks to carry out collaborative learning, namely,sharing and jumping tasks. Sharing tasks are joint tasks completed collaborativelyin groups containing basic concepts and concepts that refer to learning objectives. It aims to foster mutual learning between students and teachers as a sharing that occurs in learning. In the jumping taskactivity, students are given problems that are developed through the application of basic concepts that have been learned in sharing tasks (Fatimah et al., 2018). It has a higher level of difficulty than sharing tasks and is usually presented in the form of challenges so that it is possible to improve student's problem-solving and critical thinking skills (Fibrianto et al., 2021). The existence of sharing andjumping tasks in learning will form a 'listening to each other' relationship between fellow students-students and students-teachers, as well as among fellow teachers through the exchange of opinions or discussions so that these two tasks support the growth of collaborative skills in groups (Saito & Sato, 2012).

METHODS

The method used in this research isa qualitative descriptive research method using didactical design research (DDR) indesigning and reflecting on the learning process. The research was conducted in one of the public high schools in Cimahi City, with participants involving students of class X MIPA for the academic year 2021/2022. The data were collected using observation and documentation studies that were recorded using cameras and audio tapes, then transcribed and analysedusing the transcripted-based lessonanalysis (TBLA). Data collection techniques in didactical design research were carried out based on three stages according to Suryadi (2013), namely: (1) didactic situation analysis before learning, (2) analysis of the didactic situation during learning, and (3) didactic situation analysis after learning.

In the first stage, before developing the lesson design, data analysis was carried out in the form of a chemistrytextbook review study to obtain essential concepts on the topic of balancing chemical equations and RPP studies to obtain issues/problems, predict student responses, and anticipate/help teachers as well as the limits of teaching materialsrelated to the topic of balancing chemical equations. Furthermore, interviews wereconducted with teachers and students whohave previously studied the topic ofbalancing chemical equations so that an overview of the student's difficulties instudying the topic of chemical reactionequations was conducted and saw how theteacher carried out chemical reaction balancing learning activities.

In the second stage, the implementation of a validated lesson design is carried out in the form of anticipation made by the teacher on the responses given by students during the learning process, both predictable student responses and previously unpredictable student responses. Analysis duringlearning is done by identifying the dialogue and collaboration that occurs between students and students as well as those that occur between teachers and students.

In the third stage, analysis of thedidactic situation after learning was carried out based on the results of video- audio transcripts during the learning process, observation notes, and reflectionsafter learning. The analysis was carriedout to see how the didactic situation was in the form of predicting student responses and teacher anticipation before and during the implementation of lesson designs, such as; how the dialogue and thelearning process occur when usingsharing and jumping task lesson designsso that they can grow student's collaborative skills in the learning process. Next, the researcher

transcribed all the recorded learning data based on theobservation sheet transcript and the video-audio recording data during the lesson. Student-teacher speech learning transcripts were analysed using the transcript-based lesson analysis (TBLA)method developed by John Airey. TBLA was used to analyse data from student-teacher conversations converted into transcripts. By using Excel Program, the transcript was analysed based on (1) the number of words spoken by students- teacher, and (2) the frequency of occurrence of student collaborative skills.

RESULTS AND DISCUSSION

The lesson design in this study comprises issues/problems, predictions of student responses, and anticipation/ teacher assistance developed by Lewis (2002). The design of sharing and jumping tasks is described based on three learning activities stages: initial, core, and final.

In the initial activity, the teacher explains apperception by reminding students about the concepts that have beenobtained in the previous learning material and are still related to the topic of balancing chemical equations. They understand chemical reactions, thecharacteristics of chemical reactions, and the sound of the law of conservation of mass.

The core activity is the main activity in learning because it aims to build student's concepts and to understand through mutual learning activities between students and studentsand students and teachers so that sharing occurs in learning (Fibrianto et al., 2021). The core activity consists of four sharing task activities in which students discuss with their groupmates learning to find andunderstand the basic concepts of writing and balancing chemical equations in ammonia formation and photosynthetic reactions.

In the final activity, it is a learning activity in which there is jumping where the tasks in the jumping task activity havea higher level of difficulty than sharing tasks and are usually presented in the form of challenges, making it possible to improve student's problem-solving abilities (Fibrianto et al., 2021). In the jumping task activity, students were askedto listen to a video about forest fires and discuss the causes, impacts, and prevention methods, then write and balance the chemical equations involved in the forest fires.

The results of the implementation interms of the analysis of the suitability of student responses when implementing the lesson designs, it can be concluded that in the sharing task activities, student responses during implementation are following the predictions of student responses in lesson design, while student responses on the jumping task activity are not in accordance with the predictions of student responses in the lesson design. This happens because the time used toperform the jumping task is limited.

A graphic analysis of the number of characters spoken by the teacher/student to students during the implementation of the sharing and jumping task lessondesign is needed to analyse whetherlearning encourages students to speak in the discussion using the TBLA method. Learning that encourages students to speak supports the growth of collaborative skills during learning. The graph of the number of characters spoken by the teacher/student can be seen in the figure below as an example of what happened in groups 3 and 4. The positive vertical or upward Y-axis represents the number of words the teachers speak, and the negative vertical or down Y-axis represents the number of words the students speak. In addition, the horizontal X-axis (horizontal) represents the conversation index for both the teacherand the students (from the start to the end of the session).

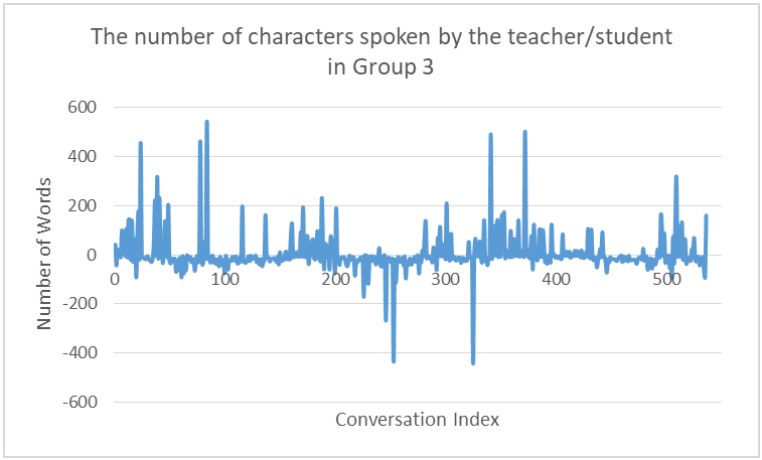

Figure 1. The Number of Characters Spoken bythe Teacher/Student in Group 3

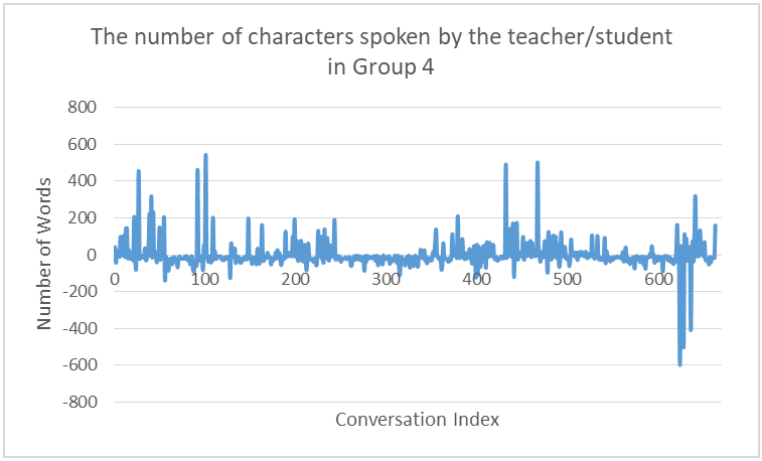

Figure 2. The Number of Characters Spoken bythe Teacher/Student in Group 4

Upward sharp peaks in Figures 1 and 2 are shown mostly, followed by blunt downward peaks. There are some sharp downward peaks but not as many sharp peaks upward. This shows that the class discussion is participatory. However, the teacher took the lead while the student's responses were brief (Winarti et al., 2021).

Based on the implementation resultsin terms of graphic analysis of the numberof characters spoken by the teacher/student in all groups, it can be concluded that the overall learningprocess in each group encourages studentsto speak because, in the learning process, students are struggling to find their concepts through discussion instead of presenting information (Ilhan & Ekber Gülersoy, 2019). This type of learning is also in accordance with 21st-century learning to support the growth ofcollaborative skills in groups.

The profile of collaborative skills that grow in students when implementing sharing and jumping task lesson designs identify by analysing the data obtained from the transcripts on observation sheets and recordings of student dialogues on video and audio tapes, then transformed into a graph. Transcript data from the beginning to the end of learning were analysed using transcript-based lessonanalysis (TBLA), then verified indicators of collaborative skills that emerged in the group (Hidayat et al., 2020). Theindicators of student collaborative skills are based on Binkley (Griffin et al., 2012), which suggests seven indicators of student collaborative skills in Table 1.

Table 1. Seven Indicators of Student's Collaborative Skills

No	Collaborative Indicators	Information
1	1st	Asking friends/ teachers when they do notunderstand

2	2nd	Being able toargue
3	3rd	Appreciate and respect the opinions to others
4	4th	Work togetherto solve the problems
5	5th	Dividing the tasks amonggroups
6	6th	Showing concern for friends
7	7th	Being able to guide others to achieve goals

The student's collaborative skill profile is identified based on the collaborative indicator graph that grows on sharing tasks and jumping tasks.The graph below shows indicators ofcollaborative skills that grew in the first sharing task, second task sharing, third task sharing, fourth task sharing, and jumping task.

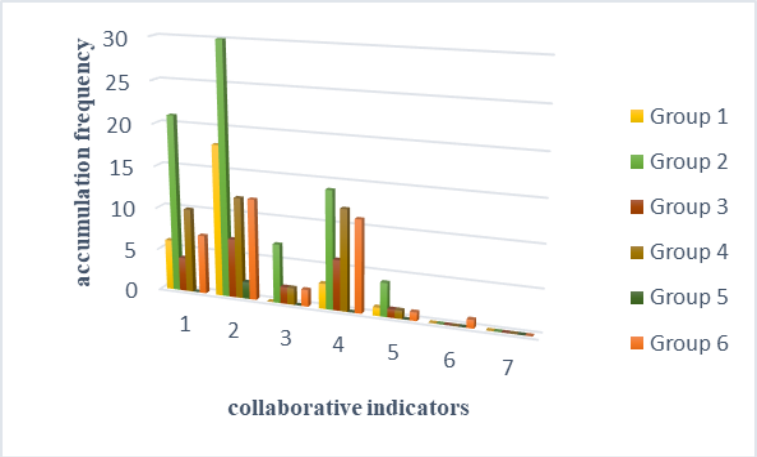

Figure 3. Collaborative Indicators Growing onSharing Task-1

In the first sharing task activity, the second indicator, namely being able toargue, is the most identified indicator of collaborative skills, and the seventh indicator, namely being able to guide others, is an indicator of collaborative skills that were not identified in the first sharing task. This happens because: (1) not all highly academic students in thegroup can guide other students, (2) thestudents lack concern for other students, and (3) students tend to listen to the teacher's explanations and directions during learning.

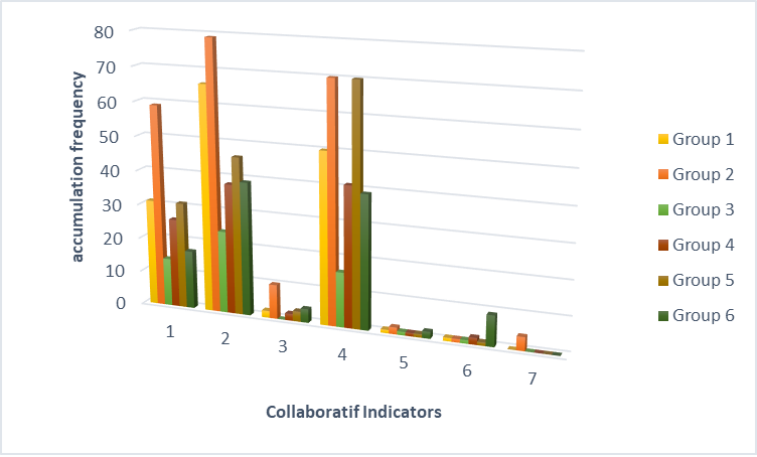

Figure 4. Collaborative Indicators Growing onSharing Task-2

Based on the analysis of the seven indicators of collaborative skills in the second sharing task, the identification of collaborative skills was good in each group because the seven indicators of

collaborative skills were identified. As in the first sharing task activity, the second indicator, namely being able to argue, is the most identified indicator of collaborative skills, and the seventh indicator, namely being able to guide others, is the indicator of collaborative skills that appears the least.

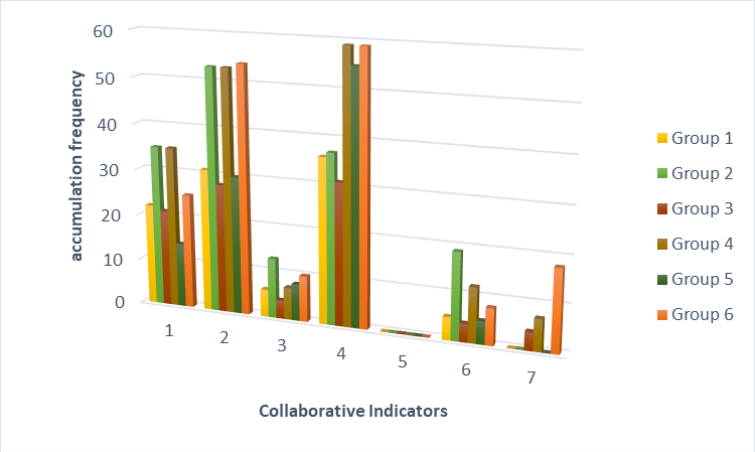

Figure 5. Collaborative Indicators Growing onSharing Task-3

In the third sharing task activity, the fourth indicator, working together in solving problems, is the most identified indicator of collaborative skills. The unidentified collaborative indicator is the indicator of dividing tasks among groups. This happens because when sharing the third task, students only focus on problems in student worksheets (LKS) that the teacher distributes individually.Thus the distribution of individual worksheets is expected so that students in groups can master basic concepts during learning.

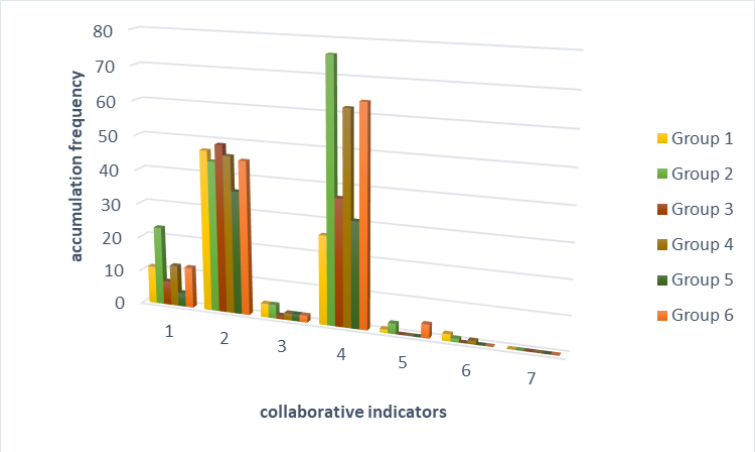

Figure 6. Collaborative Indicators Growing onSharing Task-4

In the fourth sharing task activity, the fourth indicator, working together in solving problems, was the most identified indicator of collaborative skill, and unidentified collaborative indicators are indicators capable of guiding others.

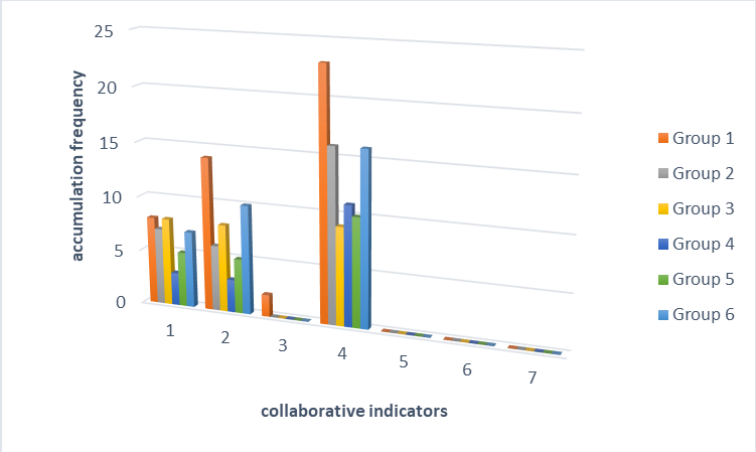

Figure 7. Collaborative Indicators Growing onJumping Task

In the jumping task activity, information was obtained that there were only four indicators of collaborative skillsidentified. The fourth indicator that is working together in solving problems is the most identified indicator of collaborative skills, and the third indicatorof respecting the opinions of others is the least identified indicator of collaborative skills, so the third indicator is not evenly distributed in all groups because it only appears in group one as much as one time.At the time of the jumping task, the implementation time was very limited , sothe teacher only gave some problems and the students had difficulty doing the tasks on the jumping task.

From the results of the analysis of indicators of collaborative skills that grew during the implementation of sharing and jumping task lesson designs on the topicof balancing chemical equations, it can be concluded that overall the 4th indicator or indicator of being able to work together insolving problems is the most growing collaborative indicator, while the 3rd indicator or indicator of dividing tasks is the indicator that grows the least compared to other collaborative indicators.

CONCLUSION

Based on the findings and discussion data, the following conclusionsare obtained: (1) the lesson design comprises student issues/problems, predictions of student responses, and anticipation/teacher assistance. It also consists of three stages: preliminary activities, core activities consisting of foursharing tasks, and final activities consisting of one jumping task, (2) theresults of the implementation of the sharing and jumping task lesson designs on the topic of balancing chemical equations indicate that learning encourages students to speak to support the growth of collaborative skills during the learning process, and (3) the profile ofstudent's collaborative skills that grew during the implementation of the lesson design for the first and second sharing tasks were the 2nd indicator, and the third, fourth, and jumping tasks were the 4th indicator.

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