ANALYSIS OF COLLABORATIVE SKILLS OF BIOLOGY EDUCATION STUDENTS SULTAN AGENG TIRTAYASA UNIVERSITY

Iing Dwi Lestari[*)1], Dian Rachmawati[1]
[1]Universitas Sultan Ageng Tirtayasa, Banten, Indonesia; iingdwiles@untirta.ac.id
[*)]Corresponding author: Iing Dwi Lestari; Email: iingdwiles@untirta.ac.id

Abstract. Collaboration skills are essential for students to work effectively in teams, negotiate successfully, and make decisions collectively. This research analyzes the collaboration skills of Biology Education students at Sultan Ageng Tirtayasa University. The research methodology employed is quantitative descriptive analysis, which provides a comprehensive and detailed understanding of the students' collaboration skills. The research findings indicate that the average score for student collaboration skills was 84% in the outstanding category, 14% in the excellent category, and 1% in the sufficient category. The students scored 85 for indicators of positive interdependence, 84 for face-to-face interaction, 96 for individual personal accountability and responsibility, 89 for communication skills, and 91 for group working skills.

INTRODUCTION

The 21st century is marked by advances in technology and digital, often referred to as the era of globalization or better known as the Industrial Revolution 4.0. One of the characteristics of the 21st century phenomenon is marked by very rapid and dynamic changes in the aspects of human life, a system shift from conventional society to modern society (Puspaningsih, 2020; Purnadewi & Widana, 2023). Most human activities are carried out using technology and digitalization systems. Education as the spearhead of a nation's progress should provide services that are in line with the demands of the times. In order to become a successful person in the next century In the 21st century, someone living in that century is required to have various relevant skills must be mastered in order to adapt and contribute (Husain, 2021). The demands of 21st century capabilities increasingly competitive demands four competencies, namely: Critical Thinking and Problem Solving, Creativity and Innovation, Communication and Collaboration (Lestari et al., 2022). Education as bearers of reformative and transformative roles must be able to prepare students to master these various skills.

The Independent Curriculum offers educators the opportunity to deliver learning that aligns with the unique characteristics of their students. This curriculum, a policy of the Kemendikbud RI (Marisa, 2021), is designed to provide students with the freedom to

understand the concepts of the material. The aim is to develop students who are independent, critical, and socially sensitive. In the Independent Curriculum, students are not only given the freedom to search for learning resources, but they are also encouraged to learn independently and actively. Importantly, they are also guided to learn collaboratively, recognizing the value of teamwork in the learning process.

Collaboration skills are one of the 21st-century skills that are very important for students to have in facing the challenges of an increasingly complex and dynamic world of work. Collaboration involves working in teams, sharing ideas, negotiating, and solving problems collectively to achieve common goals (Dillenbourg, 1999; Laal & Ghodsi, 2012). In higher education, students are often required to work on assignments and projects in groups, so collaboration skills are the key to learning success (Rasyid & Fitriah, 2021). Collaborative learning is a learning skill where students with various variations work together in small groups, helping each other to achieve goals (Almerich et al., 2020; Marisda & Handayani, 2020). Collaboration skills are essential skills for students to master in order to be able to collaborate and communicate effectively with team members, as well as practice fluency in making decisions to reach mutual agreements (Stahl, 2015; Susmariani et al., 2022).

Even though research on collaboration skills has been carried out, there still needs to be a gap in research related to analyzing student collaboration skills, especially in Indonesia. Research by Kyndt et al. (2013) on factors influencing student-team collaboration in design projects was only conducted in educational contexts abroad. It may be outside the culture and education system in Indonesia. In addition, Yasa et al. (2023) developed a model to assess students' collaboration abilities in online learning but only focused on the online learning context. Collaboration in face-to-face learning may show different results. Previous research focuses on specific aspects of collaboration, such as team communication (Sari et al., 2017) or conflict management (Lee et al., 2015), but only some have analyzed collaboration capabilities comprehensively.

Collaboration involves various elements such as leadership, time management, negotiation, and respect for differences (Laal & Ghodsi, 2012; Widana & Ratnaya, 2021). Therefore, research is needed that analyzes students' collaboration abilities comprehensively, considering the various aspects involved in the collaboration process. Differences in culture and educational systems greatly influence the dynamics of collaboration, so this research is important to carry out. Collaboration is one of the important competencies, namely the ability to work together in a diverse team, flexibility, willingness to achieve common goals, joint responsibility for collaborative work, and respect for the individual contributions of team members. Indicators that show collaboration skills are contributing actively, working productively, showing flexibility and compromise, showing responsibility, and showing an attitude of respect (Greenstein, 2012).

Based on observations and interviews with lecturers in the Animal Developmental Structure 1 course, information was obtained that students' collaboration skills in the Class of 2022/2023 were still relatively low. This is shown by the lack of student cooperation when working on group assignments; the results of student worksheet assessments could be more optimal, and there are still passive students when presenting group assignments. By analyzing students' collaboration skills in depth, this research is expected to provide new insights into the factors that influence students' collaboration abilities in Indonesia and provide practical recommendations for improving their collaboration skills. This is very

important to prepare students to have the skills needed in a world of work that increasingly demands effective collaboration and teamwork.

METHOD
This study utilized a combination of quantitative and descriptive research approaches to comprehensively examine the research issues. The study population comprised all students currently registered in the Department of Biology Education at Sultan Ageng Tirtayasa University. A stratified random selection method was employed to assure representativeness in selecting a sample of 95 students from the second semester of the 2023/2024 academic year. The data collection techniques, which were chosen for their comprehensive nature, include questionnaires, observations, and interviews. The primary data collection instrument was a structured questionnaire aimed at assessing students' collaboration skills. The questionnaire included items measured on a Likert scale and covered five key indicators: positive interdependence, face-to-face interaction, individual accountability and personal responsibility, communication skills, and working skills in groups. The questionnaire was rigorously validated through a pilot study and expert reviews to ensure its reliability and validity.

Classroom observations were conducted systematically to collect real-time data on student interactions and collaborative behaviors. A checklist was employed to observe and evaluate the questionnaire indicators, providing both consistency and comprehensiveness. Observers received training to reduce bias and enhance the dependability of the observational data. Qualitative insights on students' experiences and attitudes on collaboration were obtained through the use of semi-structured interviews. The interview protocol consisted of open-ended questions that facilitated a thorough examination of the important variables evaluated by the questionnaire. The interviews were meticulously recorded and transcribed word for word, and a systematic analysis was conducted to detect common patterns and trends. Data analysis: The quantitative data obtained from the surveys were evaluated using descriptive statistics to provide a concise summary of the average and range of students' collaboration capabilities by Excell.

RESULTS AND DISCUSSION
Data from the questionnaire results in this research are presented as descriptive statistics on student collaboration skills. The maximum score achieved by students is 100, while the minimum score is 60. In addition, the average score for student collaboration skills is 89.03 in the very good category (Table 1).

Table 1. Descriptive Value of Student Collaboration Skills

Statistics Scores	Values Statistics
Sample size	95
Mean	89,03
Median	90
Mode	86
Standard deviation	8,34
Variance	69,61
Maximum Score	100
Minimum Score	60

The frequency distribution of categorizing students' collaboration skills scores shows a score of 84%, which is included in the very good category (Table 2).

Tabel 2. Frequency Distribution of Categorization of Student Collaboration Skills Values

Category	Score range	Frequency	Percentage
Very Good	>80	80	84%
Good	>60-80	14	15%
Fair	>40-60	1	1%
Less	>20-40	0	0%
Very Poor	≤20	0	0%
Total		95	100%

Image 1 shows that the score range for each indicator of student collaboration skills has an average value of >80. This shows that each indicator's achievement of student collaboration skills is included in the very good category. This research shows that students could collaborate with fellow group members when working on group assignments.
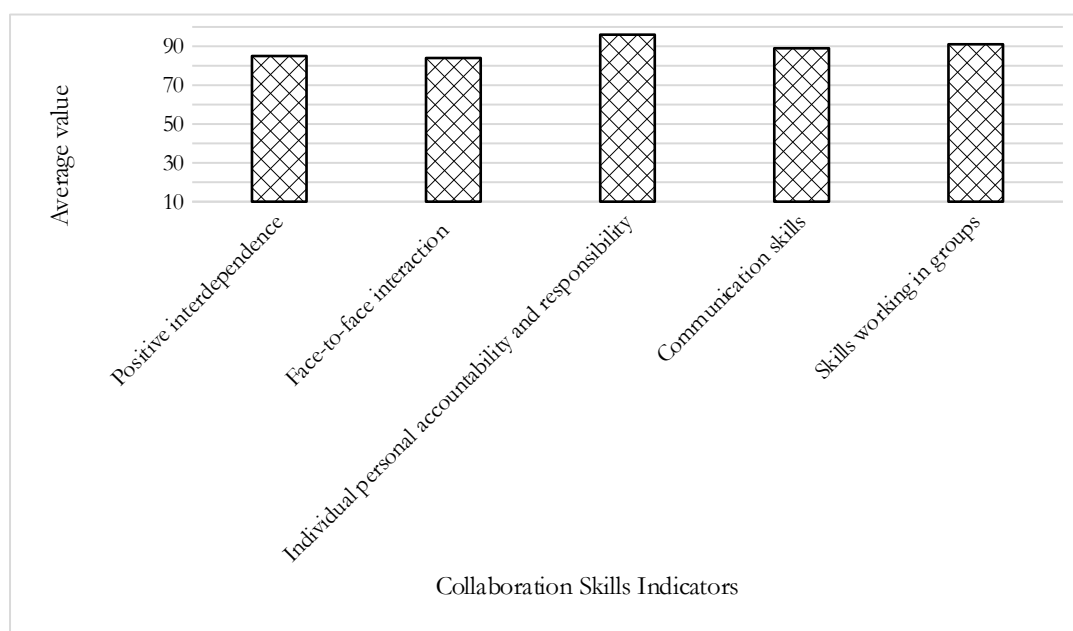

Image 1. Average Value of Student Collaboration Skills for Each Indicator

Individual personal accountability and responsibility is the indicator with the highest score, namely 96, and is included in the very good category. This can be seen during learning, where students try to take responsibility for completing it according to the agreed time. Students are also seen trying their best to submit assignments on time. Students with high accountability will ensure that their contributions to the group are of high quality because they understand that the results of their group work will be evaluated (Roseth et al., 2008). Accountable students will not rely on other members and will always ensure they contribute optimally (Sung et al., 2016). A sense of responsibility will encourage students to learn independently to ensure that each member has relevant knowledge and good understanding when discussing in their group (Broadbent & Poon, 2015). Responsible students tend to have a high sense of ownership of group assignments, so their involvement in completing assignments will be better (Martin et al., 2018).

Indicators of working skills in groups and communication skills scored 91 and 89, included in the very good category. During learning, students realize that the tasks must follow

sequential procedures. A clear structure and division of tasks help create efficient task completion. A clear division of work can reduce student confusion and increase understanding of the tasks (Slavin, 2015). The division of performance stages makes it easier for students to determine priorities for completing the work from the easiest to the most difficult. This is useful for minimizing work chaos (Hmello-Silver & Barrow, 2006; Stahl, 2015). Completing assignments in stages will encourage each student's responsibility and create more unified collaboration (Dillenbourg, 2014).

In communicating, students are seen actively discussing with their group friends, asking their friends when they encounter problems, and carrying out all stages of completing group assignments. Working in groups allows members to divide tasks effectively, maximize the potential of each member, and complete tasks more efficiently. Apart from that, a good division of work can increase overall group productivity (Zakaria & Iksan, 2017). Group work helps students develop social skills, empathy, and conflict management. This is very important for success in collaborative learning (Johnson et al., 2013; Kyndt et al., 2013).

The interdependence indicator positively shows a score of 85, included in the very good category. During research, students can work on group assignments based on previously agreed division of tasks. This is shown by the student's tendency to produce good and original results. This is in line with the research results of Sukendra et al., (2023), which state that student behavior that is independent and able to control itself during collaboration is necessary to create original task outcomes. Dependence is positively related to the psychological condition of each individual when trying to achieve the same goal. The existence of positive interdependence creates opportunities for students to work together and encourages students to help each other (Chiriac et al., 2019). During learning activities, students are seen using learning resources like books and the internet when working on assignments. In textbooks, structured information is written by an expert who has undergone an editing process to validate its validity (Slavin, 2014). Apart from that, books function to make it easier to distribute tasks. Studying certain parts of the book can guide each group member to play an essential role in achieving common goals (Cennamo et al., 2018).

The face-to-face interaction indicator has a score of 84 in the good category. This shows that face-to-face activities in student work groups can run, where each team member gathers and discusses to complete their tasks. During class, students can also be seen sitting close together according to their groups, and each member actively works on group assignments. Each group member brings reading sources in the form of different books to ensure smooth communication when writing down the discussion results. Besides books, technological devices are also used to support group work during learning. Devices and the internet can support group work and joint discussions and make interactions between group members more meaningful (Cennamo et al., 2018). By combining information from books and the internet, students can be more critical in discussing and analyzing, comparing information from various sources, and developing a more comprehensive understanding. This encourages positive interdependence because each student contributes to the analysis and discussion process (Moskal et al., 2013).

CONCLUSION
This research concludes that students' collaboration skills are in the very good category at 84%, the good category at 14%, and the fair category at 1%. The highest indicator of

collaboration is individual accountability and responsibility of 96. During learning, students show their awareness and responsibility for completing assignments within the agreed time and strive to provide quality contributions in group work. They utilize the skills of working in groups by following procedures sequentially, which helps create efficiency and increases engagement. Good communication skills facilitate productive discussions and effective collaboration between group members. Meanwhile, using learning resources such as books and the internet allows students to develop a comprehensive understanding and encourages positive interdependence. Thus, integrating these skills and strategies is critical to supporting effective collaborative learning.

BIBLIOGRAPHY

Almerich, G., Gisbert, M., & Maquilón, J. J. (2020). Collaborative learning assessment: A systematic review. *Educational Psychology Review*, *32*(1), 189-219. DOI: 10.1007/s10648-019-09512-8

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education*, *27*(4), 1-13. DOI: 10.1016/j.iheduc.2015.04.007

Cennamo, K. S., Ross, J. D., & Ertmer, P. A. (2018). *Technology integration for meaningful classroom use: A standards-based approach*. Cengage Learning.

Chiriac, E.H, Michael Rosander, dan Karin Forslund Frykedal. (2019). An educational intervention to increase efficacy and interdependence in group work. *The Asian Institute of Research Education Quarterly Reviews, 2*(2), 435-447.

Dillenbourg, P. (1999). *What do you mean by "collaborative learning"?* In *Collaborative-learning: Cognitive and Computational Approaches*. Elsevier. DOI: 10.1016/S0360-1315(99)00055-4

Dillenbourg, P. (2014). *The evolution of research on collaborative learning*. In *The Oxford Handbook of the Learning Sciences*. Oxford University Press. DOI: 10.1093/oxfordhb/9780199766451.013.0027

Greenstein, L. (2012). *Assessing 21st century skills: A guide to evaluating mastery and authentic learning*. Corwin.

Hmelo-Silver, C. E., & Barrows, H. S. (2006). Goals and strategies of a problem-based learning facilitator. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 21-39. DOI: 10.7771/1541-5015.1002

Husain, H. (2021). Upaya membantu guru membuat e-ulangan melalui metode SHOPING menggunakan whatsapp. *Indonesian Journal of Educational Development*, *1*(4), 544-555. https://doi.org/10.5281/zenodo.4559684

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2013). *Cooperation in the classroom*. Interaction Book Company.

Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., & Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings? *Educational Research Review*, *10*(2), 133-149. DOI: 10.1016/j.edurev.2013.02.002

Laal, M., & Ghodsi, S. M. (2012). Benefits of collaborative learning. *Procedia-Social and Behavioral Sciences*, *31*(3), 486-490. DOI: 10.1016/j.sbspro.2011.12.091

Lee, D., Huh, Y. & Reigeluth, C.M. Collaboration, intragroup conflict, and social skills in project-based learning. *Instr Sci, 43*(2), 561–590. https://doi.org/10.1007/s11251-015-9348-7

Lestari, I. D., Ratnasari, D., & Usman, U. (2022). Profil kemampuan literasi bahasa, literasi budaya dan kewargaan pada mahasiswa Universitas Sultan Ageng Tirtayasa. *Indonesian Journal of Educational Development (IJED), 3*(3), 312-319. https://doi.org/10.5281/zenodo.7365078

Marisa, Mira. (2021). Inovasi Kurikulum "Merdeka Belajar" di era society 5.0. *Jurnal Sejarah, Pendidikan Dan Humaniora, 5*(1), 66–78. https://doi.org/10.36526/js.v3i2.e-ISSN

Marisda, D.H dan Handayani, Y. 2020. Model pembelajaran kolaboratif berbasis tugas sebagai alternatif pembelajaran fisika matematika. *Prosiding Seninar Nasional Fisika, 2*, 9-12. http://ojs.unm.ac.id/semnasfisika

Martin, F., Wang, C., & Sadaf, A. (2018). Student perception of helpfulness of facilitation strategies that enhance instructor presence, connectedness, engagement, and learning in online courses. *The Internet and Higher Education*, *37*(4), 52-65. DOI: 10.1016/j.iheduc.2018.01.003

Moskal, P., Dziuban, C., & Hartman, J. (2013). Blended learning: A dangerous idea? *The Internet and Higher Education*, *18*(4), 15-23. DOI: 10.1016/j.iheduc.2012.12.001

Ng, P.M.L., Chan, J.K.Y. & Lit, K.K. (2022). Student learning performance in online collaborative learning. *Educ Inf Technol*, *27*(4), 8129–8145. https://doi.org/10.1007/s10639-022-10923-x

Purnadewi, G. A. A., & Widana, I. W. (2023). Improving student's science numeration capability through the implementation of PBL model based on local wisdom. *Indonesian Journal of Educational Development (IJED), 4*(3), 307-317. https://doi.org/10.59672/ijed.v4i3.3252

Puspaningsih, A. R. (2020). Penerapan biology interactive notebooks dalam flipped classroom untuk meningkatkan hasil belajar biologi. *Indonesian Journal of Educational Development*, *1*(3), 401-409. https://doi.org/10.5281/zenodo.4284509

Rasyid, Muhamad Al dan Fitriah Khoirunnisa. 2021. The effect of project-based learning on collaboration skills of high school students. *Jurnal Pendidikan Sains (JPS), 9*(1), 113-119. ISSN:2339-0786 DOI: https://doi.org/10.26714/jps.9.1.2021.113-119

Roseth, C. J., Garfield, J. B., & Ben-Zvi, D. (2008). Collaboration in learning and teaching statistics. *Journal of Statistics Education*, *16*(1), 1-15. DOI: 10.1080/10691898.2008.11889557

Sari, K.A, Zuhdan Kun Prasetyo, dan Widodo Setiyo Wibowo. (2017). Development of science student worksheet based on project based learning model to improve collaboration and communication skills of junior high school student. *Journal of Science Education Research, 1*(1), 1-6.

Scager, K., Boonstra, J., Peeters, T., Vulperhorst, J., Wiegant, F. (2020). *Collaborative learning in college science: Evoking positive interdependence*. Springer, Cham. https://doi.org/10.1007/978-3-030-33600-4_16

Slavin, R. E. (2014). Cooperative learning and academic achievement: Why does groupwork work? *Anales de Psicología/Annals of Psychology*, *30*(3), 785-791

Slavin, R. E. (2015). Cooperative learning in elementary schools. *Education and Urban Society*, *47*(4), 419-438. DOI: 10.1177/0013124513495685

Stahl, G. (2015). Studying virtual math teams. *Computers & Education*, *52*(2), 471-489. DOI: 10.1016/j.compedu.2008.08.010

Sukendra, I. K., Widana, I. W., Juwana, D. P. (2023). Senior high school mathematics e-module based on STEM. *Jurnal Pendidikan Indonesia, 12*(4), 647-657. https://doi.org/10.23887/jpiundiksha.v12i4.61042

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, *94*(3), 252-275. DOI: 10.1016/j.compedu.2015.11.008

Susmariani, N. K., Widana, I. W., & Rasmen Adi, I. N. (2022). Pengaruh model pembelajaran inkuiri terbimbing berbasis blended learning dan kemandirian belajar

terhadap hasil belajar matematika siswa sekolah dasar. *Jurnal Ilmiah Pendidikan Citra Bakti, 9*(1), 230-240. https://doi.org/10.38048/jipcb.v9i1.675

Widana, I. W. & Ratnaya, I. G. (2021). Relationship between divergent thinking and digital literacy on teacher ability to develop HOTS assessment. *Journal of Educational Research and Evaluation, 5*(4), 516-524. https://doi.org/10.23887/jere.v5i4.35128

Yasa, I. P. G., Widana, I. W., & Aisyah, S. (2023). The determination of the principal's leadership style, teachers' work motivation, and mind-set of the performance of elementary school teachers. *Edukasi: Jurnal Pendidikan dan Pengajaran, 10*(1), 42-50. https://doi.org/https://doi.org/10.19109/ejpp.v10i1.16790

Zakaria, M. H., & Iksan, Z. H. (2017). Promoting cooperative learning in science and mathematics education: A Malaysian perspective. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(8), 4775-4787. DOI: 10.12973/eurasia.2017.00947a