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Case Study of Interactive Teaching of Science "*Food and Digestive System*": Developing Communication Skills Towards Science Literacy of Grade VIII Junior High School Students

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ABSTRACT Communication skills require students to be able to manage, understand, develop, and create orally and in writing. Teaching methods that generally use conventional models of learning activities that are not formed in groups cause students' science communication skills to be lacking, so learning activities are more teacher-centered. This learning causes students' science communication skills to be challenging to develop, especially toward understanding or science literacy. The development of this science interactive teaching case study aims to develop communication skills towards science literacy of grade VIII junior high school students. The type of research used is the mixed method. This research involved the subjects of Science 1 and Science 2 teachers in class VIII and students from 2 classes with 32 students taught by the two teachers. Data analysis was conducted through transcript coding using N-Vivo assistance and statistical analysis from SPSS statistics and Minitab. The study's results show that from the three indicators described, there are significant differences in interactive teaching carried out by Science Teacher 1 and Science Teacher 2. This is due to the different perspectives held by the two teachers in the communication skills approach used. Science Teacher 1 emphasizes exploration activities more, while science teacher 2 focuses more on discussion activities.

Keywords Interactive, Science, Communication skills, Science literacy; Teaching.

1. INTRODUCTION

This research project was conducted based on the researcher's experience during science teaching, which is expected to improve communication skills through interactive teaching to achieve the desired learning objectives. This can be done through the application of emphasizing classroom discussion activities that focus on the dialog that occurs between teachers and learners in the form of small groups (McMahon, 2012; Rudi, Mirnawati & Muis, 2023). Small-group learning has improved academic performance and attitudes towards learning (Knight & Wood, 2005; Simanungkalit, 2021).

Communication skills require learners to be able to manage, understand, develop, and create communication orally, in writing, and in multimedia (Iskandar, 2019; Zulfa & Rosyidah, 2020). During the learning process, a learner can be hampered by the learning process if he cannot communicate the ideas and ideas he has in his mind (Sintiawati, Sinaga & Karim, 2021). Facts have shown that current science teaching provides few opportunities for learners to explore the ideas in their minds. However, teachers have more opportunities to deal directly with their ideas. Conversely, the emphasis on science teaching that has been done is different from the learning theory of science constructivism.

Constructivism is aimed at learners in junior high school who generally support a constructivist teaching model. In line with this teaching model, it is based on learners' ideas developed through investigation or discussion (Harlen & Qualter, 2004; Ahdar & Wardana, 2020). The constructivist teaching model, which focuses on eliciting and developing learners' ideas through inquiry and science-based focus, is challenging for teachers during classroom learning activities (Driver, Asoko, Leach, Scott & Mortimer, 1994; Erickson, 2000). In addition, teachers also find it challenging to engage different ideas from a

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large group of learners. From these problems, composing one idea with another will take more work for learners. Thus, the possibility for students to obtain new information or ideas that can help students understand a problem cannot be done optimally and affect students' science literacy.

This is following the results of a comparative study conducted by PISA-OECD (Program for International Student Assessment-Organization for Economic Cooperation and Development), which shows that the average science literacy test score of Indonesian students is 383 from the International average science literacy test score of 500 (Deryati, Abdurrahman & Maharta, 2013; Fajzrina et al., 2023; Yusmar & Fadilah, 2023)—based on the average value of Indonesia's science literacy, referring to the process of science, namely involvement in solving a problem such as identifying or interpreting evidence and explaining the conclusions of students who tend to be lacking. Science literacy is understanding science concepts and processes while utilizing science in everyday life. Science literacy can be measured through a study conducted by PISA-OECD that found low science literacy results for students in Indonesia. The low level of science literacy in Indonesia is generally because the learning conducted by teachers has not been focused and oriented toward developing science literacy. Various factors can cause low science literacy in students, such as the state of school infrastructure, school human resources, school management, curriculum, and education system, selection of methods and teaching by teachers, learning facilities, and teaching materials (OECD, 2016; Ardianto & Rubinni, 2016; Kurnia & Fathurohman, 2014; Sutrisna 2021).

The results of research conducted by (Angraini, 2014) show that the science literacy of students in Solok City still needs to improve. The low ability of students is triggered by the material tested not having been studied, students not being familiar with questions that use discourse, and the learning process not supporting the development of students' science literacy skills. Likewise, research conducted by (Rizkita, 2016) shows that the science literacy skills of students in Malang City still need to improve. This is caused by the learning process that does not involve science. Science communication helps students develop abilities such as understanding scientific concepts and science processes and engaging with science directly so that it can advance science, especially literacy in Indonesia (Shivni, Cline, Newport, Yuan & Bergan-Roller, 2021; Sugiarto, 2023).

Research conducted by DeRocco and Taylor states that communication skills are one of the 21st-century skills every individual must have. Skills in the 21st century are used as individual support to face 21st-century challenges, such as when becoming a workforce (Andrew, De Rocco & Taylor, 2009). When a person needs to gain 21st-century skills, they must avoid facing the challenges that arise along with science and technology that continuously develop.

In addition, the importance of 21st-century skills is also stated in the regulation of the Minister of National Education of the Republic of Indonesia number 23 of 2006. The regulation explains that one of the competency standards for graduates of junior high school teaching units in science subjects is being able to communicate and interact effectively and politely (Permendiknas, 2006). The lack of student communication skills in Indonesia was also found by research conducted at a private junior high school in Bandung (Taryono, 2016). It is known that students rarely get tasks to observe or projects as a form of assignment; here, when students do project assignments, it will indirectly impact communication skills, and teachers in the field do not do this. In addition to projects, students can practice communication skills by delivering project results through presentations and making written reports. So far, from Taryono's research, it has been found that students are more given to work on questions from student textbooks, so students' communication skills must be trained (Haryanti & Sumarwa, 2018).

2. METHOD

Teaching methods that generally use conventional models and learning activities that are not formed in groups cause students' science communication skills to be lacking, so learning activities are more teacher-centered. This learning causes students' science communication skills challenging to develop, significantly affecting understanding or science literacy. Research focuses on developing communication skills toward science literacy as a collective proximal development (Vygotsky & Cole, 1978). Learning is influenced by the pedagogical focus and the abilities considered relevant to the science environment driven by that assessment (Biggs & Tang, 2011; Fitriyana, Ningsih & Panjaitan, 2020; Kuh, 2008; Morgan, Clarke, Weidmann, Laidlaw & Law, 2007).

In science education, a framework has been developed to analyze the "communication skill focus" of teachers in two areas: dialogical with authoritative and interactive with non-interactive (Mortimer & Scott, 2003; Zahro, Atika & Westhisi, 2019). In these studies, dialogic can refer to the extent to which learners' ideas can be considered and given value in the field of science in the classroom.

Furthermore, teaching can be categorized into several communication skills, namely: 1) interactive/authoritative (IA), 2) non-interactive/authoritative (NA), 3) interactive/dialogic (ID), and 4) non-interactive/dialogic (ND). The development considers the imagination of ideas, especially in the differences between ideas that will be influenced by learners who communicate/dialogue (Kanah & Mardiani, 2022; Scott, Mortimer & Aguiar, 2006).

Communication skills also play a role in building closer relationships between teachers and learners to share knowledge, thoughts, and experiences (Hayati, Amaliyah & Kasanova, 2023; Urwani, Ramli & Ariyanto, 2018). Learners' communication skills need to be developed to improve various abilities, including cognitive, emotional, and social abilities (Arifudin, 2022; Kartika, 2019). Low communication skills will cause students' multiple perceptions and misconceptions so that learning objectives are not appropriately conveyed (Aeni, Ariyanto & Santoso, 2017; Sintiawati, Sinaga & Karim, 2021; Zulfa & Rosyidah, 2020).

Science learning requires students to be able to communicate their findings (Rahmi & Pratiwi, 2023; Sintiawati, Sinaga & Karim, 2021). There is a habit of teacher-centered learning activities, especially seen in the pattern of whole-class interaction, which can limit the involvement of students' ideas in discussions (Alexander, 2008; Intania, Raharjo & Yulianto, 2023; Myhill, Jones & Hopper, 2005). Classroom conversations are generally conducted through question-and-answer sessions, where the teacher asks questions and evaluates learners' responses in the form of feedback responses (Anita & Bentri, 2023; Sinclair & Coulthard, 1975). Therefore, the researcher felt interested in conducting a study entitled "Case Study of Interactive Teaching of Science "Food and Digestive System": Development of Communication Skills for Science Literacy of Class VIII Junior High School Learners."

This research is also based on previous research (Isnaini & Astuti, 2023; Alammudin, Ahmad & Dunarno, 2022; Bahriadi, Ahmad & Sulaiman, 2022). In this study, it is interesting to understand the professional competence of teachers in interactive teaching in schools. So, with research conducted with interactive teaching of science focusing on communication skills, researchers get data based on field facts or actual events. Through the professional competence of science, teachers can provide teaching that focuses primarily on students, the material is well developed, and the use of media and teaching methods can run to activate the class. The researcher conducted various processes in the case study, which can be seen in Figure 1.

2.1 Research Approach

This research uses mixed-method research. It aims to analyze the research results more complexly, and data management can be described in numbers and narratives. In addition, applying research using quantitative and qualitative methods simultaneously can provide an in-depth understanding of the phenomenon being studied, as in this study, which examines the interactive teaching of science in developing communication skills toward students' science literacy. This type of research is expected to obtain comprehensive, reliable, valid, and objective results. This research does not use an experimental design but only implements learning by science teachers 1 and 2 and then analyzes it based on indicators of communication skills.

2.2 Research Participants

This research was conducted in one of the junior high schools in Ponorogo. The population in this study was taken from 1 class taught by science teachers 1 and 2 from level VIII. Each class has a total of 32 students. The selection of this sample is based on the similarity of the material to be studied, namely "food and digestive system," using a nonprobability sampling technique (purposive sampling). At the same time, this research location was chosen because of the unique element found by the researcher when conducting a diagnostic test. The results of the diagnostic tests found that students at the school had low-average communication skills.

2.3 Research Instruments

The instruments used in this study are pre-tests and post-tests of communication skills indicators. Based on the indicators, the focus of communication skills includes sharing thoughts, information, and findings with others, discussing the results of activities regarding a problem or event, and concluding. Some of these indicators are tested on students using several instruments. Instruments in the form of multiple choice totaling eight questions, descriptions of 3 questions, and side-emotional six questions. Experts have validated all learning instructions and instrument tests. The validation stage, carried out by material and media experts, is obtained through assessment data through questionnaires.

2.4 Data Collection

Data collection techniques were tests, observations, and deep interviews. Students conducted tests as diagnostic tests before science teaching began (pre-test) and after teaching was completed (post-test). The question contains the material "food and the digestive system)" which takes approximately one month or four meetings. In addition, deep interviews were conducted involving two science teachers as the teachers of science subjects at the 8th-grade

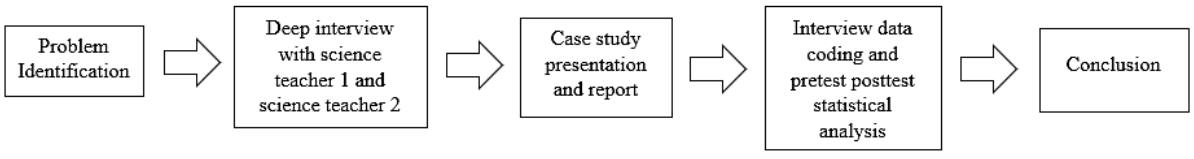

Figure 1 Case study research mechanism" (number 15, page 10).

level. The researcher then analyzes the data that has been collected.

2.5 Data Analysis

Data analysis techniques used qualitative descriptions and inferential statistics. Data analysis was carried out with the help of the NVivo application, Minitab, and SPSS Statistics 25. After the interview, the researcher analyzed the research results by coding the data. While analyzing the study results, the researcher utilized data analysis assistance from the NVivo application. The test results that have been analyzed are explained descriptively and qualitatively and are presented in the form of coded concept maps.

Meanwhile, data analysis through statistics was carried out from the pre-test and post-test results, which were analyzed through several tests. Among them are the normality, Wilcoxon, homogeneous, and Mann-Whitney tests. Some of these statistical tests were carried out with the help of SPSS Statistics 25 and Minitab in the analysis.

3. RESULT AND DISCUSSION

The use of the four communicative approaches in each case study is presented in Tables 1 and 2. The tables provide further insight into the different time scales at which the case studies of Science Teacher 1 and Science Teacher 2 taught the overall communicative approach. There is no clear evidence of a cycle of ID, IA, and NA communicative skills approaches as seen by (Indiantoro et al., 2023; Mortimer & Scott, 2003) in learning, but there is a complex combination of dialogic interaction to "open" and authoritative interaction to "close" learning discussions.

As seen in Tables 1 and 2, case study 1 started with a combination of ID and IA communication skills approaches. However, the dominant one used in science teaching was IA or authoritative interactive. This is related to the teaching practice activities. Case study 1 is characterized by the situations and conditions created by science teacher 1 with frequent exploration activities from direct observation of materials during practicum activities. This aligns with Jan Lightghart in 1859, who said that exploration-based learning can strengthen existing knowledge while helping to discover new knowledge (Marlina, Nuraida & Rizal, 2019). The IA communication skills approach is interpreted by reviewing and recapitulating conceptual ideas through objects around students.

The case study of Science Teacher 2 focused on the ID or interactive dialogic communication skills approach to discussion. This ranged from 37% to 48% of the classroom teaching time of the three classes taught by Science Teacher 2. The highest percentage of ID talk occurred in core learning activities related to exploring learners' ideas through collaborative group discussion activities and with the teacher during presentations in front of the class. This follows Needham's constructivist learning model, prioritizing systematic/planned learning. One is through the discussion step as a phase of structuring initial ideas to reconstruct new knowledge (Andriani, 2020; Sundram & Romli, 2023). In addition, in this activity, students interpret knowledge from the investigation while making observations. Not only collecting ideas, students are also required to be active in asking questions, which is visible at the beginning of t he series of lessons.

The differences in the use of communication skills approaches by case study teachers towards different science literacies are summarized in Figure 2. Some of them, collecting and summarizing ideas as a sign that these ideas are essential (Kustian, 2021) and science teacher ideas from group work to develop scientific activities (Aiman, Dantes & Suma, 2019; Lemke, 1990; Mortimer & Scott, 2003). This article discusses three indicators of communication skills toward science literacy.

Table 1 Case study 1 percentage of lesson time in science teacher 1's class by communication skills approach" (number 4, page 13)

Class	Duration (minute)	Percentage of communication skills approach time				Percentage of lesson time in WCT
		ID	IA	ND	NA	
1	80	25	16	5	8	54
2	80	20	30	4	6	60
3	80	15	32	7	10	64

WCT, whole class 8 teaching by Science teacher 1

Table 2 Case study 2 percentage of lesson time in Science Teacher 2's class based on communicative approach" (number 5, page 13)

Class	Duration (minute)	Percentage of communication skills approach time				Percentage of lesson time in WCT
		ID	IA	ND	NA	
1	80	45	14	3	8	70
2	80	37	5	5	12	59
3	80	48	10	2	9	69

WCT, whole class 8 teaching by Science teacher 2

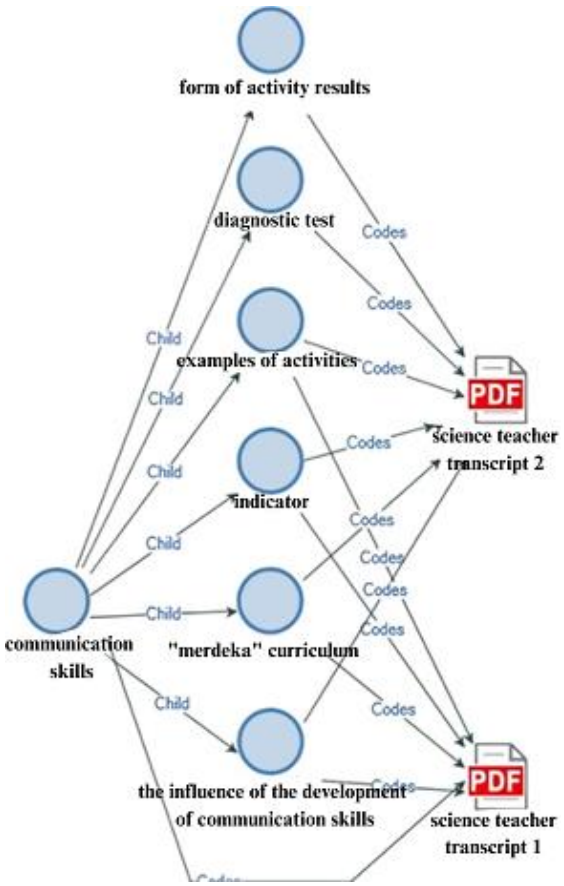

Figure 2 The focus of communication skills in terms of the coding results of the case study transcripts of science teachers 1 and 2" (number 4, page 14).

3.1 Share thoughts, information, and discoveries with others: ID

Figure 3

The first indicator of the focus on communication skills in terms of the coding results of the case study transcripts of science teachers 1 and 2 on the first indicator of the focus on communication skills can be seen in Figure 3. In case studies 1 and 2, the teacher shared ideas, thoughts, information, and discoveries with other learners at the beginning of a series of lessons through stimulus questions. Expressing ideas in the stimulus formed the potential to gather different views held by each learner. In addition, providing optimal stimulus can help the brain capture knowledge through meaningful experiences (Fajzrina et al., 2023; Sujarwo, Kusumawardani & Nurmalasari, 2022).

Using the pronoun "we" to stimulate learners' questions or ideas can be like, "Do you want to share your ideas?". With a sense of ownership of learners' ideas, learners will feel more free and will not be attacked/ pressured. Although idea generation does not have to be in the form of questions, it contributes to positioning them as science scientists (Millah, Iskandar, Rosmana, Anjani & Putri, 2022; Ningrum & Putri, 2021).

Idea pooling allows for collective ideas and provides linguistic resources in dialog, and learners are emotionally

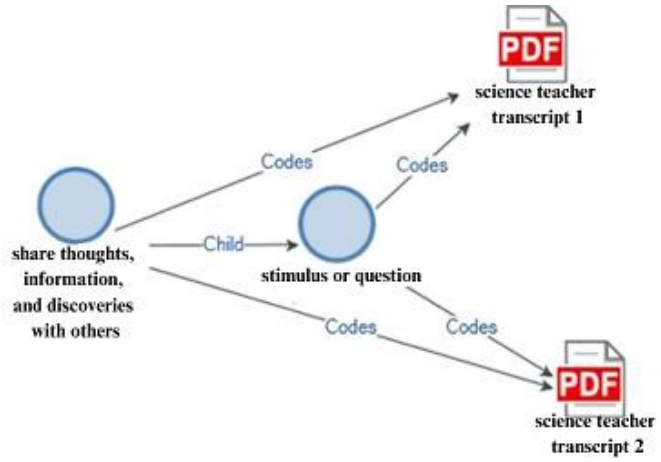

Figure 3 The first indicator of the focus on communication skills in terms of the coding results of the case study transcripts of science teachers 1 and 2" (number 12, page 14).

more comfortable expressing their ideas. The focus of communication skills associated with this is ID (Scott, Mortimer & Aguiar, 2006; Sriati, 2020). The emergence and sharing of thoughts or learners is a collective process towards the view of science in conceptual understanding. This follows Piaget's 1971 view that learners are required to be able to adapt and evaluate their knowledge (Sugrah, 2019). This can be seen from case studies 1 and 2 transcripts below (P for a researcher, G1 for science teacher 1, and G2 for science teacher 2).

Extract from Case Study Transcript 1

P : During learning, students look active; what do you do so that students can develop their communication skills?

G1 : At the beginning of the lesson, they are given a stimulus. What do they know or do so that later it can provoke questions? With the different conditions of each learner, some are quick to adapt; some are silent. If in class, there are still students who are "babbling," well, that, as a teacher, directs them to be better.

Extract from Case Study Transcript 2

G2 : I prioritize dialogical learning. This is because I do more discussions with students so that they are actively involved in learning.

P : During learning, students look active; what do you do so that students can develop their communication skills?

G2 : By providing space for discussion or opinion for students. Given that in this independent curriculum, the teacher only acts as a facilitator, students' activeness is the main thing that must be done during learning.

3.2 Discuss the results of an activity regarding a problem or an event: ID

The second indicator of the focus on communication skills in terms of the coding results of the case study

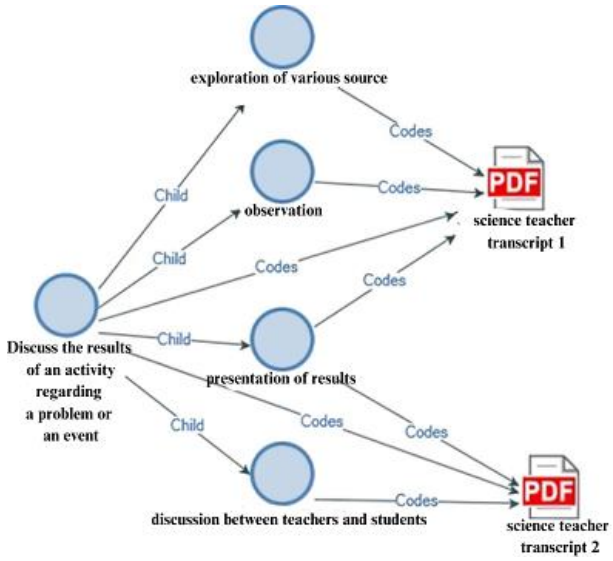

Figure 4 The second indicator of the focus on communication skills in terms of the coding results of the case study transcripts of science teachers 1 and 2" (number 3, page 16).

transcripts of science teachers 1 and 2 on the first indicator of the focus on communication skills can be seen in Figure 4. This section discusses how the ID communicative approach is used to discuss the results of activities regarding a problem through discussion activities from ideas developed by learners and the results of illustrative practical work. In case study 1, science teacher 1 frees learners to explore learning resources actively. These activities are supported by observations by students to add insight based on the data obtained (Jusuf, 2018; Monika & Farida, 2022). In line with the theory of constructivist learning by Slavin (1994), in the learning process, students are required to find, check, evaluate, and transform information obtained through their ideas (Budiati, 2013).

Case study 2 by Science Teacher 2 prioritizes teacher discussion with learners to shape socioemotional and develop learners' communication skills. Science teacher 2 conducted a diagnostic test to determine students' communication skills. Diagnostic tests aim to find out the difficulties/misconceptions students have about the material to be taught and measure students' communication skills (Permana & Bakri, 2022; Wirabhakti, 2020). In addition, students also make presentations in front of the class to convey the discussion results.

When the teacher provides time for students to explore, it aims to develop the insight of students' ideas about the material being studied (Syaparuddin, Meldianus & Elihami, 2020). From these problems, learners' perspectives develop, especially when presenting the results of discussions as a responsibility to the task. This activity is an example of the construction of ideas to discuss the results of activities regarding a problem through the ID communicative approach. The ID communicative approach refers to the everyday meaning that learners associate. This can be seen from case studies 1 and 2 transcripts below (P for researcher, G1 for science teacher 1, and G2 for science teacher 2).

Extract from Case Study Transcript 1

P : What do you do with these gadgets when learning?

G1 : When students work on assignments, for example, when making observations, to observe it, it takes much time; with this, students are given the space to explore through the internet network so that students have more insight.

P : What interactive learning activities do you do to make this dull and often sleepy science learning more fun?

G1 : It emphasizes exploration. Combined with practice using literacy books and gadgets, it already takes up much time.

P : Are learners given free space to express their opinions?

G1 : When conducting discussions in group work, then make presentations. In these activities, students have their own opinions, and the teacher directly directs students in their implementation. So that there is a standard view between students and teachers.

Extract from Case Study Transcript 2

P : Are there any specific activities devoted to practicing learners' communication skills?

G2 : There is no unique activity; I do a presentation of the results of the students' discussion.

P : Does the learning emphasize authoritative or dialogical?

G2 : I prioritize dialogical learning. Because I do more discussions with students so that they are actively involved in learning..

3.3 Summarize, summarize, and summarize conceptual knowledge: IA

The third indicator of the focus on communication skills in terms of the coding results of the case study transcripts of science teachers 1 and 2 on the first indicator of the focus on communication skills can be seen in Figure 5. The third indicator of the communication skills focus is the activity of inferring, summarizing, and summarizing knowledge. In case study 1, the approach targeted summarizing results procedurally. This is to teach learners to generalize the results of investigations from observations/discussions. This section shows an example of learning indicators of communication skills with different points of view between Case Study 1, Science Teacher 1, and Case Study 2, Science Teacher. Differences through different patterns produce generalizations that are reinforced through repetition by the teacher. This repetition is related to the material "food and digestive system" by the teacher according to the level of understanding of students.

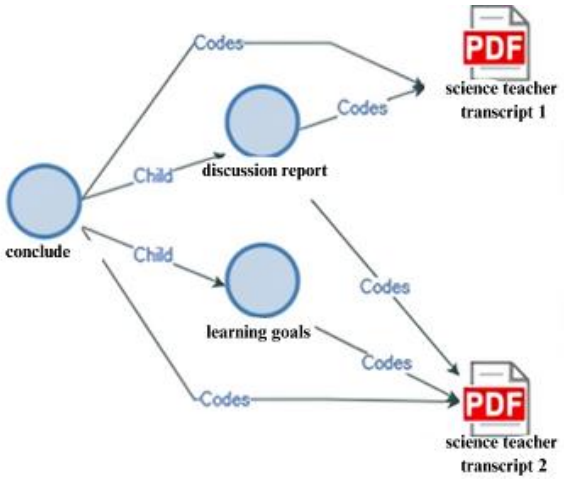

Figure 5 The third indicator of the focus on communication skills in terms of the coding results of the case study transcripts of science teachers 1 and 2" (number 3, page 18).

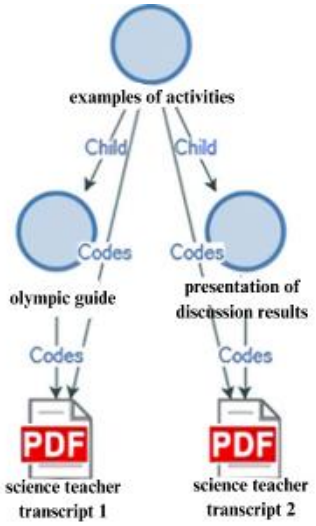

Figure 6 Examples of activities from the focus of communication skills based on the coding results of the case study transcripts of Science Teacher 1 and Science Teacher 2" (number 5, page 20).

Making generalizations requires more understanding if the purpose of conducting such activities, whether it is experiments or collaborative discussions, is more than to find answers to questions or problems at hand, for example, how to calculate the calories needed based on the case that has been given, here learners also build knowledge that can be applied in other contexts. This is a sophisticated form of understanding of the critical epistemological features of science and differs from everyday discourse in that it has high learning demands (Leach & Scott, 2002). This can be seen from case studies 1 and 2 transcripts below (P for a researcher, G1 for science teacher 1, and G2 for science teacher 2).

Extract from Case Study Transcript 1

P : Do learners do summarizing activities during the learning process?

G1 : By themselves, with their opinions. During learning, after students make observations, each group is given a task; that is where the teacher knows the opinions of each group. So that students are given space to argue according to their views while learning freely.

Extract from Case Study Transcript 2

P : Do learners do summarizing activities during the learning process?

G2 : Yes, of course. In the closing activity, students must be able to conclude from what has been learned, while the teacher only straightens out things that may not feel right from the students' opinions. In conclusion, it is hoped that students will know the benefits of learning objectives in learning activities.

Talking about the experience of abstraction form representation symbolization so that construction can be seen as an example of the role of communication activities in creating generalizations that support the transition of everyday life into science literacy activities (Firdaus, 2020; Wertsch, 1991). In the case study, there was substantial evidence from the summative assessment conducted by the teacher that most learners had used the two-part structure of the desired generalization. Whole-class interactions extend access to science literacy as a source of knowledge that connects to the field of science (Lemke, 1990; Putri, 2023; Yusmar & Fadilah, 2023), and the Science 1 teacher guides learners who have a talent interest in natural science to participate in science olympiads. This can be proven through examples of activities by teachers in the picture below.

Examples of communication skills activities based on the coding results of the case study transcripts of Science Teacher 1 and Science Teacher 2 can be seen in Figure 6. Emphasis by the teacher is a generalization process that raises questions about how teaching procedural and conceptual knowledge can motivate learners (Agusta, 2020; Tang, Coffey, Elby & Levin, 2010). Thus, the IA communicative approach supports understanding aspects of the process of scientific inquiry, science literacy, and broad access to science through its application. However, it reduces learners' comfort and ownership of learning activities if it is not a significant part of dialogic activities.

3.4 Science Literacy

The results of the coding of science literacy in the case study transcripts of science teachers 1 and 2 can be seen in Figure 7. The National Education Association has suggested several 21st-century skills needed to improve communication. These skills include interpreting thoughts and ideas effectively in written and spoken form. The ability is supported by supporting knowledge. One of them is through science literacy. This can be formed to improve the ability to understand science material fundamental

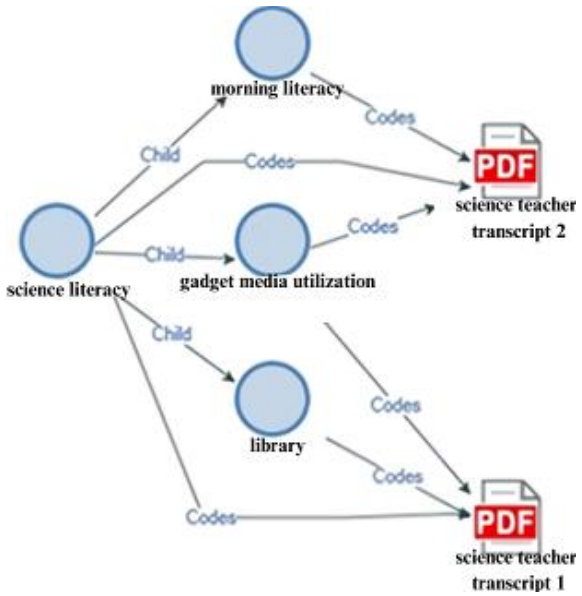

Figure 7 Science literacy in terms of the coding results of the case study transcripts of science teachers 1 and 2" (number 15, page 22).

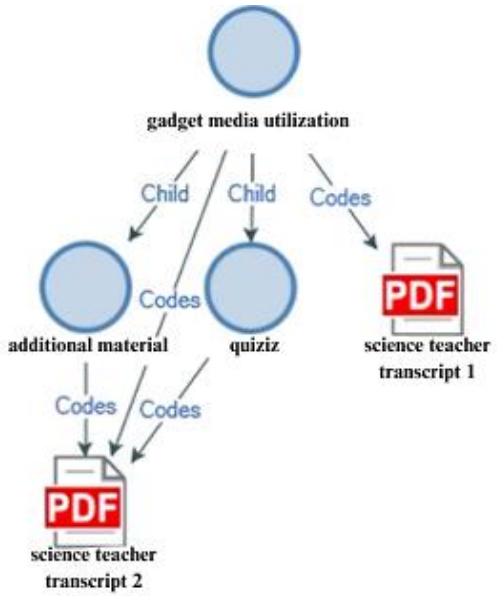

Figure 8 The use of gadgets in terms of the coding results of the case study transcripts of science teachers 1 and 2" (number 2, page 22).

science concepts (Antika & Marpaung, 2023; Arifudin, 2022; Robbia & Fuadi, 2020).

To communicate well, basic knowledge, including science literacy, is needed. Several activities have been carried out to develop and improve students' science literacy levels at SMPN "X" Ponorogo. Such as morning literacy activities for students every day. The hope is that it can increase students' interest in reading. In addition, the school also provides library facilities.

In addition, case studies 1 and 2 integrate technology as "gadgets" during learning. In line with George Marisson's book, learning that uses gadgets as learning media aims to increase literacy, cooperation, and intensive and innovative communication between students and teachers (Arifin, 2022). However, it is necessary for the teacher to adjust the situation, conditions, and time to create conducive learning.

In case study 2, through morning literacy activities from cultures by students who have been scheduled and from reading texts sent through the "WhatsApp" group. The teacher has a role in accompanying students in literacy activities in a unique literacy book, which will later be signed by the teacher who has the first-hour teaching schedule in class. When students carry out literacy activities, several supporting questions are given to help them understand what has been read before. In this way, the teacher will correct the answers from various perspectives owned by students. This can be seen from the transcript of case study 2 below (P for researcher and G2 for science teacher 2).

Extract from Case Study Transcript 2

P : Currently, students need help with reading; how do you overcome this?

G2 : The school already conducts literacy activities every morning to improve students' literacy. Literacy is through texts sent by homeroom teachers to each class grub; then, students are asked to read and answer the questions that have been provided.

The coding results of the case study transcripts of science teachers 1 and 2 on the use of gadgets can be seen in Figure 8. Another strategy used is using gadgets by teachers during learning, which breaks the link between observation and explanation. Instead, they explore other learning resources to improve learners' science literacy. This difference challenges the empirical view of science and allows teachers to discuss different explanations. One example is finding out the course of the digestive system in the human body by utilizing internet media, as illustrated in the following quote:

Extract from Case Study Transcript 1

G1 : It emphasizes exploration. Combined with using book literacy and gadgets, it takes up much time. In addition, by following the times when students like to hold gadgets more than books, teachers also utilize gadgets in learning. However, teachers also limit their use; there are times to use books, and there are also times to use gadgets.

In comparison, in case study 2, "gadgets" are used as learning media, especially in providing additional material sources from the teacher. One is by providing students with PDF files of material outside the package book or LKS. In addition, teachers also use "gadgets" to provide an evaluation with the help of online-based quizzes "quiz." As illustrated in the following quote.

Extract from Case Study Transcript 2

G2 : During learning, I use gadgets to evaluate the material learned through "quizzes." In addition, I also use gadgets to send PDF files of material that might add insight to the material learned. This is what students like during learning, so they hope to feel energized when learning in class.

Variations in such activities contribute to diversity and the different ways learners perceive and understand them. To develop communication skills towards univocal science literacy (Mortimer, 1998), both teachers drew attention to certain visible features of the situation and focused on them. By adopting a communication skills focus that aligns children's experiences and science content, teachers can draw attention to salient features of their experience of the phenomenon while valuing learners' observations. Strategies for developing multivocality are bringing together different observations and valuing extended observations expressed orally and in writing. The strategy for developing univocality is to focus on selected observations and points of communication developed in class. Making connections between observations and explanations is also essential in providing explanations and developing children's understanding of the nature of science, especially in the material "food and digestive system."

The realization of shared experiences to make discussions meaningful and relevant. This is following the implementation of the independent curriculum, which applies Ki Hadjar Dewantara's national education philosophy, which upholds the ability to reason critically which reflects noble character but prioritizes meaningful understanding for students (Rahayu, Rosita, Rahayuningsih, Hernawan & Prihantini, 2022; Rahayuningsih, 2022). In line with the opinion presented by (Wells, 1999) that although language becomes a tool for connecting, observing understanding among participants will be too large. However, the application is intended as an opportunity for dialog in scientific inquiry to develop communication skills.

3.5 Interactive Teaching

The results of coding the case study transcripts of science teachers 1 and 2 in terms of interactive science teaching can be seen in Figure 9. Interactive teaching in case study 1, science teacher 1, and case study 2, science teacher 2, has a significant difference. This can be seen in Figure 8 above, where science teacher 1 applies all approaches to developing students' communication skills. In addition, Science Teacher 1 relies on exploring learning activities, such as laboratory practicum activities. Meanwhile, Science Teacher 2 applies various approaches tailored to the material, such as game activities, to determine material understanding. The game is with the help of media in the form of a "quiz." To find out more, please refer to the case study transcript below.

Extract from Case Study Transcript 1

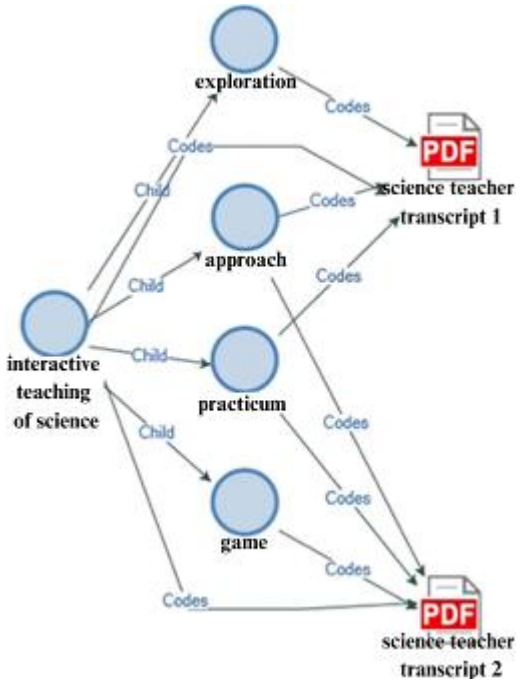

Figure 9 Interactive teaching of science in terms of the results of coding the case study transcripts of science teacher 1 and science teacher 2" (number 3, page 23).

P : What kind of interactive science learning have you done?

G1 : Interactive learning that I have done is by doing practicum activities. This activity is carried out so that learning can run effectively; the teacher conveys in theory and practically.

P : What methods/approaches do you often use when learning?

G1 : When learning, incorporate all forms of approaches. Because each child has a different view/interpretation, try to do everything you can.

P : What interactive learning activities did Mr. Munif do to make this dull and often sleepy science learning more fun?

G1 : It emphasizes exploration. By combining this with practice using book literacy and gadgets, it already takes up a lot of time. For this reason, the teacher synergizes through ice-breaking so that students are not tense during learning in class, and learning is silent/static. Mr. Munif did not see any tension during this learning because students tend to be active during learning.

Extract from Case Study Transcript 2

P : What kind of interactive science learning have you done?

G2 : The interactive learning that I have done is by doing practicum activities. These activities are carried out so that learning can be more varied, not only done in class.

P : What methods/approaches do you like to use when learning?

G2 : I use various methods or approaches, such as differentiated learning, project-based learning, etc. It all depends on the material to be taught and the condition of the students who will do the learning.

P : What interactive learning activities do you like to do so that science learning, which seems dull and often makes you sleepy, can be more fun?

G2 : To avoid getting bored, ice-breaking should be given in the middle of learning, but I still need to do this. Meanwhile, I have provided games from "quiz," which is very popular with students during learning, so that they hope not to feel bored when learning in class.

Interactive learning is needed because of the low quality of Indonesian education, especially with the need for school science learning media facilities. This supports varied learning. In this learning, the enculturation of students in the classroom is generally dialogic, with a shared understanding that scientific discourse and science literacy involve argumentation, which results from lessons focusing on communication skills (Zahro, Atika & Westhisi, 2019).

In case study 2, the classroom approach that supports learners in generating and debating ideas aligns with the teacher's view on the importance of developing ideas and interests. In case study 1, science teacher one prioritized learner outcomes from exploration or observation activities. In addition, case studies 1 and 2 discuss organizing resources to support the approach. Research presented by (Alexander, 2008; Antony, 2022; Tarigan & Simbolon, 2023) on dialogical teaching emphasizes the potential for learner involvement in the value of the discussion results. In line with this, dialogic talk also focuses on reasoning (Surawan, 2020; Wegerif, 2008).

3.6 Quantitative Analysis

The basis for making the Kolmogorov-Smirnov Normality Test decision, namely, if the significance value (sig)> 0.05, then the data is usually distributed, and if the significance value (sig) <0.05 then the data is not normally distributed (Table 3). Based on the data obtained, the results show that the data is usually distributed. So, the research can be tested using parametric statistics, namely ANCOVA and one-tailed t-test, to analyze research data (Tables 4-5).

Based on the results of ANCOVA, the sig. The value of science literacy is 0.041, which is the sig value. <0.05, so science literacy influences students' communication skills. In addition, the output of the test results shows that the sig. The value of science teachers is 0.012, so the difference in science teaching between science teacher one and science teacher two partially affects communication skills. The effect of science literacy and differences in science teaching on students' communication skills can simultaneously be determined from the significance of the corrected model. It can be seen that the sig. The value is 0.031, which is sig. < 0,05. This shows that simultaneously, science literacy and science teaching by science teachers affect students' communication skills.

Table 3 Normality test results of case study data based on communicative approach" (number 12, page 26)

Test	Kolmogorof-Smirnov		
	Statistic	df	Sig.
Pretest IPA 1	0.154	32	0.051
Posttest IPA 1	0.139	32	0.121
Pretest IPA 2	0.138	32	0.129
Posttest IPA 2	0.132	32	0.169

Table 4 Ancova test results with type III pretest covariates" (number 19, page 26)

Source	Analysis of Variance		
	df	F	Sig.
Corrected Model	2	3.672	0.031
Intercept	1	168.248	0.000
Science Literacy	1	0.669	0.041
Science Teacher	1	6.737	0.012

Table 5 One-tailed t-test results" (number 6, page 27)

	N	Mean	StDev	SE Mean
IPA 1	32	82.09	8.02	1.4
IPA 2	32	83.41	9.71	1.7
Difference = mu (IPA 1) - mu (IPA 2)				
Estimate for difference: -1.31				
95% upper bound for difference: 2.40				
T-Test of difference = 0 (vs <): T-Value = -0.59				
P-Value = 0.027 DF = 62				
Both use Pooled StDev = 8.9049				

Based on the results of the one-tailed t-test output from Minitab presented in Table 5, it is known that the P-value is 0.027. Because the P-value of IPA 1 and IPA 2 classes <0.05, it can be stated that H0 is rejected. So, there is a significant difference between the interactive science teaching conducted by Science Teacher 1 and Science Teacher 2. This difference indicates that interactive teaching conducted by both teachers results in different communication between students taught by Science Teacher 1 and Science Teacher 2. This difference is based on the different teaching methods used by science teacher one and science teacher 2. If Science Teacher 1 prioritizes exploration activities with students directly, Science Teacher 2 is more based on significant in-depth discussion activities and takes a complete socioemotional approach to students.

Providing a pleasant atmosphere for students when teaching takes place makes them more motivated to learn. Learners' enjoyment of the learning atmosphere raises their ability to experience development, especially in their

communication skills. This follows the theory put forward by Jean Piaget that the development of learners depends on changing learners and active interaction with the environment. One of the things related to active interaction with the environment is through a socioemotional approach that focuses on how learners can respond or respond to things that happen in their environment (Naldi, 2018; Neviyarni, 2020).

4. CONCLUSION

Based on the research results, it was found that interactive science teaching carried out by Science Teachers 1 and 2 needed to be carried out optimally to develop communication skills towards science literacy of VIII grade students of SMPN "X" Ponorogo. This can be seen from the results of interviews and data analysis conducted. Nevertheless, this case study has used various approaches linked to communication skills through the learning process. In addition, the results of learning associated with communication skills and the contribution that can be made by whole-class teaching are related to the emergence of students' ideas through various indicators of communication skills.

On the other hand, science teaching models need to be clarified for teachers to meet learning objectives. This case study shows a new role in exploring ideas to expand the mainstream view in the literature through science literacy from various sources. Learners are emphasized on brainstorming or discussion to build shared understanding. In the case study, the collection of ideas in the initial or introductory activities is a conceptual knowledge resource everyone can utilize.

In both case studies, different discussion activities were implemented. In case study 1, science teacher 1 emphasized collaborative discussion among students and exploration through internet media. Meanwhile, in case study 2, science teacher 2 uses discussion activities between teachers and students directly. Both are following the demands of the independent curriculum, which prioritizes students as the main actors of learning but still frees students in developing their ideas or ideas.

Case study 2, Science Teacher 2, provides an example of open learning planning in learning science practices and theories and doing practice through practicum activities. Meanwhile, case study 1 science teacher 1 is closer to the community of practice with observation and exploration activities through practicum in the laboratory. One of the challenges is developing communication skills among students with different levels of ability. This difference can be overcome by using interactive multimedia that can connect the context or material associated with technology, such as animation or artificial intelligence. This can be used as further research for researchers who have the same interests as this research.

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