



Indigenous Knowledge Integrated Biology Learning with Project-based Learning to Support Team Communication Skills

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Abbreviations

IKIBL: Indigenous Knowledge Integrated Biology Learning; **PBL:** Project-Based Learning; **TCS:** Team Communication Skills

ABSTRACT

Proficiency in team communication skills (TCS) is essential for academic achievement in higher education. Discussing socio-scientific issues that are also backed by indigenous knowledge, such as the environment and biodiversity, requires TCS. Nevertheless, there is a dearth of literature on the integration of indigenous knowledge or local wisdom into biology learning, particularly in the context of project-based learning (PBL) at the university level. The objective of this study is to delineate the process of indigenous knowledge integrated biology learning with project-based learning (IKIBL with PBL). Additionally, the aim is to ascertain the TCS score subsequent to treatment using IKIBL with PBL. The study, which employed classroom action research, involved 19 university students. The IKIBL with PBL is a series of activities that are aligned with the PBL methodology. These activities integrate research related to indigenous knowledge into learning. The results of this research were used to create an educational video. The results showed that there was an increase in the percentage of high categories in each learning cycle. Although there was no increase of high categories in Cycle 2, more than 75% of the students were in the high category. The most prominent aspect was closed-loop communication, followed by information sharing, and finally listening. TCS is needed as a requirement for 21st century learning and solving social science issues such as biodiversity and the environment.

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INTRODUCTION

Socio-scientific issues can be solved by students who have 21st-century skills. Skills of the 21st century consist of learning skills, namely critical thinking, creativity and innovation, collaboration, and

communication (Central Board of Secondary Education, 2015; Chirudosen, 2020; Erdogan, 2019). Skills of the 21st century refer to the skills required for a person to actively face the challenges of the 21st century world globally (Central Board

of Secondary Education, 2015). These skills are higher-order thinking, complex thinking, and communication skills (Saavedra & Opfer, 2012). Strong communication and collaboration skills are required to solve problems (Larson & Miller, 2011).

Communication is the first element that is important because there is an exchange of knowledge or opinions to optimize understanding by the recipient (Griffin, 2015). Communication skills are necessary in learning, especially when students collaborate to think and create. Communication is inherent to human nature and has great significance to human life (Yildiz & Tutkun, 2021). Communication is about sharing thoughts, questions, ideas, and solutions (Chirudosen, 2020). Communication is demonstrated in activities such as storytelling and public speaking, asking the right questions, synthesizing messages, and active listening (Kennedy et al., 2022). Communication happens, especially when students work on a team, which requires team communication skills.

Team communication skills (TCS) are still an obstacle to learning. The results of Al-Omari (2020) showed that the level of practice of communication skills among students at Putri Rahma University College was moderate or sufficient. In his research, the data indicate that the field of the university environment was the primary factor, followed by the field of study

subjects and, finally, the field of faculty members. Based on Okeke's research (2020) research, the reasons that led to the deterioration of mastery of this communication skill included students' negative attitudes towards lectures and exams, incorrect use of GSM phones, lecturers' unfaithfulness in teaching the proper use of English, and the grading of students' assignments and exam scripts. The preliminary study yielded similar findings with respect to the sufficient level of communication within the student group.

Team communication skills (TCS) constraints also occur in university students in the Biology Education Undergraduate Study Program at FKIP UKI. A survey was conducted with 33 students in the 2nd and 4th semesters. The survey results showed 51.52% had high TCS, 21.21% had sufficient TCS, and 27.27% had low TCS. Although there are already more than 50% who have high TCS, there are still 48.48% who need help to improve their TCS to a high level. The lack of optimal TCS among biology education students is a big problem because they should have TCS to solve socio-scientific issues, such as biodiversity and environmental issues.

TCS constraints are caused by several factors. Research by Yildiz & Tutkun (2021) lists these factors, including insecurity, selfishness, gossip, and slang. Low communication skills can be seen when

students make presentations in front of their classmates; the students are afraid to speak in front of their friends (Tahir & Anwar Korompot, 2023). Culture exerts a profound influence on verbal language, including the processes of coding and decoding in the communication sphere, as well as the structure of individual thought processes and nonverbal behavior (Mavianti et al., 2020). FKIP-UKI biology education students come from Batak tribe, Mentawai tribe, Nias tribe, Dayak tribe, Javanese tribe, Sundanese tribe, tribe in Papua, and tribe in Nusa Tenggara. In addition, Okeke (2020) posits that factors such as the articulation of words, writing, a lack of reading, and accuracy in interpreting grammatical meaning impede communication.

The problem of TCS is also evident from the lack of direction on how students should work together (Al-Omari, 2020). Communication skills are closely related to collaboration skills (Erdogan, 2019). Students need to be prepared for new ways of working that demand team communication skills in collaboration activities (Griffin, 2015). A collaborative learning step proven to improve communication is project-based learning (PBL). Project-based learning (PBL) is a form of active student-centered teaching (Kokotsaki et al., 2016; Lou & Kim MacGregor, 2004; Sauter et al., 2022). PBL is characterized by student autonomy,

constructive inquiry, goal setting, collaboration, communication, and reflection in real-world practice (Sauter et al., 2022). PBL is an innovative and engaging learning format where students choose many aspects of their task and are motivated by a real-world problem that can, and in many cases, will contribute to their community (Bender, 2012).

Several studies have examined communication skills integrated with PBL. Research by Crespí et al. (2022) showed the effectiveness of the PBL in developing these interpersonal communication and teamwork skills among university students who received the course in 610 students in Madrid. Research by Rahayu et al. (2021) created a PBL collaboration and communication skills assessment tool for improving student soft skills that is valid, practical, and effective. These studies have not accommodated TCS related to socio-scientific issues such as biodiversity at the university level.

PBL is a pedagogical approach that can be utilized to address issues pertaining to biodiversity. Biodiversity is inextricably linked to culture, encompassing the existence of collective knowledge about biodiversity, its utilization and management, and the diverse ways in which various cultures interact with the environment (WWF dan WCEE, 1996). Biodiversity is inextricably linked with indigenous

knowledge (Adam et al., 2019; Ali, 2021; Kosoe et al., 2020). Indigenous knowledge refers to the principles, skills, practices, rituals, and customs developed by a particular race and inherited from generation to generation (Adam et al., 2019; Cajete, 2020). Consequently, it is essential to integrate indigenous knowledge into biology learning through the use of PBL.

The lack of TCS needs to be supported by learning that invites students to collaborate on biodiversity and environmental issues using PBL. The topic of biodiversity is related to indigenous knowledge, so it is a good idea to integrate the two. However, no one has developed indigenous knowledge integrated biology learning (IKIBL) with project-based learning (PBL) at the university level. Therefore, this study aims to describe IKIBL with PBL in biodiversity learning at the university. In addition, this study aims to determine the increase in students' TCS after receiving IKIBL with PBL treatment. The improvement of students' TCS is expected to be the first step to solving socio-scientific problems such as environment and biodiversity.

METHODS

This research was classroom action research. Classroom action research typically involves the use of qualitative and interpretive modes of inquiry with the aim of

assessing how teachers can improve their practice (Kemmis et al., 2014). Action research bridges the gap between theory, research, and educational practice (Selener, 1997). Action research can be used in almost any situation where problems involving people, tasks, and procedures require solutions (Cohen et al., 2018). Classroom action research was conducted in Class A of the Biology Learning Course Based on Local Wisdom (*Pembelajaran Biologi berbasis Kearifan Lokal*), Semester IV, in the Biology Education Study Program FKIP UKI. The implementation of action research, namely for 16 meetings from February to July 2023. The number of students involved in this study was 19. The research procedure used the spiral action research step from Kemmis et al. (2014) with PBL steps by Bender (2012). This stage consists of plan, act, observe, and reflect. This research was conducted in two cycles, as described in **Figure 1**.

There are three types of data collection techniques: video artifact assessment techniques, PBL process performance observation techniques, and survey TCS. The product assessment technique uses a video artifact assessment sheet. The video artifact assessment sheet uses an instrument modified from the SMM Conference (2021) with 11 statements covering aspects of content, relevance, educational value, organization, technical, and creative ability.

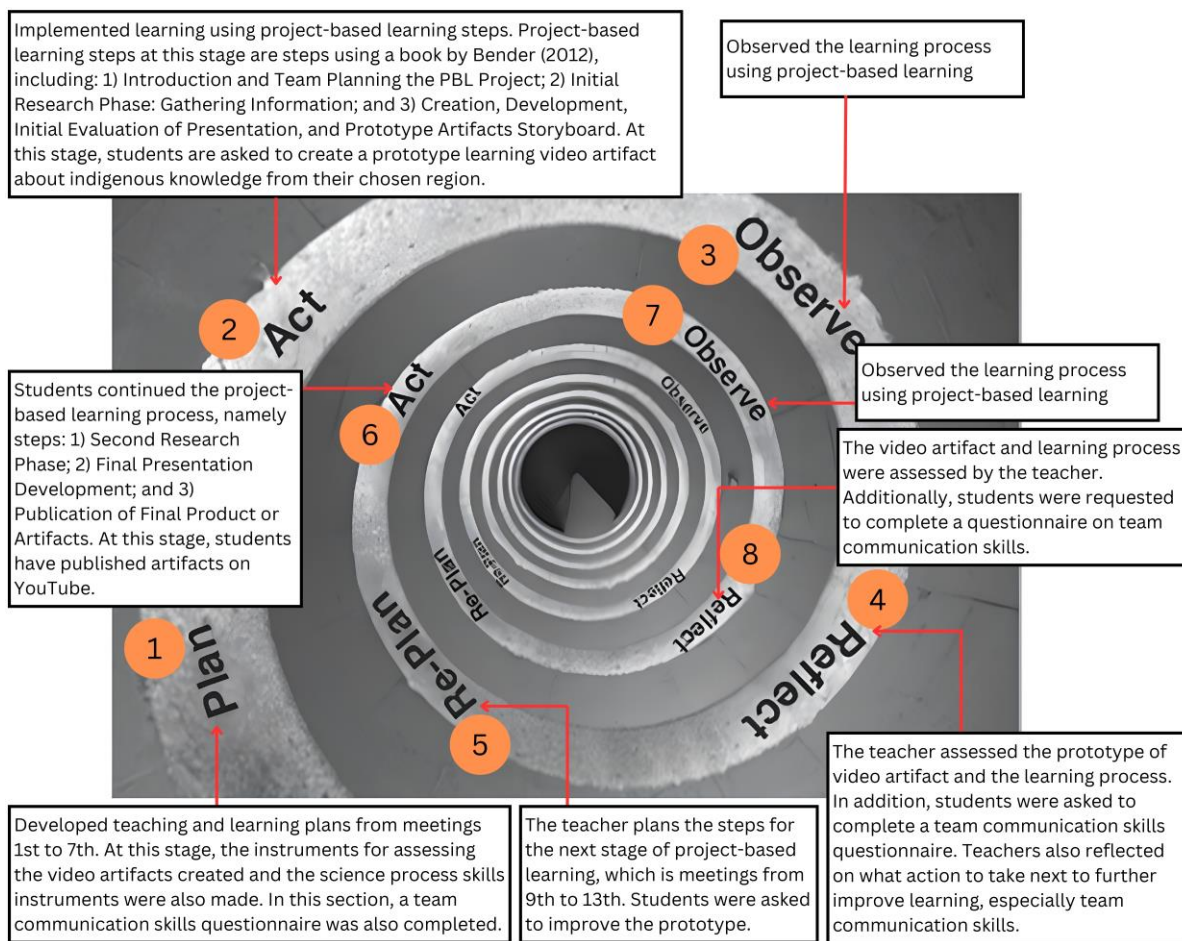


Figure 1. Classroom Action Research Procedure

Source. Author's document based on the steps of Kemmis et al. (2014)

PBL process performance observation technique using observation sheet was used to assess the performance of the PBL process. The instrument used to observe PBL performance was modified from Hamidah et al. (2020) with 4 aspect questions including planning, data collection, data analysis, and presentation. The survey TCS used a TCS questionnaire modified from Nelson (2018) with 28 questions covering dimensions or aspects of closed-loop communication, information exchange, and listening processes.

Data were analyzed using descriptive statistics. These descriptive statistics describe and present data, for example, in the form of frequency summaries and no attempt is made to infer or predict population parameters, and they are only concerned with enumeration and organization (Cohen et al., 2018). The target for the TCS score was 75% of students in the high category. For the assessment of video artifacts and PBL performance, the scores of students who were in the excellent and above average categories were above 65%. The summed data for each aspect was then used as a

percentage and categorized according to Briggs et al. (2023), including high for the excellent category (90%–100%) and above average (80%–89%); sufficient for the average category (70%–79%); and low for the below average category (60%–69%) and failure (0%–59%).

RESULTS AND DISCUSSION

This research shows how to implement IKIBL with PBL, which is expected to TCS to address socio-scientific issues, namely biodiversity and the environment. This study uses classroom action research because it starts from problems in the classroom related to TCS. The results of the study are presented as follows.

Characteristics of Respondents

Student respondents in this study totaled 19 biology education teacher candidate students. The students came from diverse tribes. The data showed that the students came from ethnic groups, including Batak (31.58%), Mentawai (31.58%), Nias (10.53%), Dayak (10.53%), Java (5.26%), Sunda (5.26%), and Sabu (5.26%). Research by Bengtsson et al. (2017) stated that team members who communicate with each other by emphasizing different ethnic identities have the potential to have increased interference, which in turn can produce more misunderstandings. The ethnic diversity in the class can be a threat and a potential. It becomes a threat if we cannot direct students

to communicate well. It becomes potential because each region has potential indigenous knowledge that can be explored so that it can support learning. Therefore, it is necessary to try to communicate effectively with people from various cultures (Mardhiyyah et al., 2022).

The age range of students is between 20 and 25, with details of ages 20–21 (84.21%), ages 22–23 (10.53%), and ages >23 (5.26%). This range means that they are in the youth or young people category. The UN Secretariat uses the terms youth and young people interchangeably to mean ages 15–24 (UNDESA, 2014). Emerging adulthood is proposed as a new conception of development for the period from late adolescence to the twenties, with a focus on 18–25-year-olds (Arnett, 2000). Emerging adulthood is a time of high instability, as young people experience a series of love relationships and often change jobs before making lasting decisions (Arnett et al., 2014). Therefore, it is important to teach TCS using IKIBL with PBL so that they are accustomed to communicating and collaborating to answer socio-scientific issues.

Implementation of Classroom Action Research

The implementation of this classroom action research consists of two cycles, namely cycle I and cycle II. Cycle I was carried out until midterm, while cycle II was

carried out from midterm to the final semester exam. The implementation of the meeting consisted of 16 meetings. The two cycles are described as follows.

Cycle I

Plan

Planning was used to organize the teaching and learning steps in the first cycle. Teaching and learning used PBL by Bender (2012). The first cycle was more directed towards designing the research and collecting data. The teaching and learning plan are described in **Table 2**.

Table 2. Cycle I teaching and learning plan

Meeting to	Learning objectives	Methods	Students Activity	Estimated Time
1 st	Students are able to understand the outline of the teacher, the teacher contract, and the understanding of learning biology based on indigenous knowledge.	Stage 1 PBL: Introduction and Team Planning the PBL.	Students get into groups and discuss the concept of local wisdom or indigenous knowledge.	2x50'
2 nd -3 rd	Students are able to understand research methods that are suitable for indigenous knowledge research.	Stage 1 PBL: Introduction and Team Planning the PBL.	Students get into groups and carry out activities, namely reviewing and creating a fundamental question, brainstorming for a research question, defining team tasks, defining goals and timelines, dividing work, and defining tools and materials.	2x50'
4 th -6 th	Students are able to collect indigenous knowledge data related to biological topics.	Stage 2 PBL: Initial Research Phase: Gathering Information.	Students are in groups and carry out activities, namely searching for information sources from the internet, interviewing informants or sources, reviewing or identifying other sources, conducting short lessons on certain topics, and evaluating information sources.	2x50'
7 th	Students are able to create prototypes of indigenous knowledge video artifacts associated with biology learning.	Stage 3 PBL: Creation, Development, Initial Evaluation of Presentation, and Prototype Artifacts Storyboard.	Students get into groups and do the activities of developing a storyline, starting to download or search for photos and videos, and developing initial artifacts.	2x50'
8 th				Midterm Examination

Act

At this stage, students carried out activities as planned at the plan stage. Students were randomly drawn to be divided into 6 groups, each consisting of 3 to 4 students. This group division is very important because students come from various ethnic groups so as to practice communication skills in teams with different cultures. Students discussed the project-based learning sheet guide and worked accordingly.

In Stage 1 of the PBL, students worked in groups to review and create a fundamental question. Students looked for problems related to indigenous knowledge and biology learning. After that, students brainstormed for research questions. This is used to find problem-solving solutions. Next, students determined team tasks, set goals and timelines, and divided the work. The last step in stage 1 is to determine the tools and materials. Proof of discussion can be seen in **Figures 2.a** and **2.b**.

In stage 2 of the PBL, students in groups search for information sources on the internet and interview informants or sources. Students review or identify other sources, conduct short lessons on specific topics, and evaluate sources of information. Proof of discussion can be seen in **Figures 2.c**.

In Stage 3 of the PBL, students are in groups and carry out activities, namely developing a storyline. Students start downloading or searching for photos and videos and developing initial artifacts. Proof of discussion can be seen in **Figures 2.d**

Panel a: Syllabus and Learning Plan

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PROGRAM STUDI PENDIDIKAN BIOLOGI

RENCANA PEMBELAJARAN SEMESTER					
MATA KULIAH	KODE	Rumpun (MK)	BOBOT (BB)	SEMESTER	Tgl Penyusunan
Pembelajaran Biologi Berbasis Kearifan Lokal	151241039	Pendidikan Biologi	2	IV/Genap	12 Februari 2022
Penyusunan PBL		Peninggi		14 Februari 2022	

Nama Kelompok:

- Dewi Nurhasanah 2115150005
- Windy Setiawan Halawa 2115150011
- Joice Elma Miranda Gulo 2115150015
- Tri Permata Nita 2115150001

PANDUAN PROJECT-BASED LEARNING: PEMBUATAN VIDEO PEMBELAJARAN

Langkah Project-based learning (PBL) Project 1 ini menggunakan buku kerangka Bender (2012) yang disajikan sebagai berikut:

Tahap 1: Introduction and Team Planning the PBL Project
(Pengertian dan Perencanaan Tim Proyek PBL)
Isi: Berkelompok sesuai dengan kelompok tim

Lakukan kegiatan ini dan tuliskan hasilnya pada Jurnal Harian Biologi!

- Review sumber awal reflection on specific questions
 - Kearifan lokal atau indigenous knowledge merupakan pengetahuan asli atau adat yang sudah ada sebelum pengetahuan hasil dari modern.
 - Kearifan lokal bisa diadopsi dengan pengetahuan biologi, seperti topik biodiversitas.
- Classwide brainstorming on specific research questions
 - Diskusikan bersama kelompok tentang topik masalah dengan panduan pertanyaan berikut dengan memulainya pada Tabel 1.
 - Kearifan lokal apa yang telah diterapkan dalam pembelajaran Biologi?
 - Mengapa kearifan lokal itu belum diterapkan? Apa kendalanya?
 - Bagaimana menjelaskan kearifan lokal tersebut dalam pembelajaran Biologi? (bagaimana bisa juga diadopsi dengan pembelajaran biologi, seperti apa saja sesuai)

Tabel 1 Masalah dan Solusi/Alternatif Pemecahan Masalah

No	Masalah	Solusi/Alternatif Pemecahan Masalah
1	Tradisi Manafa Nias	Sebagai elemen manafa Nias
2	Murungnya pembelajaran biologi, melalui mahasiswa asal daerah	Sebagai elemen Manafa Nias

Panel b: Problem Solving Process

No	Masalah	Solusi/Alternatif Pemecahan Masalah
1	Manafa Nias, dalam pembelajaran Biologi, hindarada pada mahasiswa Biologi	Nas juga masyarakat sekitar yang berada di wilayah jemberdewa
3	Pada bahan Manafa Nias yang terdiri atas lima bahan dasar di	Bahan manafa Nias terdiri dari lima, yaitu sirih yang merupakan bahan dasar, kemudian semolina, buah pinang, daun pinang, dan kapur yang merupakan keanekaragaman hayati tumbuhan. Sehingga kami menggunakan tradisi manafa Nias menggunakan kearifan lokal pembelajaran Biologi.

Panel c: Research Phase Gathering Information

Tahap 2: Initial Research Phase: Gathering Information (Tahap Penelitian Awal: Mengumpulkan Informasi)
Gawes berkelompok sesuai dengan kelompok tim dan mengumpulkan informasi dengan melakukan aktivitas ini:

- Interview completed forms
- Interview with locals
- Research/identify other sources (e.g., YouTube, newspapers, books, media center, etc.)
- Interviews on specific topics might be offered
- Evaluation of information from the internet

Tabel 5 Evaluasi sumber dari internet dan media sosial

No	Pertanyaan	Jawaban
1	Apakah ada nama penulis/ditor dalam web tersebut?	Ya, ada
2	Apakah ada foto atau data pada sumber web yang kalian cari?	Ya, ada
3	Apakah web yang kalian cari memuat informasi yang akurat, dan antara golongan?	Ya, benar
4	Apakah web yang kalian cari mendukung keyakinan/gosip atau beresil menyebarkan berita bohong, dan tidak benar?	Tidak
5	Apakah informasi yang kalian cari dapat dipercaya atau kredibel?	Ya, ada
6	Apakah ada nama penulis/ditor dalam web tersebut?	Ya, ada
7	Apakah ada foto atau data pada sumber web yang kalian cari?	Ya, ada
8	Apakah web yang kalian cari memuat informasi yang akurat, dan antara golongan?	Ya, benar
9	Apakah web yang kalian cari mendukung keyakinan/gosip atau beresil menyebarkan berita bohong, dan tidak benar?	Tidak
10	Apakah informasi yang kalian cari dapat dipercaya atau kredibel?	Ya, ada

Panel d: Storyboard and Artifact Development

Tabel 6 Perencanaan storyboard (alur cerita)

No	Alur Video	Mentri ke	Urutan	Perbaikan
1	Pembuatan Video Opening	01:00 - 01:11	Penyempurnaan dari Asal Perguruan, maka kalian yang menjadi fokus project dan Dosen pengampu mata kuliah	
2	Proses pembuatan Manafa	04:00 - 06:53	Proses pembuatan Manafa	Video diperpanjang agar dapat dibarengi bagaimana proses pembuatan Manafa
3	Kemampuan membaca Manafa	07:00 - 07:26	Kemampuan yang diberikan untuk membaca Manafa	Pada bagian ini diperbaiki audio dan gambar pembuatan Manafa
4	Penerangan Sph	08:50	Bagian penerangan Manafa (akhir)	Pada bagian ini video diperbaiki

Tabel 7 Perencanaan proyek

No	Alat dan Bahan	Kegiatan
6	Alat Tulis	Fasilitas lapangan
7	Kamera	Kemampuan video dokumentasi
8	Jurnal/Data	Sebagai data pendukung
9	Hp	Sebagai alat bantu kamera
10	Laptop	Membuat laporan dan hasil hasil data

Tahap 3: Creation, Development, Initial Evaluation of Presentation, and Prototype Artifacts (Pencapaian, Pengembangan, Evaluasi Awal Presentasi, dan Artefak Prototipe)

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Storyboard development: Tim berkolaborasi melakukan penyesuaian penertarikan dari tahap sebelumnya dengan bantuan Tabel 6.

Figure 2. Performance evidence of Stage 1 to 3 PBL discussions Source. Author's Document

Observe

At this stage, the teacher observes the learning process, including the students' TCS. The teacher is involved in discussions with students, especially when students conduct the PBL process. In this observation stage, the teacher is also assisted with observation sheets for performance assessment of the project-based learning process, including planning, data collection, data analysis, and presentation. The data is used to assess students' PBL processes.

Reflect

The reflection stage is based on the evaluation of learning outcomes. In order to assess the students' performance in the PBL project, the teacher observed them in the planning and data collection stages. Furthermore, the students completed the TCS questionnaire at the conclusion of Cycle I. The subsequent section will delineate the TCS condition of the students. However, it is evident that some team members have not yet achieved cohesion, as they have not yet fully internalized their assigned responsibilities. The teacher provided feedback through direct discussion with the team when inquiring about the project's progress.

Cycle II

Plan

Planning was used to develop the teaching and learning steps in cycle 2. Teaching and learning still continued the

PBL stage by Bender (2012). Stage 3 of the PBL is still ongoing, which is about group evaluation and formative evaluation of artifacts. Furthermore, students entered stages 4 (second research phase), 5 (final presentation development), and 6 (artifact publication). The teaching and learning plan are described in **Table 3**.

Act

At this stage, students carried out activities as planned at the plan stage. Students continued stage 3 of the PBL, which was interrupted by the midterm exam schedule. Each group provided input to improve the prototype artifact. The group that was given input responded and recorded it on the PBL sheet. In addition, each group also conducted formative evaluations so that the video artifacts were suitable for viewing and the messages conveyed could be clearly received. Proof of the discussion can be seen in **Figures 3.a** and **3.b**.

In stage 4, students will look for the information they need to fill in the gaps in the overall presentation after conducting the formative evaluation. Students can also receive lessons or feedback from the teacher. Furthermore, the story board is revised at the end. In stage 5, the final presentation is developed. Students begin to improve the video artifact by adding text or editing the video. Proof of the discussion can be seen in **Figure 3.c**.

Table 3. Cycle II teaching and learning plan

Meeting to	Learning objectives	Methods	Students Activity	Estimated Time
9 th	Students are able to evaluate the prototype of local wisdom video artifacts associated with biology learning.	Stage 3 PBL: Creation, Development, Initial Evaluation of Presentation, and Prototype Artifacts Storyboard.	Students evaluate the artifact prototype by presenting it to other groups. In addition to getting feedback from other groups, students conduct a formative evaluation of the artifact prototype.	2x50'
10 th -13 th	Students are able to make local wisdom video artifacts that are associated with biology learning.	Stage 4 PBL: Second Research Phase Seek Tahap 5 PBL: Final Presentation Development	Students seek additional information to develop prototypes more fully, do minilessons on specific topics that might be offered, and make revisions to prototypes and storyboards with new information. After that, students make storyboard revisions and additions	2x50'
14 th	Students are able to publish indigenous knowledge video artifacts through YouTube.	Stage 6 PBL: Publication of Product or Artifacts	Students do the final classwide evaluation (perhaps peer evaluation) and publication of projects or artifacts.	2x50'
15 th 16 th			Reflection End of Semester Examination	

4. Group evaluation of the prototypes. Setiap kelompok memberikan masukan untuk perbaikan prototype artefak dengan panduan Tabel 8. Tabel 8 Evaluasi Grup terhadap Prototype

No	Kelompok	Uraian Masukan
1	Kelompok 1	Durasi video yang singkat sehingga video yang dimasukan cenderung di ulang-ulang
2	Kelompok 2	Penggunaan musik opening dengan volume seperti yang terdapat dalam video cukup nyaring sehingga bisa diperhatikan lagi dengan memperkecil volume dari pengambilan video yang kurang baik sehingga membuat penonton pusing saat melihat video
3	Kelompok 3	Mohon diberikan tambahan subtitle dan memperhatikan audio background dan menyesuaikan volume voice serta penambahan sumber pengambilan video (jika ada)
4	Kelompok 5	Mohon diperhatikan cara pengambilan video dan audio yang kurang jelas (bisling)

5. Formative evaluation of prototype artifacts. Evaluasi formatif dilakukan dilakukan agar artefak video layak untuk dilihat dan pesan yang disampaikan dapat diterima secara jelas. Evaluasi formatif dapat menggunakan penilaian seperti pada Tabel 9. Evaluasi formatif dilakukan untuk melihat sejauh mana kualitas artefak video yang dibuat.

Tahap 5. Final Presentation Development (Pengembangan Presentasi Akhir)

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- Storyboard revision/additions.** Tim menuliskan perbaikan alur cerita video pada Tabel 10. Namun, jika pada bagian tertentu tidak ada perbaikan, maka tidak perlu dilakukan.
- Some write, some speak, some videotape, some edit, some do art, etc.** Pada tahap ini juga perlu perbaikan tulisan, suara, dan sebagainya untuk perbaikan video.

No	Alur Video	Perbaikan
1	Pembukaan video	Pada pembuatan video awal sebelum direvisi belum ditambahkan keterangan mengenai asal universitas dan dosen mata kuliah beserta mata kuliah yang menjadi tugas video
2	Audio video	Penyesuaian volume video

Tahap 6. Publication of Product or Artifacts (Publikasi Produk atau Artefak)

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- Final classwide evaluation (perhaps peer evaluation).** Pada tahap ini dilakukan evaluasi oleh antar kelompok atau oleh Dosen untuk artefak akhir yang dihasilkan pada dan proses Project-based learning. Pada modul ini ditambahkan juga penilaian diri dan penilaian antar teman selama proses pembuatan produk artefak yang akan diisi di akhir pembelajaran.
- Publication of project or artifacts.** Publikasi artefak dilakukan melalui media sosial seperti instagram dan youtube sehingga kegiatan mempromosikan kearifan lokal yang berkaitan dengan biodiversitas bisa terwujud. Selain itu, sebagai wujud nyata komitmen untuk SDGS target 15 tentang biodiversitas.

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Tabel 9 Penilaian artefak video*

No	Aspek yang Dievaluasi	Kriteria	Keteradaan	Ya	Tidak
1	Content and messages.	Video menawarkan ringkasan singkat dari temuan dan menyoroti poin-poin penting dari topik. Tujuan yang diangkat jelas dan metode dijelaskan secara memadai. Kesimpulan didukung oleh bukti yang kuat (berdasarkan data).	Ya		
2	Relevance.	Video tersebut menunjukkan hubungan topik untuk khalayak luas.	Ya		
3	Educational Value.	Video tersebut mempunyai nilai pendidikan bagi tim dan khalayak umum yang lebih luas.	Ya		
4	Organization.	Video mempunyai awal, tengah, dan akhir yang jelas yang menampilkan pengantar, metode, hasil, dan kesimpulan serta mudah diikuti. Temuan utama dan hubungannya mampu diungkapkan dengan baik.	Ya		
5	Grammar and Vocabulary.	Bahasa mudah dipahami. Istilah atau akronim ilmiah didefinisikan dengan jelas atau diganti dengan istilah yang lebih akrab.	Ya		
6	Delivery and Narration.	Narasinya jelas, santai, dapat dipahami, mempunyai keceptaan yang mampu dan gaya yang konsisten. Suara penjelasan ekspresif dan menawarkan irama yang mendorong untuk mendengarkan.	Ya		
7	Technical Production and Editing.	Alur cerita dikisahkan secara efektif melalui rekaman video, suara, dan efek khusus dan secara keseluruhan menarik.	Ya		
8	Audio and Sound.	Adegan mengalir lancar dari satu ke yang lain tanpa ruang kosong. Cuplikan dan efek video memiliki suara dan audio berkualitas tinggi secara konsisten, dan bersama-sama melengkapi alur cerita.	Ya		
9	Visuals and Graphics.	Graph, animasi, dan visual lainnya secara efektif digunakan untuk mengungkapkan tujuan dan temuan penelitian dan melengkapi audio.	Ya		
10	Video Quality and Camera Techniques.	Kualitas dan resolusi Video secara konsisten tinggi. Gambar dan rekaman Video terfokus dan disusun secara efektif.	Ya		
11	Creativity.	Penggerakan kamera mulus. Konten visual dan audio dari Video digunakan secara kreatif untuk mengungkapkan tujuan, temuan, dan kesimpulan secara efektif.	Ya		Tidak

*dimodifikasi dari SMM Conference (2021)

Tahap 4. Second Research Phase (Fase Penelitian Kedua)

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Figure 3. Performance evidence of advanced discussion of Stage 3 to 6 of PBL Source. Author's Document



In the last stage, namely stage 6, students publish video artifacts through YouTube. YouTube was chosen because it can be seen by many people, so the promotion of biodiversity from an indigenous knowledge perspective can be realized. In addition, YouTube is also effective as a learning medium to teach knowledge about biodiversity (Adinugraha, 2022b). To keep monitoring the progress of the project, students in their groups are required to make a log book. This log book contains activities that have been carried out, including the time and targets set. This logbook is useful for completing the video artifact within the set time. The logbook is utilized by the teacher to identify and address issues that arise within the group,





facilitating a collaborative approach to problem-solving.

Observe

At this stage, the teacher observes the learning process, including the students' TCS. The teacher is involved in discussions with students, and when students do project-based learning, the observation yields the following results: Students have begun to communicate with one another in a more natural manner. However, some students still exhibit reticence when expressing their opinions. In this observation stage, the teacher assessed the learning process using project-based learning and an observation sheet. Observation in Cycle II is also to assess the results of video artifacts that have been made by students.

Table 4. Results of student-made video artifacts

Group	Figure of Video	Brief explanation
1	 <p>Kelompok 1 Ikan Arsik sebagai Sumber Belajar Biodiversitas</p>	<p>Title: Arsik Fish as a Biodiversity Learning Resource (<i>Ikan Arsik sebagai Sumber Belajar Biodiversitas</i>) Video Link: https://youtu.be/Mt3ny6CoFtI Video duration: 5 minutes 53 seconds Arsik food comes from the Batak tribe made from various spices with carp as the main ingredient.</p>
2	 <p>Kelompok 2 Bubur Pedas sebagai Pembelajaran Biodiversitas</p>	<p>Title: Spicy Porridge as Biodiversity Learning (<i>Bubur Pedas sebagai Pembelajaran Biodiversitas</i>) Video Link: https://youtu.be/BAmjQCwOOU Video duration: 7 minutes 47 seconds Spicy porridge is a traditional food in West Kalimantan made from rice and grated coconut that has been roasted with various vegetables.</p>

Group	Figure of Video	Brief explanation
3	 <p data-bbox="371 517 762 533">Kelompok 3 Batik Kawung sebagai Pembelajaran Topik Biodiversitas</p>	<p data-bbox="823 230 1406 315">Title: Kawung Batik as Biodiversity Topic Learning (Batik Kawung sebagai Pembelajaran Topik Biodiversitas)</p> <p data-bbox="823 320 1302 349">Video Link: https://youtu.be/ZuRopzCJW0c</p> <p data-bbox="823 353 1230 383">Video duration: 9 minutes 56 seconds</p> <p data-bbox="823 387 1406 439">Kawung batik as a traditional motif that uses plants in the motif and natural dyes.</p>
4	 <p data-bbox="371 826 762 842">Kelompok 4 Tradisi Manafa Nias sebagai Pembelajaran Topik Biodiversitas</p>	<p data-bbox="823 539 1406 624">Title: Nias Manafa Tradition as Biodiversity Topic Learning (<i>Tradisi Manafa Nias sebagai Pembelajaran Topik Biodiversitas</i>)</p> <p data-bbox="823 629 1286 658">Video Link: https://youtu.be/jyqUbjH5IZk</p> <p data-bbox="823 663 1243 692">Video duration: 13 minutes 41 seconds</p> <p data-bbox="823 696 1406 869">This tradition is a form of respect for guests who arrive at the house. The tradition is referred to as "manafa" because of the five ingredients used; betel leaves (<i>tawuo</i>), lime (<i>betua</i>), gambier (<i>gambe</i>), tobacco (<i>bago</i>) and areca nut (<i>fino</i>). The concoction of these five ingredients is called "Afo".</p>
5	 <p data-bbox="371 1162 762 1178">Kelompok 5 Makanan Subet Mentawai dan Kaitannya dengan Pembelajaran Topik Biodiversitas</p>	<p data-bbox="823 875 1406 992">Title: Mentawai Subsistence Food and its Link to Biodiversity Topic Learning (<i>Makanan Subet Mentawai dan Kaitannya dengan Pembelajaran Topik Biodiversitas</i>)</p> <p data-bbox="823 996 1307 1025">Video Link: https://youtu.be/x9ZmyYN_ha0</p> <p data-bbox="823 1030 1163 1059">Duration: 7 minutes 33 seconds</p> <p data-bbox="823 1064 1406 1144"><i>Subet</i> is a traditional Mentawai food made from a mixture of taro and boiled banana sprinkled with grated coconut.</p>
6	 <p data-bbox="371 1485 762 1500">Kelompok 6 Dekke Na Niarsik sebagai Pembelajaran Topik Biodiversitas</p>	<p data-bbox="823 1198 1406 1283">Title: <i>Dekke Na Niarsik</i> as Biodiversity Topic Learning (<i>Dekke Na Niarsik sebagai Pembelajaran Topik Biodiversitas</i>)</p> <p data-bbox="823 1288 1291 1317">Video Link: https://youtu.be/n532_N3vdk</p> <p data-bbox="823 1321 1243 1350">Video duration: 11 minutes 19 seconds</p> <p data-bbox="823 1355 1406 1494"><i>Dekke Na Niarsik</i> is often used for traditional Batak wedding ceremonies, thanksgiving, family gatherings and death ceremonies. In making <i>Dekke Na Niarsik</i> using Goldfish often found in Lake Toba, Sumatra Island.</p>

Reflect

The reflection stage is based on the evaluation of learning, including video artifact assessment, PBL performance, and measurement of students' TCS. The feedback indicated that, upon completion of the draft video, the team presented it to the class. The teacher and other group members provided feedback to the presenting group.

There were six video artifacts made by six groups. The results of video artifacts made by students are presented in **Table 4**.

The IKIBL has the potential to be used in learning. Currently, not many have combined indigenous knowledge or local wisdom with western science. Some indigenous knowledge that has the potential to be used to study biodiversity and the

environment includes traditional rituals such as *eresik sumur pitu* (Adinugraha, 2020), dances such as *Dolalak* dance (Adinugraha, 2018), and food such as *Betawi* food culture (Adinugraha et al., 2020). This indigenous knowledge needs to be studied first before being integrated into the curriculum. Indigenous knowledge can be studied using ethnobiology. The indigenous knowledge and culture approach can be an approach to learning biodiversity (Adinugraha, 2022a; Adinugraha et al., 2021).

Assessment of video artifacts and PBL performance

Video artifact assessment is conducted after the video is published on YouTube and conducted by teacher. The evaluation of the video artifact and PBL process was employed to ascertain the factors that influence students' TCS. PBL performance assessment is carried out during the learning process, starting with planning, data

collection, data analysis, and presentation. Data on video artifact assessment and PBL performance are presented in **Figure 4**.

In **Figure 4**, it shows that individual scores on video artifacts are mostly (52.63%) in the high category, 31.56% in the moderate category, and 26.32% in the low category. Students have the maximum score, which is an average of 3 on the indicators of message content and educational value. This means that the video presented has been able to provide information on the topic of biodiversity to viewers. The average scores of the indicators on the video artifact assessment are as follows: relevance (2.84), creativity (2.84), grammar (2.68), organization (2.37), messaging and narration (2.37), video quality and camera techniques (2.37), audio and sound (2.32), production and editing techniques (2.21), and visuals and graphics (2.05).

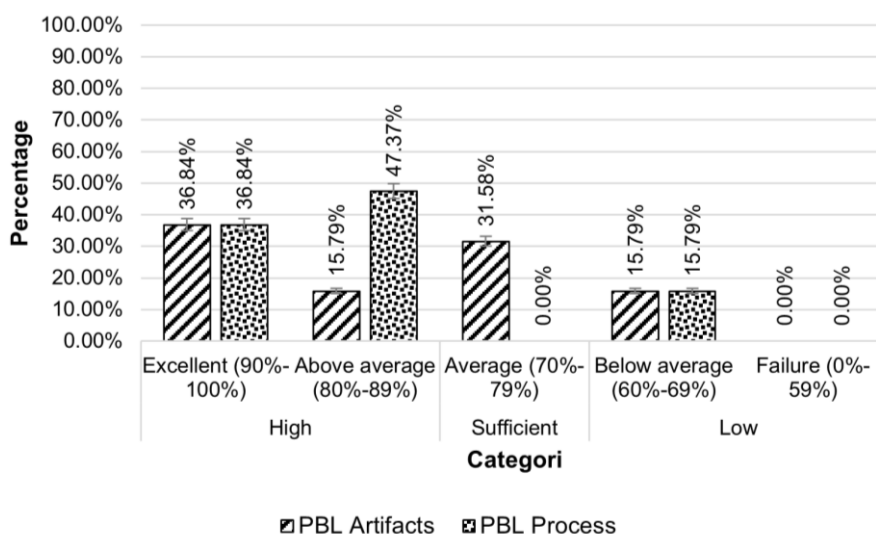


Figure 4. Assessment of video artifacts and PBL process performance
Source. Author's Document

Figure 4 also shows that most, or 84.21%, of the PBL process individual performance scores are in the high category and 15.79% are in the low category. Successively, the average indicator scores on the PBL process performance are as follows: planning (3.84), data collection (3.68), presentation (3.53), and data analysis (3.21). The percentage of categories between the PBL artifact score and the PBL process is nearly identical. However, there is a notable discrepancy in the percentage within the sufficient category. It is plausible that students lack proficiency in communicating with one another. Based on the interview results, several students failed to fulfill their task obligations, necessitating assistance from their peers to complete the artifacts.

For the assessment of PBL performance in this research, the scores of students who were in the excellent and above average categories were above 65%. In PBL performance, the target can be

exceeded and even exceeded. However, the results of the video artifact assessment are still below 65%. The low value of video artifact results is an evaluation for the future. Before doing a project in the form of a video artifact, students must be given sufficient provision to edit and use video applications properly. This is because not all groups have video editing skills. The division of groups was done by a lottery system, so the teacher did not see the expertise of each group. Other times, teacher need to pay attention to heterogeneity, not only in terms of ethnicity but also expertise. This research focuses on ethnic heterogeneity to teach TCS.

Team communication skill (TCS)

Team communication skills (TCS) are the main focus of classroom action research. The focus of this research is on ethnic diversity, so the division of groups is done randomly so that cooperation between students of different ethnicities occurs. The results of the TCS category are presented in **Figure 5**.

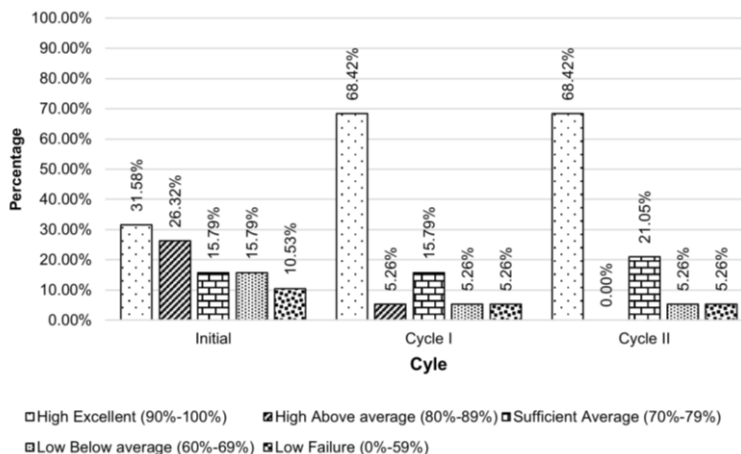


Figure 5. TCS score for each cycle
Source. Author's Document

Figure 5 shows that there was an increase in the group of students who had high TCS category. At the beginning, before the implementation of cycle I, 57.90% of students were in the high category. Furthermore, the group of students who had a high TCS category in cycle I reached 73.68%. In cycle II, there was a decrease in the group of students who had a high TCS category, which was 68.42%. The loss of 5.26% was in the moderate category, which increased to 21.05% from 15.79%. Although there was a decrease in the number of student groups who had high TCS, it was still in the sufficient category.

The reduction in high TCS levels in Cycle II and the distribution of TCS levels within a sufficient range are feasible outcomes because students engage in PBL activities at the artifact completion stage. This may result in a lack of opportunity for TCS to be utilized, as students tend to prioritize their individual work tasks. In contrast to the approach taken in Cycle I, which prioritizes planning and data

collection. Furthermore, the value of data analysis is also reflected in the comparatively low performance score for PBL in comparison to the scores for planning and data collection. Notwithstanding, the objective score for TCS has been attained, with 75% of students falling within the high category, which is excellent and above average.

Team communication skills (TCS), according to Nelson (2018), include dimensions and aspects of closed-loop communication, information exchange, and the listening process. When viewed per aspect, closed-loop communication gets the highest score compared to other aspects. Closed-loop communication skills have increased with each cycle. The lowest average improvement was listening ability. Listening ability became the lowest aspect after information change, even though it was higher than information change at the beginning before the implementation of cycles I and II. Data per aspect is presented in **Figure 6**.

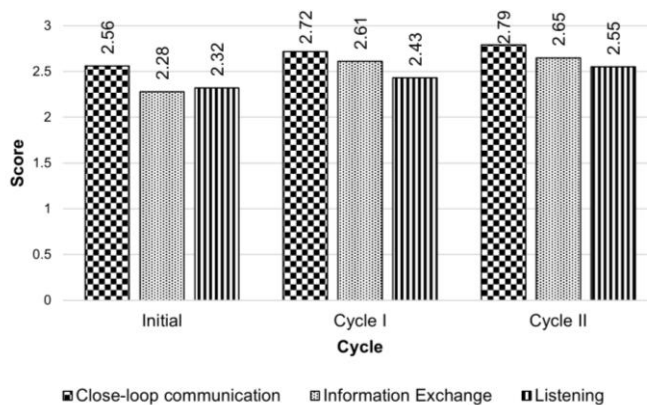


Figure 6. Team communication skills (TCS) per aspect
Source. Author's Document

The three aspects of communication skills must be balanced. Sometimes we find it easier to give our opinions than to listen to arguments or suggestions from group members. This results in incompatibilities in collaboration because we want to win on our own. Therefore, the group leader plays a very important role in project-based learning. The leader must be able to make decisions when there is a conflict of opinion among members. Maintaining team cohesiveness can be realized if the three aspects of communication can be balanced. Effective communication should be within the framework of understanding, listening, and respecting each other (Yildiz & Tutkun, 2021).

A limitation of this study is the relatively small number of students included in the analysis. Prior to being assigned a task related to the creation of educational videos, it is essential that students receive instruction on the process of producing such videos. Furthermore, PBL habituation should be conducted on an ongoing basis to ensure that students maintain proficiency in TCS. Future research should investigate the factors that impede the development of TCS in the context of PBL. The duration of 16 meetings allotted by the instructor is sufficient, yet some students still exhibit deficiencies in TCS. This phenomenon

warrants psychological examination in relation to students' learning styles.

CONCLUSION

The IKIBL with PBL comprises a series of activities aligned with the PBL methodology. The subject matter encompasses theoretical frameworks pertaining to indigenous knowledge, the theoretical underpinnings of research methods pertinent to indigenous knowledge, the practical aspects of field research, the creation of educational video artifacts, and the dissemination of educational video artifacts. There were six videos successfully made by student groups. The video artifact assessment score of about 52.63% of students was in the high category, while the PBL performance assessment of about 84.21% was in the high category. There was an increase in students who had high TCS category before implementation. At the beginning, before the implementation of cycle I, the group of students who were in the high category was 57.90%. Furthermore, the group of students who had a TCS category in cycle I was 73.68%. In cycle II, there was a decrease in the group of students who had a TCS category, which was 68.42%. This loss of 5.26% was in the sufficient category, which increased to 21.05% from 15.79%. The most prominent aspect is closed-loop communication,

followed by information exchange, and finally listening. TCS need to be continuously trained so that they get used to working collaboratively.

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