



Communication Skills in Learning: An Integrative Review

Khoiriah¹(✉), Agus Suyatna², Abdurrahman², and Tri Jalmo³

¹ Department of Education Doctoral Program, Lampung University, Lampung, Indonesia
khoiriahspd74@gmail.com

² Department of Graduate Physics Education, Lampung University, Lampung, Indonesia
{agus.suyatna, abdurrahman.1968}@fkip.unila.ac.id

³ Department of Graduate Biology Education, Lampung University, Lampung, Indonesia
tri.jalmo@fkip.unila.ac.id

Abstract. Communication skills play a critical role in equipping the global community to survive in the face of increasing job competition as a result of the rapid pace of change brought on by the development of digital technologies. In addition to enabling information, the education sector is encouraged to incorporate the development of communication skills in learning. This article gives the results of an integrative review research study that looked at prior studies on communication skills in learning from 2015 to 2020. From October to December 2020, a search for relevant literature was conducted using the keywords communication skills of students or communication skills in learning in the Education Resources Information Center, Google Scholar, and Science Direct databases. Tables and concept maps are used to analyze data and display the outcomes of the integrative review. The findings of this study show that the development of communication skills in learning is critical beginning at the primary level. Further researchers interested in developing communication skills should pay close attention to the characteristics of students' learning styles, according to the findings of this integrative review research study.

Keywords: integrative review · communication skills · 21st-century skills

1 Introduction

Science and technology in the 21st-century are predicted to experience very fast development [1] and significantly impact human life [2]. Education is considered as one of the most appropriate sectors to prepare supplies for the world community in order to survive in the 21st-century [3]. However, currently high school and college graduates are considered to be still lacking in the application of basic skills and applied skills in the world of work [4]. Therefore, education needs to be urged to reform the quality of learning by contributing to helping students develop various important skills that are the demands of life to face the global trends of the 21st-century [5].

21st-century skills are a series of new competencies as potential life skills that are thought to be able to save the world community from the effects of massive unemployment due to changes in digital technology [6]. 21st-century employment has a very high demand for workers with the qualifications to communicate verbally and in writing, collaborate in teams, and act as problem solvers [7]. Communication skills are so important because the advantages contained in a product cannot be known well by consumers if they are not socialized with communication skills [8].

Empirical studies consistently report that students have difficulty developing communication skills [9–13]. Further empirical studies reveal that the non-verbal communication skills of the most Indonesian students are in the intermediate category while the criteria for oral communication skills do not meet the standards [14]. Even today, many college graduates have very good practical knowledge but lack communication skills [8]. This indicates that the development of written and oral communication skills in learning design is important to be maximized.

There have been many empirical studies on communication skills in learning [8–13, 15–21]. However, a review related to this has not been carried out so that researchers are interested in conducting an integrative review of communication skills in learning.

This integrative review study aims to compile the findings of research studies on communication skills in learning in the last five years, namely the period 2015 to 2020. The research questions are (1) what is the theoretical basis that underlies the importance of developing communication skills in students? (2) what are the instruments used to measure students' communication skills? (3) what learning model is applied in developing communication skills in students? (4) what other factors contribute to the development of communication skills in students?

Research questions like this are so important to guide researchers in investigating previous research so that they can make new things for further research.

2 Research Method

A. Design

The method in this study is an integrative review that examines the literature on communication skills in learning through qualitative studies [22]. The study in integrative review is a typical research that can generate new knowledge about a particular topic, stimulate further research [23], and provide a comprehensive understanding based on separate research findings through five stages, namely identifying problems, searching literature, evaluating data, analyzing data, and presenting research results [22].

B. Procedures

The search for relevant literature was carried out through the Education Resources Information Center (ERIC), Google Scholar, and Science Direct database in October–December 2020 using the keywords communication skills of students or communication skills in learning. Literature sources are limited to empirical studies for the 2015–2020 period.

The basic consideration for doing this is because this integrative review research is part of a research literature study that serves as an initial study material for a research

research that will be carried out so that it is so important to know the development of learning designs that have been carried out by other previous researchers in developing students' communication skills.

Based on the results of literature identification 432,986 reference sources including 41,218 articles came from the Education Resources Information Center (ERIC) database, Google Scholar 236,000 articles and 155,768 articles through Science Direct. After the reference source was successfully downloaded, the researchers looked at the title and abstract until 13 research articles were selected.

The researcher did not apply specific assessment criteria in this integrative review process. Previous empirical studies can be included in this research review if the article is in English, is in the form of a research report, published through peer-reviewed journals, and describes communication skills in learning.

C. Data Analysis

Data analysis and presentation of research data were carried out in the form of tables and concept maps. This concept map was chosen because it can make it easier for researchers and readers to gain conceptual understanding of a number of articles that are studied as well as provide strategies for analyzing and organizing various existing information including ways to identify and link concepts [24].

3 Results

The results of each empirical study in this integrative review can be seen in Table 1, while the description of the research questions presented in the form of a concept map can be seen in Figs. 1, 2, 3 and 4.

Based on the analysis result in Table I, it can be explained that this integrative review study reviewed 13 articles which included 7 empirical studies conducted at universities, 5 empirical studies carried out at the junior high school level, and 1 empirical study at the kindergarten level.

Furthermore, it can also be explained that 6 studies were published in the 2015–2018 period and 7 studies between 2019–2020. Table 1 explains that of the 13 articles there are 11 research articles that show significant research results on improving communication skills and the other 2 articles do not show significant results on improving communication skills.

A. What is the theoretical basic that underlies the importance of developing *communication skills*?

Through this integrative review research, it can be explained that the theoretical basis underlying the importance of developing communication skills in learning was identified in 13 research articles [8–13, 15–21].

Based on the analysis of the 13 research articles, it can be explained that the concepts that are an important part of the theoretical basis in the development of students' communication skills include individual perceptions, improvement of the learning climate, professional orientation, as well as cross-disciplinary knowledge, for example between Indonesian and science.

Table 1. Research Results of Integrative Review.

Researcher	Level	Research Result
[8]	University	Sixth semester students have a higher positive attitude towards communication skills than first semester students.
[9]	Junior high school	Students' communication skills improved as a result of integrating picture descriptions in classroom activities.
[10]	University	There is a significant difference between students' mathematical communication skills with guided discovery learning and traditional learning.
[11]	University	There is a significant difference between oral skills development (OSD) and non-OSD students on oral presentation assignments.
[12]	Junior high school	There was a significant increase in students' information and communication skills in the experimental group who were taught using web-based science materials with a guided inquiry approach.
[13]	University	There are significant differences in problem solving skills and communication skills between experimental and control group students.
[15]	University	PBL learning based on environmental problems has a significant effect on students' communication skills.
[16]	Kindergarten	There is a significant effect between the students of the thematic approach group and the traditional approach.
[17]	Junior high school	The development of discovery learning models using a scientific approach can significantly improve students' understanding and communication skills.
[18]	University	Student communication skills did not differ significantly by gender, class, or field of education.
[19]	University	The MIKIR approach significantly improves students' science communication skills. Students' written science communication skills are lower than verbal communication skills.
[20]	Junior high school	There are significant differences in the communication skills of gifted students according to gender and school type. There is no significant difference according to grade level.
[21]	Junior high school	There is a positive relationship between communication skills and students' self-efficacy in learning science.

The empirical study information data related to the theoretical basis that underlies the importance of developing communication skills in learning is shown in Fig. 1.

Based on the analysis results in Fig. 1, it can be explained that the basic study of individual perception theory on the importance of developing communication skills is

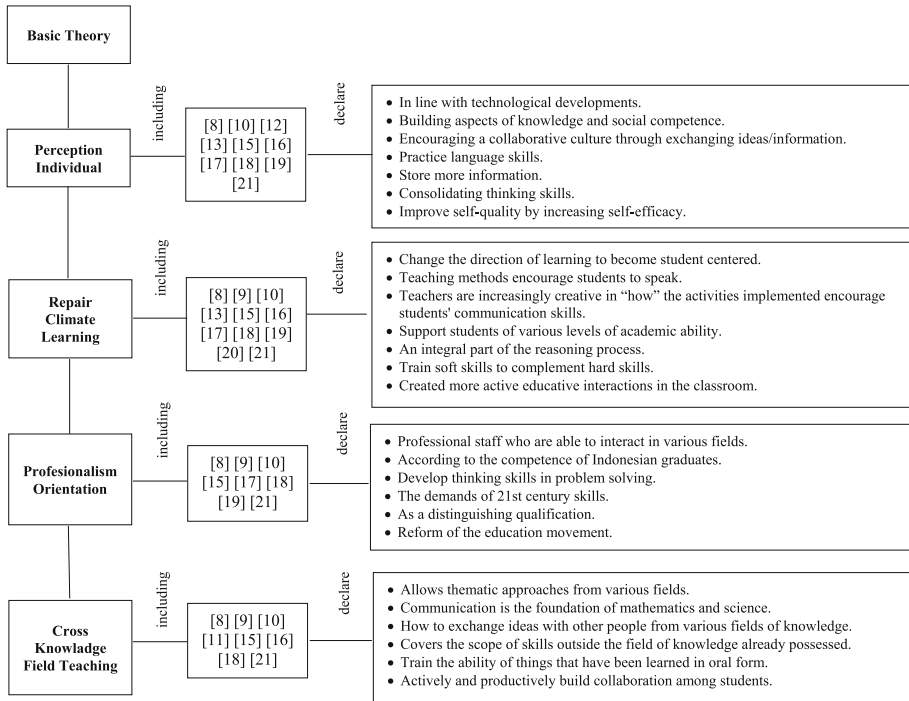


Fig. 1. Basic theory of the importance of developing communication skills.

found in 10 research articles [8–10, 12, 13, 15–19]. These articles generally explain that applying the development of communication skills in learning design means providing a vehicle that allows students to plan learning activities by asking questions, trying to engage in communication, and selecting evidence of information according to the context of the learning problem.

The theoretical basis for improving the learning climate on the importance of developing communication skills was identified in 11 research articles [8–10, 13, 15–21]. These articles reveal that when the learning climate requires improvement through the development of communication skills, the interaction of students with the learning environment must be ensured to be realized. This means that students are able to direct self-ability related to communication skills if given the opportunity to learn to develop their communicative competence.

The theoretical basis for the orientation of professionalism to the importance of develop communication skills can be seen through 8 research articles [8–10, 15, 17–19, 21]. These research articles explain that successful communication can make a positive contribution to students’ self-confidence in demonstrating abilities, building inter-communication relationships, and increasing future professional success.

The theoretical basis for cross-disciplinary teaching on the importance of developing communication skills was identified in 8 research articles [8–11, 15, 16, 18, 21]. These research articles explain that communication skills have an important role in all areas of

teaching. Even the development of communication skills can be a means of integrating one or two particular subjects. Learning like this over time has an impact on strengthening students to obtain a lot of information from various sciences, making it easier to find solutions to problems so that they are potential problem solvers.

B. What instruments are used to measure students' communication skills?

The data collection instrument used to measure students' communication skills in this integrative review study was found in 13 research articles [8–13, 15–21]. Based on the analysis results, it can be stated that the communication skills instruments used in empirical research studies have various types and when viewed in terms of validation there are instruments with categories validated by a team of experts and not validated. This is as shown in Fig. 2.

Based on the analysis results in Fig. 2, it can be explained that there are 7 empirical research studies using validated communication skills instruments and 6 empirical research studies using unvalidated instruments. Furthermore, referring to the results of

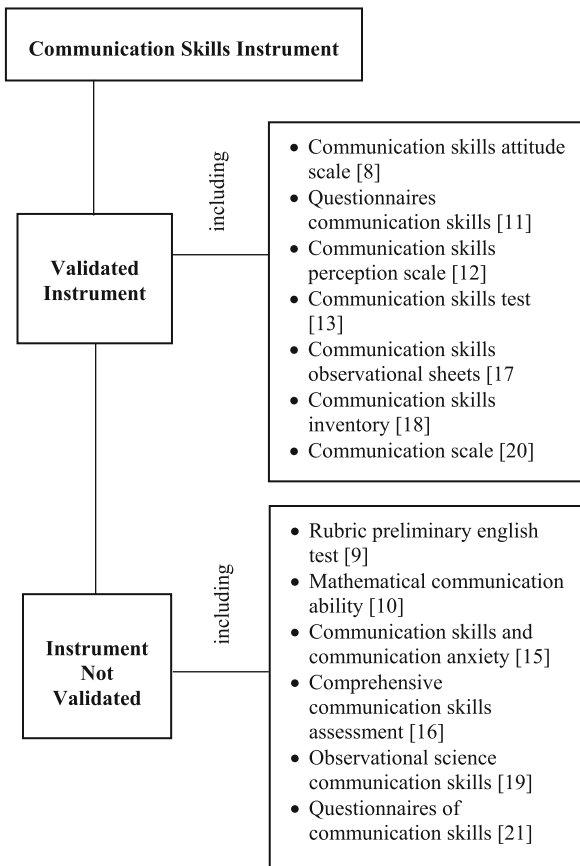


Fig. 2. Concept map of communication skill instruments.

the analysis of 7 empirical research studies using these validated instruments, it can be stated that the selection of the type of instrument depends on the observational aspect of communication skills. This is as described in research [8] using the Communication Skills Attitude Scale (CSAS) instrument because the observational aspect of the empirical study in this study investigated student attitudes towards communication skills. This represents that further researchers need to analyze the research objectives in order to determine the choice of the instrument used.

The empirical study of this research also explains that there are differences in the number of instrument indicator items after the validation process. As explained in research [18] during the first validation process there were 70 indicator items on the instrument but after the second validation stage it became 45 items. This represents that instrument validation is an important agenda so that the dimensions of the essential indicators are not missed being realized as questions or statements in the instrument.

Furthermore, the results of the analysis of these research articles explain that the statements on the instrument are grouped as favorite items and unfavorable items. This is done so that respondents seriously read and answer all instrument statements more carefully. This means that respondents need to think about determining the most appropriate answer choice.

Furthermore, the analysis results also describe that the instrument rating scale uses five answer choices, starting with number 1 as “strongly disagree” to number 5 as “strongly agree”. This represents that the answer choices on the instrument can be categorized as neither too few nor too many, making it easier for respondents to distinguish between each answer choice.

C. What learning models are applied in developing communication skills in students?

Integrative review research identified that there were 5 research articles [10, 12, 13, 15, 17] that apply learning models in development communication skills.

Based on the analysis of the 5 research articles, it can be explained that the application of certain learning models is related to the subject matter (Fig. 3).

Based on the analysis results in Fig. 3, it can be described that previous researchers have applied models of problem-based learning, discovery learning, guided discovery learning, guided inquiry, and ELSII based local wisdom in developing communication skills in students.

Models of problem-based learning, discovery learning, guided discovery learning, and guided inquiry have been widely known in research topics. This is different from the ELSII learning model based on local wisdom [13]. The ELSII learning model based on local wisdom is a modification of the inquiry learning model and process oriented guided inquiry learning by integrating the content of local wisdom in the “sangkep” social system. This shows that when you want to develop communication skills, apart from applying the old learning model, it can also be proven through the development of new learning models.

The analysis results in Fig. 3 also describe that the selection of learning models is related to the subject matter. As research [15] requires students to be able to express ideas and ideas on environmental issues, problem-based learning models are the choice.

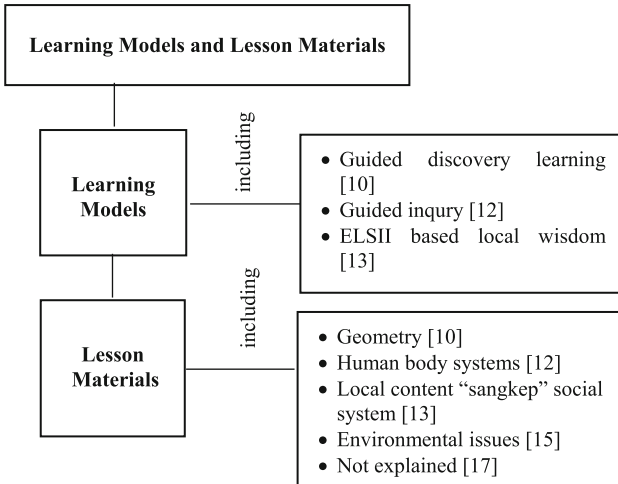


Fig. 3. Concept map of learning models and lesson materials.

Further disclosed research [10] which expects students to be able to find concepts in geometry material so that the guided discovery learning model is the choice. The above can be interpreted that the guided discovery learning model is believed to be able to guide students to discover concepts that were previously unknown.

The surprising thing identified in the empirical research study [17] was that there was no information about the subject matter that was part of the research, so it was impossible to predict the basis for the researchers' considerations in choosing the discovery learning model. However, in general, the results of the research as shown in Fig. 3 represent that certain learning models are suitable for certain learning materials as well.

D. What other factors contribute to the development of communication skills in students?

Through this integrative review research, it is known that there are other factors that contribute to the improvement of students' communication skills, namely the learning approach and the duration of the study. The learning approach factors are described in 7 research articles [9, 11, 12, 15–17, 19], while the duration of the study is described in 6 research articles [9, 11–13, 15, 16].

The empirical research study that describes the types of learning approaches and the duration of research in this integrative review study is shown in Fig. 4.

Based on the analysis results in Fig. 4, it can be identified that the learning approach applied by previous researchers includes an environmental problem-oriented, thematic, image-description-based, scientific, transdisciplinary approach, MIKIR approach, as well as investigation and technology integration.

The results of the study [12] explained that through this inquiry-based learning approach and technology integration, each student was given the opportunity to speak as much as possible in the classroom related to the investigation process carried out to solve the existing problems. Furthermore, [12] explained that learning with an inquiry-based

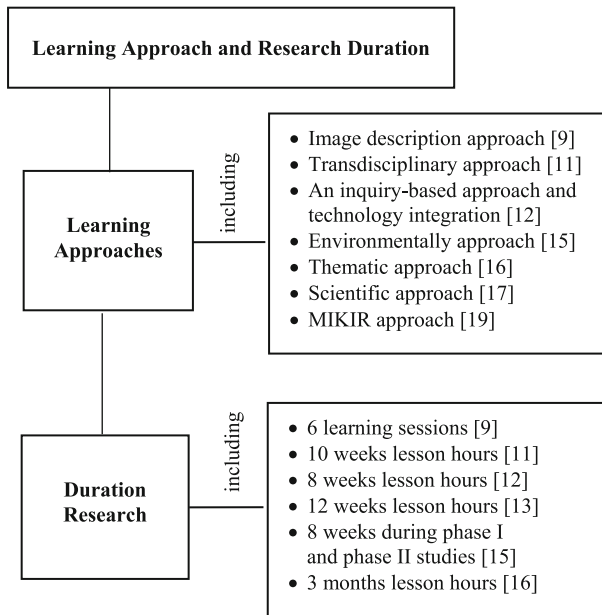


Fig. 4. Learning approach and research duration.

approach and technology integration encourages students to express academic quality by actively presenting various ideas and ideas.

Furthermore, research [9] revealed that students when looking at pictures think of ideas that can help build a thinking context so that their imagination develops. It was also emphasized that the learning approach using pictures contributes more positively to making it easier for students to communicate, reducing speaking anxiety factors, and supporting active participation in a conducive classroom climate [9].

Learning using a thematic approach encourages the involvement of all students because the topics presented are relevant to the real world. Through the selection of interesting topics, it encourages the desire for conversations between students and even between students and teachers [16]. Students have an interest in participating when the study room presents an approach oriented to environmental problems so that they feel motivated to demonstrate knowledge through the performance of communication skills [15]. Generally, students tend to be more active and willing to be directly involved in the learning process if the learning activities presented provide opportunities to build potential. This means that the learning approach invites students to interact and communicate actively in the learning process [19].

Based on the analysis results in Fig. 4, it was also revealed that the research duration factor also contributed to the improvement of students' communication skills. The results of the analysis identified that these empirical studies used the shortest duration of study was 6 learning sessions [9] and the longest duration was 12 weeks lesson hours [13].

4 Discussion

Based on the analysis results in Table 1, it can be explained that empirical studies of communication skills development are mostly carried out at the tertiary education level, reaching 53,85% or identified through 7 research articles [8, 10, 11, 13, 15, 18, 19] junior high school level 38,46% or found in 5 research articles [9, 12, 17, 20, 21], and Kindergarten level 7,69% or 1 research article [16]. The data of this study indicate that universities interpret the importance of communication skills for graduates. As [8] stated that nowadays many entrepreneurs often complain about the lack of communication skills in the workforce from college graduates. [9] also revealed that most students have good academic competence but have not been able to communicate properly. Furthermore [25] emphasized that it is very important for students to master adequate communication skills outside of academic knowledge. In line with this [20] emphasizes that the future success of students in various fields of work can be realized through communication skills.

Based on the analysis results in Fig. 1, it can be formulated about the theoretical foundations which are the important basis for research to develop communication skills in learning. These various theoretical bases generally represent that today's teaching is no longer only focused on facilitating student learning at the knowledge level, but it is important to pay attention to integrating the achievement of communication skills aspects in teaching design. The most surprising thing is that there is a theoretical basis which states that teachers should no longer only be aware of "what" students need in learning but also be aware of "how" the activities implemented by teachers in the teaching process are able to encourage students to speak and practice oral communication skills [9]. This is as [26] revealed that 21st-century education requires teachers who equip students not only with aspects of knowledge and information but also encourage students to be able to process information, develop creative thinking, and acquire problem solving skills.

Furthermore, based on the analysis results in Fig. 1 another theoretical basis is also presented, namely that communication skills are so important because they can encourage students to present ideas and opinions in solving problems [12, 19, 20], building self-efficacy [18, 21], expanding the climate of sharing and mutual respect [15], as well as preparing qualification competencies to face the competitive job market [8]. This is in line with [27] that the ability to express opinions is very important for students because it can build explanations and reinforce conceptual knowledge in the context of learning.

Validation of research instruments is a very important process [28]. Validation plays a role in testing the ability of an instrument so that it can measure variables correctly [27]. However, based on the analysis results in Fig. 2, 7 empirical studies from 13 research studies were identified using validated instruments [8, 11–13, 17, 18, 20]. This means that not all empirical studies use research instruments that have gone through a validation process. The communication skill data collection instrument used in the empirical study of this integrative review research was revealed to be derived from the results of the researcher's development and adapted from various types of communication skills instruments of other researchers. Furthermore, [28] suggested that for the purpose of maintaining the consistency of the instrument's feasibility, researchers need to carry out a validation process on the instrument. This is in line with the opinion [29] that it is necessary to review various questions or statements of research instruments in order to

obtain a set of instruments of adequate quality. [30] also stated that through the validation process, the suitability and representativeness of the competencies to be measured were actually stated as indicators in the instrument. Furthermore, [31] confirms that the validity review process is carried out so that the quality of the instrument is maintained.

The analysis results in Fig. 3 confirm that several learning models were applied by previous researchers in empirical studies of communication skills development. Learning models can help teachers organize student learning experiences in order to be able to achieve learning goals [32]. To create a conducive learning environment so that the target learning objectives can be achieved, teachers need to understand various learning models and be able to apply learning models properly and appropriately [33]. This is as [34] confirmed that through the selection of the right learning model can help students improve understanding of knowledge concepts and develop learning skills.

The learning models applied by previous researchers in this integrative review research are problem-based learning, discovery learning, guided discovery learning, and guided inquiry. There is an interesting thing from the empirical study of this research, namely the finding of a high interest in the development of communication skills, namely that previous researchers developed an ELSII learning model based on local wisdom by involving the content of the local culture of the “sangkep” social system [13].

Based on the analysis results in Fig. 4, it was found interesting things related to the learning approach, namely teaching does not want students to answer problems by copying material from reference sources of teaching materials. However, students are encouraged to express opinions by agreeing or rejecting a certain idea from other students in the classroom [19]. In general, it can be identified that the various choices of learning approaches used in this study aim to build learning activities to share ideas and ideas when completing tasks related to the subject matter. Through teaching facts like this, it is believed that it can encourage students to organize themselves to become more and more actively involved in the learning process and increase learning motivation so that in the end gradually their communication skills can develop well. This is as research results [35] reveal that the ability to regulate and motivate oneself in the learning process is an important aspect of supporting the success of student education. Furthermore [36] confirmed that the construction of motivation is believed to have a positive and significant relationship in controlling independent learning.

The duration of the study can be interpreted as the time span or the length of time students participate in the process of learning activities designed by researchers. Based on the analysis results in Fig. 4, it can be seen that the empirical studies included in this integrative review study used research durations in the range of 1,5 to 3 months. This indicates that students get an adequate portion of learning for the process of developing communication skills so that it is very possible to develop the potential of these soft skills. As the results of research [37] show that there is a positive influence between the duration of learning and the achievement of mathematics learning outcomes. Furthermore, [38] emphasized that the teaching process is important considering the allocation of learning time.

5 Conclusion

Communication skills are one of the important soft skills that students need to have in addition to knowledge competence. It is appropriate that the development of communication skills begins at the elementary level of education. However, it must be recognized that each student has their own learning style tendencies. Based on previous research studies, it was identified that researchers have not shown attention to developing communication skills that are oriented towards the characteristics of learning styles. Therefore, this study recommends conducting further research that supports the development of communication skills based on the characteristics of students' learning styles.

References

1. I. W. Redhana, "Mengembangkan Keterampilan Abad Ke-21 Dalam Pembelajaran Kimia," *J. Inov. Pendidik. Kim.*, vol. 13, no. 1, 2019.
2. T. M. Sheykhjan, "Global Peace Education in 21 st Century," pp. 0–8, 2014.
3. A. Radziewicz-Winnicki and T. Wilk, "'Education for Tomorrow' in the New Polish Order: Images of the Postmonocentric Global Society," *New Educ. Rev.*, vol. 8, pp. 13–27, 2006.
4. B. Trilling and C. Fadel, "21St Century Skills: Learning for Life in Our Times," *Choice Rev. Online*, vol. 47, no. 10, pp. 47–5788–47–5788, 2010, doi: <https://doi.org/10.5860/choice.47-5788>
5. E. van Laar, A. J. A. M. van Deursen, J. A. G. M. van Dijk, and J. de Haan, "Determinants of 21st-Century Skills and 21st-Century Digital Skills for Workers: A Systematic Literature Review," *SAGE Open*, vol. 10, no. 1, 2020, doi: <https://doi.org/10.1177/2158244019900176>.
6. T. Rayna and L. Striukova, "Fostering skills for the 21st century: The role of Fab labs and makerspaces," *Technol. Forecast. Soc. Change*, vol. 164, no. March 2018, p. 120391, 2021, doi: <https://doi.org/10.1016/j.techfore.2020.120391>.
7. J. A. Rios, G. Ling, R. Pugh, D. M. Becker, and A. N. Bacall, "Identifying critical 21 st," pp. 80–89, 2020.
8. M. M. Kovac and N. Sirkovic, "Attitudes towards Communication Skills among Engineering Students," *English Lang. Teach.*, vol. 10, no. 3, p. 111, 2017, doi: <https://doi.org/10.5539/elt.v10n3p111>.
9. P. Lavalley and M. Briesmaster, "The Study of the Use of Picture Descriptions in Enhancing Communication Skills among the 8th- Grade Students--Learners of English as a Foreign Language.," *I.E. Inq. Educ.*, vol. 9, no. 1, p. 4, 2017.
10. J. Suratno, W. S. Tonra, and Ardiana, "The effect of guided discovery learning on students' mathematical communication skill," *AIP Conf. Proc.*, vol. 2194, no. December, pp. 1–7, 2019, doi: <https://doi.org/10.1063/1.5139851>.
11. I. McLaren, "Science Students' Responses to an Oral Communication Skills Development Initiative: Attitude and Motivation," *Int. J. Teach. Learn. High. Educ.*, vol. 31, no. 1, pp. 73–85, 2019, [Online]. Available: <http://www.isetl.org/ijtlhe/>.
12. Ü. Ormanç and S. Çepni, "Investigating the effects of web-based science material for guided inquiry approach on information and communication skills of students," *Particip. Educ. Res.*, vol. 7, no. 1, pp. 201–219, 2020, doi: <https://doi.org/10.17275/per.20.12.7.1>.
13. A. Fadli and Irwanto, "The effect of local wisdom-based ELSII learning model on the problem solving and communication skills of pre-service islamic teachers," *Int. J. Instr.*, vol. 13, no. 1, pp. 731–746, 2020, doi: <https://doi.org/10.29333/iji.2020.13147a>.

14. A. Haryanti and I. R. Suwama, "Profil Keterampilan Komunikasi Siswa Smp Dalam Pembelajaran Ipa Berbasis Stem," *WaPFI (Wahana Pendidik. Fis.*, vol. 3, no. 1, p. 49, 2018, doi: <https://doi.org/10.17509/wapfi.v3i1.10940>.
15. H. Awang and Z. Daud, "Improving a Communication Skill Through the Learning Approach Towards the Environment of Engineering Classroom," *Procedia - Soc. Behav. Sci.*, vol. 195, pp. 480–486, 2015, doi: <https://doi.org/10.1016/j.sbspro.2015.06.241>.
16. K. Venugopal, "Impact of Thematic Approach on Communication skills in Preschool," *Imp. J. Interdiscip. Res.*, vol. 2, no. 10, pp. 2454–1362, 2016.
17. M. D. Wulandari, S. Sarwi, and A. Yulianto, "Development of Discovery Learning Model Using Scientific Approach to Increase Student's Comprehension and Communication Skills," *J. Innov. Sci. Educ.*, vol. 7, no. 2, pp. 223–228, 2018, [Online]. Available: <https://journal.unnes.ac.id/sju/index.php/jise/article/view/25165>.
18. A. Ismet, "Communication skills of students in fine arts departments of education faculties," *Educ. Res. Rev.*, vol. 13, no. 20, pp. 688–695, 2018, doi: <https://doi.org/10.5897/err2018.3611>.
19. M. Alpusari, E. A. Mulyani, Z. H. Putra, A. Widyanthi, and N. Hermita, "Identifying Students' Scientific Communication Skills on Vertebrata Organs," *J. Phys. Conf. Ser.*, vol. 1351, no. 1, 2019, doi: <https://doi.org/10.1088/1742-6596/1351/1/012070>.
20. A. Eskicumali, N. Kara, S. Arslan, and K. Uzun, "Investigation of Communication Skills of Gifted Students in Terms of Various Variables," *Online J. Qual. High. Educ.*, vol. 7, no. 1, pp. 43–48, 2020.
21. A. F. R. A. Ichsan, R. Adawiyah, and I. Wilujeng, "Analysis of the ability of students' communication skills and self-efficacy on science instruction," *J. Phys. Conf. Ser.*, vol. 1440, no. 1, 2020, doi: <https://doi.org/10.1088/1742-6596/1440/1/012088>.
22. Robin Whitemore PhD APRN & Kathleen Knafel PhD, "The integrative review: updated methodology," *J. Adv. Nurs.*, vol. 52, no. 5, pp. 546–553, 2005.
23. R. J. Torraco, "Writing Integrative Literature Reviews: Guidelines and Examples," *Hum. Resour. Dev. Rev.*, vol. 4, no. 3, pp. 356–367, 2005, doi: <https://doi.org/10.1177/1534484305278283>.
24. Joseph D. Novak, "Results and Implications of a 12-Year Longitudinal Study of Science Concept Learning," *Res. inScience Educ.*, vol. 35, pp. 23–40, 2005, doi: DOI: <https://doi.org/10.1007/s11165-004-3431-4>.
25. D. M. Schultz, "A university laboratory course to improve scientific communication skills," *Bull. Am. Meteorol. Soc.*, vol. 91, no. 9, pp. 1259–1266, 2010, doi: <https://doi.org/10.1175/2010BAMS3037.1>.
26. S. C. Noh and A. M. A. Karim, "Design thinking mindset to enhance education 4.0 competitiveness in Malaysia," *Int. J. Eval. Res. Educ.*, vol. 10, no. 2, pp. 494–501, 2021, doi: <https://doi.org/10.11591/ijere.v10i2.20988>.
27. R. Perdana, Riwayani, J. Jumadi, and D. Rosana, "Modification level and test of scientific argumentation skill: Development and validity," *Int. J. Eval. Res. Educ.*, vol. 9, no. 3, pp. 769–777, 2020, doi: <https://doi.org/10.11591/ijere.v9i3.20594>.
28. N. F. Sulaeman and Y. Kumano, "Development of students' perception instrument of new and renewable energy (Pinre)," *New Educ. Rev.*, vol. 56, no. 2, pp. 66–77, 2019, doi: <https://doi.org/10.15804/ner.2019.56.2.05>.
29. S. Pasikowski, "The problem of matching rating scales in educational measurement of variables modelled as sets of oppositional pairs," *New Educ. Rev.*, vol. 54, no. 4, pp. 271–282, 2018, doi: <https://doi.org/10.15804/ner.2018.54.4.22>.
30. D. Westen and R. Rosenthal, "Quantifying Construct Validity: Two Simple Measures," *J. Pers. Soc. Psychol.*, vol. 84, no. 3, pp. 608–618, 2003, doi: <https://doi.org/10.1037/0022-3514.84.3.608>.

31. H. Taherdoost and H. Group, "Validity and Reliability of the Research Instrument ; How to Test the Validation of a Questionnaire / Survey in a Researchfile:///C:/Users/admin/Desktop/RISACHI REPORT 2021/reference B/2190-8050-1-PB-1 SOCIO.pdf," no. September, 2017.
32. Kementerian Pendidikan dan Kebudayaan, *Materi Pelatihan Implementasi Kurikulum 2013*. Jakarta: Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendidikan Kementerian Pendidikan dan Kebudayaan, 2014.
33. M. Hosnan, *Pendekatan Saintifik dan Konstektual dalam Pembelajaran Abad 21*. Bogor, 2014.
34. Sunyono, L. Yuanita, and M. Ibrahim, "Efektivitas model pembelajaran berbasis multipel representasi dalam membangun model mental mahasiswa topik stoikiometri reaksi," *Pendidik. Progresif*, vol. 3, no. 1, pp. 65–79, 2013.
35. Tanti, Maison, B. Syefrinando, M. Daryanto, and H. Salma, "Students' self-regulation and motivation in learning science," *Int. J. Eval. Res. Educ.*, vol. 9, no. 4, pp. 865–873, 2020, doi: <https://doi.org/10.11591/ijere.v9i4.20657>.
36. S. L. Lim and K. J. Yeo, "A systematic review of the relationship between motivational constructs and self-regulated learning," *Int. J. Eval. Res. Educ.*, vol. 10, no. 1, pp. 330–335, 2021, doi: <https://doi.org/10.11591/IJERE.V10I1.21006>.
37. B. Titis and W. Sari, "Pengaruh Durasi Belajar Terhadap Hasil Belajar Matematika Siswa Kelas 5 Ledok 006 Salatiga," *J. Rev. dan Pengajaran*, vol. 2, pp. 139–144, 2019.
38. J. Stallings, "Allocated Academic Learning Time Revisited, or Beyond Time on Task," *Educ. Res.*, vol. 9, no. 11, pp. 11–16, 1980, doi: <https://doi.org/10.3102/0013189X009011011>.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

