The Communication Skills Profile of Pre-Service Biology Teachers

Astuti Muh. Amin1*, Fitriyah Karmila2, Yuni Pantiwati2, Romi Adiansyah3, Ahmad Yani4

1 Institut Agama Islam Negeri (AIN) Ternate, North Maluku, Indonesia.
2 Universitas Muhammadiyah Malang, East Java, Indonesia.
3 Universitas Muhammadiyah Bone, South Sulawesi, Indonesia.
4 Universitas Puangrimaggalatung Sengkang, South Sulawesi, Indonesia.

Abstract: The focus of learning design and learning innovations for the twenty-first century is preparing students with communication skills. Students must have communication skills to effectively transfer scientific knowledge, processes, knowledge, insights, and other important data. This study aimed to determine the profile of communication skills possessed by pre-service biology teachers at IAIN Ternate. This is a quantitative descriptive study involving 65 students from the Tadris Biology Department at IAIN Ternate. The research was conducted during the even semester of the 2021/2022 academic year. Observation sheets of verbal and nonverbal communication were used to collect data. The technique for collecting data is direct observation (experience) of the learning process and interactive class discussion in the target classroom. The results indicated that pre-service biology teachers' verbal and nonverbal communication abilities were extremely deficient. These findings provide educators with an overview of effective learning approaches for training students to be independent and proficient in 21st-century skills.

Keywords: Communication Skills; Non-Verbal; Pre-service biology teachers; Profile; Verbal.

Introduction

The importance of studying communication skills in the realm of education stems from the fact that communication between instructors and students has a significant impact on the efficacy of learning outcomes. Effective communication has a crucial function in education, affecting both productivity and the atmosphere of the classroom (Alawamleh et al., 2020; Amin et al., 2020; Hariyanto et al., 2019). Communication in the classroom can create a free-thinking environment for students to explore and reflect on their ideas in an argumentative forum (Makur, 2019). Communication is dynamic and interactive, so students can readily respond, conclude, assess, and make comments and thoughts as feedback on a concept or argument (Uyen et al., 2021). Communication skills include the ability to explain ideas effectively and persuasively orally and in writing, express viewpoints in clear words, convey clear instructions and motivate others through effective public speaking (Amin, 2017; Hasanah & Malik, 2020; Shivni et al., 2021).

The constructivist learning paradigm is founded on the ability of students to actively interpret information in their own way; students construct their own knowledge with meaningful ideas that integrate newly acquired knowledge with previously acquired knowledge and experience (Adnan et al., 2021; Amin & Adiansyah, 2018). This process of determining meaning will be more efficient if pupils possess adequate communication skills. Through proper identification and delivery of scientific ideas, constructivist learning conditioning can be trained. Facilitating constructivist and meaningful learning experiences in the scientific inquiry process helps foster scientific literacy, teamwork, and communication skills in students (Amin & Adiansyah, 2020; Rahayu, 2017). Students must be able to utilize words, symbols, graphs, and tables to

How to Cite:
Amin, A. M., Karmila, F., Pantiwati, Y., Adiansyah, R., & Yani, A. (2022). The Communication Skills Profile of Pre-Service Biology Teachers. Jurnal Penelitian Pendidikan IPA, 8(4), 2109–2115. https://doi.org/10.29303/jppipa.v8i4.1825
describe an object, an event, an activity, and the result of a discussion in order to promote their science process skills (Omeodu et al., 2021).

To overcome verbal communication difficulties with students, comprehend nonverbal communication from students, and constructively resolve conflicts in the classroom, educators require communication skills (Santrock, 2007). Students must be able to integrate acquired knowledge into a social context by employing communication principles to construct a thinking discourse (Mwakapina, 2020). The focus of learning and innovation in the 21st century is on preparing students to think critically, communicate, collaborate, and think creatively (Amin, 2022; Permata et al., 2020).

Communication skills are essential in the workplace, especially in the twenty-first century; consequently, they must be polished in the classroom from a young age (Hariyanto et al., 2019). Students with strong communication skills can enjoy a higher quality of life because these skills can help the development of other crucial abilities (Haryanti & Suwarna, 2018).

Many biology courses in universities still follow conventional learning which leads to inactivity and lack of confidence in students to ask questions (Amin et al., 2022; Nurmala & Priantari, 2017). Poor communication skills are demonstrated by students’ poor speaking abilities in presentations or laboratory work (Fajarianingtyas et al., 2021). Learners from diverse social, cognitive, and personality backgrounds should be able to enhance an environment of active learning in which they may speak extensively to comprehend topics. Teachers are frequently challenged by students’ inability to ask questions while encountering obstacles during the learning process (Amin et al., 2021; Fitriah et al., 2020). The learning approach, which is dominated by lecturing and largely consists of passive listening, is incapable of training students’ communication abilities (Nurmal & Priantari, 2017).

Higher education faces the difficulty of preparing graduates with great self-confidence while presenting ideas, speaking publicly, asking questions, and possessing adequate verbal and nonverbal communication skills. The ability to convey discoveries or studies is one of the key abilities involved in the scientific process (sciencing) (Oktaviani & Hidayat, 2010). Biology education is meant to cultivate in students attitudes that are truthful, objective, open, persistent, critical, and able to collaborate and communicate effectively (Nawawi & Azhari, 2020).

This study’s objective was to determine the communication skills profile of pre-service biology teachers at IAIN Ternate. This study is anticipated to give a foundation for university professors to create the skills that students need to confront the challenges of the twenty-first century. In the 21st century, the learning process must stimulate active communication among participants, as well as their ability to comprehend, manage, and produce effective oral, written, and multimedia communication in diverse formats (Nurmal & Priantari, 2017). Educators can design models, learning techniques, and learning methods that will be implemented in the classroom by obtaining knowledge about communication skills. As a result, university graduates will be independent and possess 21st century skills.

Method

In this study, a quantitative descriptive design was adopted. The research sample consisted of sixty-five Biology Education students at IAIN Ternate. The research instrument comprised verbal and non-verbal communication observation sheets. Data were gathered through direct observation (experience) of the classroom learning process. Three observers were engaged in this assignment.

The participants’ capacity to communicate verbally and nonverbally was used to assess their communication skills. In this study, verbal communication skills refer to students’ abilities to ask and answer questions, interact in groups, convey ideas orally, and respond to ongoing oral presentations. Students’ nonverbal communication skills were evaluated based on their ability to communicate the outcomes of observations, debate observation data, draw inferences, make suggestions, and use correct Indonesian spelling (EBI).

Microsoft Excel was used to process the data acquired from the observation sheets, which were then presented as a percentage. The formula used to analyze the data was adopted from (Purwanto, 2009).

$$NP = \frac{R}{SM} \times 100\%$$

(Purwanto, 2009)

Remarks:

- NP = Percentage sought or expected
- R = Raw score obtained by the group
- SM = The ideal maximum score of the test

The score categories used in this study were presented below.

- 86-100% = exceptionally good
- 76-85% = good
- 60-75% = poor
- < 55% = extremely poor

Results and Discussion

Table 1 provides a summary of the verbal communication skill scores collected from the observation sheets.
Table 1. Vocal Communication Skills Scores of Students

| Vocal Communication Skills (Verbal) | Semester II | Category | Semester IV | Category | Semester VI | Category |
|------------------------------------|-------------|----------|-------------|----------|-------------|----------|
| Asking questions                   | 65.00       | poor     | 46.67       | extremely poor | 25.00       | extremely poor |
| Answering questions                | 30.00       | extremely poor | 40.00       | extremely poor | 25.00       | extremely poor |
| Group interactions                 | 40.00       | extremely poor | 33.33       | extremely poor | 20.00       | extremely poor |
| Expressing ideas                   | 35.00       | extremely poor | 20.00       | extremely poor | 15.00       | extremely poor |
| Oral presentations                 | 65.00       | poor     | 46.67       | extremely poor | 25.00       | extremely poor |
| Responding to others’ presentations | 65.00       | poor     | 40.00       | extremely poor | 35.00       | extremely poor |

Table 1 demonstrates that the vocal communication skills of second-semester biology teacher candidates at IAIN Ternate for asking questions, oral presentations, and giving presentations fall into the category of poor, while the ability of teachers to respond to questions, interact in groups, and express ideas is categorized as extremely poor. In contrast, students in semesters IV and VI demonstrated inadequate voice communication skills.

Table 2 summarizes the nonverbal communication ability scores collected from the observation sheets.

| Non-Vocal Communication Skills (Non-Verbal) | Semester II | Category | Semester IV | Category | Semester VI | Category |
|--------------------------------------------|-------------|----------|-------------|----------|-------------|----------|
| Presenting observations                    | 60.00       | Poor     | 40.00       | extremely poor | 25.00       | extremely poor |
| Discussing observational data              | 55.00       | extremely poor | 33.33       | extremely poor | 20.00       | extremely poor |
| Drawing inferences                         | 35.00       | extremely poor | 26.67       | extremely poor | 15.00       | extremely poor |
| Making suggestions                         | 30.00       | extremely poor | 13.33       | Sangat Kurang | 15.00       | extremely poor |
| Using correct Indonesian spelling (EBI)    | 50.00       | extremely poor | 40.00       | extremely poor | 25.00       | extremely poor |

According to Table 2, the non-vocal communication skills of second-semester pre-service biology teachers at IAIN Ternate for presenting observational data are classified as poor, while those for discussing observational data, drawing inferences, making suggestions, and utilizing EBI are categorized as extremely poor. Additionally, students in the fourth and sixth semesters performed poorly in all areas of the non-vocal communication skills evaluation. Observational data revealed that the pre-service biology teachers lacked both verbal and non-vocal communication skills. The poor level of their communication skills may be a result of the limited variety of learning models and techniques employed in the classroom, which are incapable of training their ability to ask and answer questions. When students with high academic ability dominate the completion of group assignments and the presentation of discussion results, group interaction is not conducive.

Participants’ capacity to articulate thoughts and arguments is deemed undeveloped. The capacity to relate assignment concepts is still confined to the key elements of the assignment material. Observations revealed that the students had trouble providing further explanations, articulating the information’s connection to everyday problems, expressing thoughts and points of view, challenging current solutions, and grasping the presented material. They also struggled with delivering the discussion’s conclusions and topic in a structured manner. This is because the students lack conceptual knowledge and critical thinking skills. They were infrequently engaged in the independent building of knowledge and comprehension because the repetitive lecturing technique had dominated the learning process thus far.

One aspect that can explain the students’ poor communication skills is their misunderstanding of biological ideas (Sari et al., 2019). In this study, the students appeared afraid to answer the lecturer’s questions since did not master the content (Hamidah & Luzyawati, 2022; Purwanti et al., 2020). Anisah & Wisanti found that errors in picking the correct sentences, lack of knowledge of subjects, lack of confidence, anxiety, and lack of fluency when expressing opinions in class also contributed to the challenges the participants experienced (Anisah & Wisanti, 2022). The students tended to communicate less interactively, use less technology, and deliver messages or information less assertively and effectively (Dipalaya et al., 2016). This lack of communication capacity might hinder the ability to comprehend information, integrate ideas and speech, and adjust to the environment (Wood & Haartshorne, 2017).

Communication skills are a fundamental requirement for conducting the scientific process (Oktaviani & Hidayat, 2017). Reading skills, discussion
presentations, and writing activity reports all contribute to the development of communication skills in biology education (Mursidah et al., 2019). With communication skills, students can gain experience presenting the results of a completed scientific procedure. Students can learn to convey the results of their studies through graphs, tables, images, and other forms of presentation (Wahyuningsih & Fatonah, 2021).

Verbal communication is essential for students to communicate their results and thoughts orally through oral presentations, conversations, and debates, and helps them predict writing test performance (Haworth & Garrill, 2003). Effective communication is characterized by the capacity to articulate thoughts and ideas clearly in vocal, written, and nonverbal forms. Communication skills are also evidenced by the capacity to listen effectively in order to interpret meaning, to use communication for a variety of reasons, to employ a variety of media and technology, and to communicate effectively in a variety of settings (including multilanguage) (Khoerunisa & Habibah, 2020).

Effective oral communication skills can assist pupils in achieving greater academic success and proficiency (Crebert et al., 2011). Oral communication is seen effective since students provide feedback in the form of questions and responses during the learning process (Wisman, 2017). This feedback enables pupils to enhance their previous communication methods. Communication skills are essential for engaging in productive social interactions, fostering mutual understanding, and maximizing learning results (Kurniati, 2016). For aspiring biology teachers, oral communication skills are the most crucial factor in effectively conveying science, understanding, and other pertinent information (Sari et al., 2019).

To attain appropriate learning objectives and outcomes, the communication process in learning is conducted from multiple directions. Confidence and the capacity to adapt students’ grasp of the content being studied are two factors that can affect students’ communication skills. The capacity to communicate can assist and aid students in expressing their thoughts and exchanging information with teachers or other students (Marfuah, 2017). The level of mastery of a subject or idea and a person’s reasoning ability will impact the quality of the argument, including the individual’s communication ability (Amin et al., 2021).

The benefit of communication skills for students in the learning process is that they enable pupils to comprehend the information and messages offered by educators as materials or concepts. In addition, through communication skills, students are able to provide comments, communicate their ideas and opinions, and ask pertinent questions when they struggle to comprehend the topic (Hujjatusnaini et al., 2022; Milawati, 2014). Verbal and nonverbal communication skills are essential to improve university graduates’ competency and their professional success (Kompella et al., 2020; Wrighting et al., 2021). Through the construction of a network structure to offer and improve good interpersonal and coordination abilities, the communication process plays a significant role in altering people’s behavior (Tekad & Febriana, 2021).

Conclusion

Based on the research findings and data analysis, it can be found that the verbal and nonverbal communication abilities of pre-service biology teachers were extremely deficient. This study on communication skills demonstrates that pre-service biology teachers’ communication skills, particularly at IAIN Ternate, still require improvement. Educators must strive for the empowerment of creative learning models that are more diverse in teaching autonomous learning and the persistent and ongoing active engagement of students in learning. This effort can be made so that the output of future biology instructors meets the skill requirements of the twenty-first century.

Acknowledgements

This study was sponsored by the Ministry of Religious Affairs, the Republic of Indonesia. The authors wish to express their gratitude to the Ministry of Religious Affairs, the Republic of Indonesia for supporting this study. We would also want to thank everyone who has contributed to this study.

References

Adnan, Mulbar, U., Sugarti, & Bahri, A. (2021). Scientific Literacy Skills of Students: Problem of Biology Teaching in Junior High School in South Sulawesi, Indonesia. International Journal of Instruction, 14(3), 847–860. https://doi.org/10.29333/iji.2021.14349a
Alawamleh, M., Al-twait, L. M., & Al-Saht, G. R. (2020). The Effect of Online Learning on Communication between Instructors and Students during Covid-19 Pandemic. Asian Education and Development Studies. https://doi.org/10.1108/AEDS-06-2020-0131
Amin, A. M. (2017). Pre Service Biology Teachers’ Argumentation Skills in Animal Physiology Laboratory. Jurnal Pengajaran MIPA, 22(2). https://doi.org/10.18269/jpmipa.v22i2.8696
Amin, A. M. (2022). Profil Critical Thinking Skills Mahasiswa Calon Guru Biologi Ternate pada Pembelajaran Biologi. Jurnal Binomial, 5(2), 95–104. https://doi.org/10.46918/bn.v5i2.1393
Amin, A. M., & Adiansyah, R. (2018). Lecturers’ Perception on Students’ Critical Thinking Skills Development and Problems Faced by Students in Developing their Critical Thinking Skills. *Jurnal Pendidikan Biologi Indonesia*, 4(1), 1-10. https://doi.org/10.22219/jpbi.v4i1.5181

Amin, A. M., & Adiansyah, R. (2020). Identification of Preservice Biology Teachers’ Metacognitive Awareness and Metacognitive Skills. *Journal of Physics: Conference Series*, 1511(012022), 1-8. https://doi.org/10.1088/1742-6596/1511/1/012029

Amin, A. M., Adiansyah, R., & Hujatusnaini, N. (2021). Students’ Argumentation Quality and Argumentation Skill Biology Education Student. *Jurnal Bioedukatika*, 9(2), 84-92. https://doi.org/doi.org/10.26555/bioedukatika.v9i2.20675

Amin, A. M., Adiansyah, R., & Hujatusnaini, N. (2022). Conceptual Knowledge and Argumentation Skills of Biology Students in Animal Physiology Courses. *Edubiotik: Jurnal Pendidikan, Biologi Dan Terapan*, 7(1), 23-35. https://doi.org/doi.org/10.33503/ebio.v7i01.1380

Amin, A. M., Corebima, A. D., Zubaidah, S., & Mahanal, S. (2020). The Correlation between Metacognitive Skills and Critical Thinking Skills at the Implementation of Four Different Learning Strategies in Animal Physiology Lectures. *European Journal of Educational Research*, 9(1), 143-163. https://doi.org/10.12973/eu-jev.r9.1.143

Anisah, & Wisanti. (2022). Pengembangan LKPD Lumut Berbasis Learning Cycle 5E untuk Melatihkan Keterampilan Komunikasi Peserta Didik Kelas X SMA. *Bioedu Berkala Ilmiah Pendidikan Biologi*, 11(2), 276-287. https://doi.org/10.26740/bioedu.v11n2.p270-284

Crebert, G., Patrick, C. J., Cragnolini, V., Smith, C., Worsfold, K., & Webb, F. (2011). *Oral Communication Toolkit 2nd Edition*.

Dipalaya, T., Susilo, H., Ibrohim, & Corebima, A. D. (2016). Pengaruh Strategi Pembelajaran PDEODE (Predict-Discuss-Observe-Discuss-Explain) pada Kemampuan Akademik Berbeda terhadap Hasil Belajar siswa SMA di Kota Makassar. *Proceedings of Seminar Nasional II Tahun 2016, Kerjasama Prodi Pendidikan Biologi FKIP Dengan Pusat Studi Lingkungan Dan Kependudukan (PSLK) Universitas Muhammadiyah Malang*.

Fajarianingtyas, D. A., Hidayat, J. N., & Anekawati, A. (2021). Pengembangan Lembar Kerja Mahasiswa Berorientasi Pemecahan Masalah pada Keterampilan Komunikasi dan Kolaborasi. *Eksakta: Jurnal Penelitian Dan Pembelajaran MIPA*, 6(2), 215-221. https://doi.org/10.31604/eksakta.v6i2.215-221

Fitriah, P. I., Yulianto, B., & Asmarani, R. (2020). Meningkatkan Keterampilan Komunikasi Penerapan Metode Everyone Is A Teacher Here Siswa. *Journal of Education Action Research*, 4(4), 546-555. https://doi.org/10.23887/jea.v4i4.28925

Hamidah, I., & Luzyawati, L. (2022). Keterampilan Komunikasi Verbal Calon Guru Biologi Melalui Pembelajaran Jarak Jauh. *Biodik: Jurnal Ilmiah Pendidikan Biologi*, 8(1), 90-96. https://doi.org/10.22437/bio.v8i1.15667

Haryanto, H., Yaminthah, S., Sukarmin, S., Saputro, S., & Mahardiani, L. (2019). The Analysis of Students’ Verbal Communication Skills by Gender in the Middle School in South Tangerang. *AIP Conference Proceedings*, 2202(020064), 1-6. https://doi.org/10.1063/1.5141677

Haryanti, A., & Suwarna, I. R. (2018). Profil Keterampilan Komunikasi Siswa SMP dalam Pembelajaran IPA Berbasis STEM. *Jurnal Wahana Pendidikan Fisika*, 3(1), 49-54.

Hasanah, H., & Malik, M. N. (2020). Blended Learning in Improving Students’ Critical Thinking and Communication Skills at University. *Cypriot Journal of Educational Research*, 15(5), 1295-1306. https://doi.org/10.18844/cjerr.v15i5.5168

Haworth, I. S., & Garrill, A. (2003). Assessment of Verbal Communication in Science Education A Comparison of Small and Large Classes. *The International Union of Biochemistry and Molecular Biology*, 31(1), 24-27. https://doi.org/10.1002/bmb.2003.4940310164

Hujatusnaini, N., Corebima, A. D., Prawiro, S. R., & Gofur, A. (2022). the Effect of Blended Project-Based Learning Integrated With 21St-Century Skills on Pre-SERVICE Biology Teachers’ Higher-Order Thinking Skills. *Jurnal Pendidikan IPA Indonesia*, 11(1), 104-118. https://doi.org/10.15294/jpbi.v11i1.27148

Khoerunisa, E., & Habibah, E. (2020). Profil Keterampilan Abad 21 (21St Century Soft Skills) pada Mahasiswa. *Iktyisaf: Jurnal Ilmu Dakwah Dan Tasawuf*, 2(2), 55-68.

Kompella, P., Gracia, B., Leblanc, L., Engelman, S., Kulkarni, C., Desai, N., June, V., March, S., Pattengale, S., Rivera, G. R., Ryu, S. W., Strohkendl, I., Mandke, P., & Clark, G. (2020). Interactive Youth Science Workshops Benefit Student Participants and Graduate Student Mentors. *Plos Biology*, 18(3), 1-10. https://doi.org/10.1371/journal.pbio.3000668

Kurniati, D. P. (2016). *Komunikasi Verbal Dan Nonverbal*. Universitas Udayana.

Makur, A. P. (2019). The Influence of PQ4R Strategy And Mathematical Reasoning Ability Towards
Mathematical Communication Skills. *SJME (Supremum Journal of Mathematics Education)*, 3(1), 18–31. https://doi.org/10.35706/sjme.v3i1.1467

Marfuah. (2017). Meningkatkan Keterampilan Komunikasi Peserta Didik Melalui Model Pembelajaran Koperatif Tipe Jigsaw. *Jurnal Pendidikan Ilmu Sosial*, 26(2), 148–160.

Milawati. (2014). Metode Everyone Is Teacher Here pada Materi Ikatan Kimia Di Kelas X SMAN 1 Marawola. *Jurnal Akademia Kimia*, 3(May), 309–316.

Mursidah, S., Susilo, H., & Corebima. (2019). Evaluation of Physical Science Learning Project Based Instruction and Its Impact on Students’ Learning. *International Journal of Educational Research*, 80, 66–80. https://doi.org/10.1016/j.ijer.2019.03.004

Mwakapina, J. W. (2020). Communication Skills Course in Bridging the Gap of Weak Students’ Communicative Competence and Accentuating Performance: A Case of Sokoine University of Agriculture. *International Journal of Language and Linguistics*, 8(1), 1–10. https://doi.org/10.11648/j.ijll.20200801.11

Nawawi, S., & Azhari, A. T. (2020). Analysis of the Level of Critical Thinking Skills of Students in Biological Materials at Muhammadiyah High School in Palembang City. *Universal Journal of Educational Research*, 8(3D), 47–53. https://doi.org/10.13189/ujer.2020.081707

Nurmaini, R. S., & Priantari, I. (2017). Meningkatkan Keterampilan Komunikasi dan Hasil Belajar Kognitif Melalui Penerapan Discovery Learning. *Jurnal Biologi Dan Pembelajaran Biologi*, 2(1), 1–10. https://doi.org/10.32528/bioma.v2i1.586

Oktaviani, F., & Hidayat, T. (2017). Profil Keterampilan Berkomunikasi Siswa SMA Menggunakan Metode Fenetik dalam Pembelajaran Klasifikasi Arthropoda. *Jurnal Pengajaran MIPA*, 15(1), 13–24. https://doi.org/10.18269/jpmipa.v15i1.288

Oktaviani, F., & Hidayat, T. (2010). Profil Keterampilan Berkomunikasi Siswa SMA Menggubakan Metode Fenetik dalam Pembelajaran Klasifikasi Arthropoda. *Jurnal Pengajaran MIPA*, 15(1), 13–24. https://doi.org/10.18269/jpmipa.v15i1.35984.g15364

Omeodu, M. D., Oduh, & Nathaniel, V.-A. (2021). Significance of Field Trip on Biology Students Acquisition of Science Process Skills in Abua Odua Local Government Area. *International Journal of Innovative Social & Science Education Research*, 9(1), 37–45.

Permana, A., Saefudin, & Amprasto. (2020). Students’ Perception towards Field Study Activity. *Journal of Physics: Conference Series*, 1521(042011), 1–6. https://doi.org/10.1088/1742-6596/1521/4/042011

Purwanti, A., Hujatussaini, N., Septiana, N., & Amin, A. (2020). Analisis Keterampilan Berpikir Kritis Mahasiswa Melalui Model Blended-Project Based Learning Terintegrasi Keterampilan Abad 21 Berdasarkan Students Skill Level. *JIP (Journal IPA Dan Pembelajaran IPA)*, 6(3), 235–245. https://doi.org/10.24815/jipi.v6i3.25128

Purwanto. (2009). *Evaluasi Hasil Belajar*. Pustaka Pelajar.

Rahayu, S. (2017). Promoting the 21st Century Scientific Literacy Skills through Innovative Chemistry Instruction. *AIP Conference Proceedings*, 1911(020025), 1–8. https://doi.org/10.1063/1.5016018

Santrock, J. W. (2007). *Psikologi Pendidikan (Edisi Kedua)*. Kencana.

Sari, I. J., Ratnasari, D., & Islami, R. A. Z. El. (2019). Analisis Komunikasi Lisan Calon Guru Biologi Melalui Pendekatan Inkuiri pada Konsep Metabolisme Sel. *Prosiding Seminar Nasional Pendidikan FKIP*, 2(1), 211–217.

Shivni, R., Cline, C., Newport, M., Yuan, S., & Bergan-Roller, H. E. (2021). Establishing a Baseline of Science Communication Skills in an Undergraduate Environmental Science Course. *International Journal of STEM Education, 8*(47), 1–15. https://doi.org/10.1186/s40594-021-00304-0

Tegak, & Febriana, R. (2021). Pengaruh Model Pembelajaran Team-Based Project terhadap Keterampilan Komunikasi dan Keterampilan Kolaborasi pada Mata Kuliah Bahasa Indonesia. *Jurnal PTK Dan Pendidikan*, 7(2), 131–141. https://doi.org/10.18592/ptk.v7i2.5445

Uyen, B. P., Tong, D. H., & Tram, N. T. B. (2021). Developing Mathematical Communication Skills for students in Grade 8 in Teaching Congruent Triangle Topics. *European Journal of Educational Research*, 10(3), 1287–1302. https://doi.org/10.12973/eu-jer.10.3.1287

Wahyuningsih, P., & Fatonah, S. (2021). Analisis Berkomunikasi dalam Keterampilan Proses Sains Siswa Melalui Pembelajaran Daring pada Mata Pelajaran IPA Kelas V di SDN 2 Negeri Katon Pesawaran Lampung. *Tarbiyah Wa Ta‘lim: Jurnal Pendidikan dan Pembelajaran*, 8(1), 1–22. https://doi.org/10.21093/twt.v8i1.2852

Wisman, Y. (2017). Komunikasi Efektif dalam Dunia Pendidikan. *Jurnal Nomosleca*, 3(2), 646–654. https://doi.org/10.26905/nomosleca.v3i2.2039

Wood, L., & Harsthorse, M. (2017). *Literacy: The Role of Communication Skills*. http://www.sec-ed.co.uk/best-practice/literacy-the-role-ofcommunication-skills
Wrighting, D. M., Dombach, J., Walker, M., Cook, J., Duncan, M., Ruiz, G. Velez, & Carmona, A. C. (2021). Teaching Undergraduates to Communicate Science, Cultivate Mentoring Relationships, and Navigate Science Culture. *Life Sciences Education, 20*(31), 1–15. https://doi.org/10.1187/cbe.20-03-0052