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Study of 21st-Century Skill Improvement for Prospective Biology Teacher Students Through the Lesson Study (LS) Model

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ABSTRACT

Education in Indonesia faces the problem of preparing human resources to face the world of work in the 21st Century Era. This study aims to describe the results of a Lesson Study on Improving 21st Century Skills for Biology Education Teacher Candidates at FKIP UMSurabaya. This research is a case study with a descriptive method. The research was conducted on the Department of Biology Education students for the 2019 Academic Year at FKIP UMSurabaya. Data were collected by documentation, test, and observation methods from 2 Lesson study cycles. Data were analyzed descriptively by calculating the percentage of students with HOTS, communication, and collaboration skill levels expressed in four categories. The results of the study showed: 1) the level of HOTS in the Very High Category in Cycles I and II was the same, namely 50% of students; 2) the level of Communication skills in the Very Competent Category in Cycle I was 26% of students and Cycle II was 36% of students; 3) the level of collaborative skills with the Very Competent Category in Cycle I was 25% of students, and Cycle II was 37% of students. The conclusion of this study shows that during Lesson Study, as many as two cycles of Biology Education Teacher Candidates at FKIP UMSurabaya have not shown an increase in HOTS. Meanwhile, his communication and collaboration skills have improved. The sustainability of the Lesson Study needs to be continued by building a learning community between lecturers of other subjects and partner teachers in schools.

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INTRODUCTION

The quality of learning in schools is primarily determined by the professional competence of teachers (Jafaruddin, 2019). According to UUGD Article 10, teacher professional competence includes pedagogic, personal, social, and professional competence obtained through professional education. Meanwhile, the professional competence of teachers based on the results of the national competency test is still below the minimum competency standards (SKM), especially the results of the Teacher Competency Test (UKG)

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on the pedagogic aspect with an average score of 51.16 (PASK, 2019; Muslimin, 2020).

On the other hand, today's teachers are also required to have many 21st-century skills and, at the same time, must be trained for students (Fadhilla, 2022; Farid Anfasa Moeloek et al., 2010; Setianingsih, 2018). Meanwhile, many educational programs for prospective teachers at the Institute of Teachers' Education (LPTK) still have not prepared prospective teachers with 21st-century competencies. Most of the LPTK curricula are content-based with scientific-based courses. Meanwhile, the learning process is still mainly done through face-to-face or pulpit lectures. As for the practice of field experience (PPL) that students carry out at school, they only do school administration and practice in class armed with theory obtained from lecturers in class. PPL is a formality as a graduation requirement (Azhar, 2009; Fauzi, 2016). Furthermore, Fauzi (2016) argues that the educational process at LPTKs should be carried out proportionally in theory, practice, and field/apprenticeship.

In addition, education results must produce human resources who can adapt to work challenges in the Industrial Revolution 4.0 Era (Sonia, 2019). Many old jobs are replaced with new ones based on information and communication technology (ICT). It is because the work done by humans is gradually being replaced by technology with digitalization programs (Wardhana, 2021). Has No exception work in education, especially the learning process. The learning process in class no longer relies on the teacher's presence (Roudlon, 2022). The learning process will use more ICT-based sources and media, such as internet-based learning resources (Weber) and social media-based videos (YouTube) (Nita, 2021). Therefore, teachers must have professional competencies that are continuously developed according to the challenges of the times (Pratidhina, 2020).

So far, the government has made various efforts to improve the professional competence of teachers, both formally and non-formally. Formally, increasing teacher professional competence is carried out with professional teacher education (PPG), both Pre-Service and In-Service (Arifa & Prayitno, 2019; Kemenristekdikti, 2018; Premono, 2005; Zulfitri et al., 2019) Meanwhile, non-formal improvement profession is carried out by organizing education and training, seminars and workshops, as well as working groups, such as PKG/KKG/MGMP (Nita, 2021). However, the results of all these efforts have not been very satisfactory. After completing competency improvement programs, teachers often stop and no longer continue the program independently at school.

In essence, the professional competence of teachers is reflected in the quality of the daily learning process in class. Indicators can be used to determine the quality of the learning process, including the process activities and the completeness of student or student learning outcomes (Memorata & Santoso, 2016; Sudjana, 2008). Written tests can easily measure the completeness of student/college student learning after completing the learning process. Written tests can be done, both formative and summative. Meanwhile, learning process activities can only be measured by observation while the learning process progresses (Sudjana, 2008). So far, observations of student learning process activities are rarely carried out by teachers because teachers have difficulty making their observations while carrying out the learning process (Zuhera et al., 2017). Therefore, observation of learning process activities requires collaboration with colleagues or colleagues.

The involvement of fellow teachers in schools needs a precise model, both in terms of

concepts and practical techniques, so that this collaboration can become a new culture in improving the quality of learning. The lesson study model is one model that can be used in collaboration among fellow teachers at school. Lesson study is a teacher professional development model that schools in Japan have long used (Baba, 2007; Hendayana & dkk., 2006; Saito et al., 2014; Sato, 2013; Sujana & Narasintawati, 2012; Susilo, 2013; Zubaidah, 2010). In Indonesia itself, many schools and universities have implemented Lesson Study (LS) to improve the quality of learning in each subject and subject with various problems (Slamet Hw et al., 2017; Suratno et al., 2010; Widiadi & Utami, 2016; Wikanta et al., 2014, 2017). This study aims to describe the results of the 21st Century Skills Improvement Lesson Study for Prospective Teachers in the FKIP UMSurabaya Biology Education Study Program with the Application of the Inquiry Learning Model.

METHOD

This research is a research lesson (Cerbin & Kopp, 2006) using a descriptive method (Widiadi & Utami, 2016). This research is a case study of applying the Inquiry Learning Model in the Animal Tissue and Body Structure Course, the Biology Education Study Program, FKIP UMSurabaya. The subjects of this research were the 2020 class students, which consisted of 18 students. The research data includes HOTS learning outcomes and 21st Century skills, especially collaboration and communication skills. Data were collected by documentation, testing, and observation methods from 2 cycles of Lesson Study, Plan-Do-See practice. Tests were conducted to measure HOTS cognitive abilities, while observations focused on student activities in the form of communication and collaboration skills during the learning process. The documentation technique in this study was used to review documents in the form of lesson plans which include: (1) Semester Learning Plan (RPS), (2) Lecture Program Unit (SAP), (3) Teaching Material, (4) Student Worksheet (LKM), (5) Assessment Instrument, and (6) Learning ressources and media. Documentation, test, and observation data were analyzed descriptively. Documentation analysis includes completeness, content, and relevance to the research problem. While the test results and observation data were analyzed by calculating the percentage of the number of students who showed cognitive levels and skills aspects. Cognitive levels are categorized into 4 groups, namely: Very Good (VG), Good (G), less Good (NG), and Not Good (VNG). The observed level of each skill aspect is grouped into 4 categories, namely: Very Competent (VC), Competent (C), Less Competent (LC), and Incompetent (I).

RESULT AND DISCUSION

Documentation Results

Documentation data collection was carried out in the early stages of the Lesson Study (LS) cycle, namely Plan (P). The documents reviewed (research lessons) for each cycle include RPS, SAP, Teaching Materials, LKM, Assessment Instruments, Learning Resources, and Media. Documentation results from data in 2 review cycles are presented in Table 1.

Tabel 1. Document Review in 2 Learning Cycles

No	Types of document	Study Results	
		cycles I	cycles II
1	RPS	• Course Learning Outcomes (CPMK) to be achieved: Able to analyze the linkages of animal body tissues and structures microscopically and macroscopically with	

No	Types of document	Study Results	
		cycles I	cycles II
		animal body functions and their problems, and utilize the results in the form of biology learning resources or media in schools, integrating religious attitudes (faith, noble character), science process skills (logical, systematic, critical, creative, innovative reasoning), and academic ethics (honest, thorough, responsible), and entrepreneurial spirit. • Competency: (1) Cognitive: analyze; (2) Psychomotor: Utilizing ICT, KPS; (3) Attitude: integrating religious, scientific, and social attitudes.	
2	SAP	• Sub-CPMK: Analyzing the relationship between animal basic tissue structure and problems faced by animals based on macroscopic and microscopic observations by integrating religious attitudes, science process skills, and academic ethics in group work. • Learning Model: Inquiry-Based Learning	
3	Teaching Materials	Epithelium and Connective Ground	Tissue Muscle and Nerve
4	LKM	• LKM with a case approach (Case Base Learning) • Problems: The bodies of vertebrate animals are arranged in stages from the simplest to the most complex. Improve the organization of the animal body, starting from cells, tissues, organs, organ systems, and organisms. The tissues that comprise the body of vertebrate animals include four essential tissues (essential tissue, primary tissue): epithelial tissue, connective tissue, muscle tissue, and nervous tissue. These four tissues build an organ with different functions. Network function has to do with the structure of each network. Meanwhile, there is no clear evidence regarding the structure of the network that supports the function of the animal body	• LKM with a case approach (Case Base Learning) • Problems: The bodies of vertebrate animals are arranged in stages from the simplest to the most complex. Improve the organization of the animal body, starting from cells, tissues, organs, organ systems, and organisms. The tissues that comprise the body of vertebrate animals include four essential tissues (fundamental tissue, primary tissue): epithelial tissue, connective tissue, muscle tissue, and nervous tissue. These four tissues build an organ with different functions. Network function has to do with the structure of each network. Meanwhile, no clear evidence exists regarding the network structure that supports the animal body's function.
5	Assessment Instrument	• HOTS-based Description Test: analyze (C4), evaluate (C5), create (C6) • Non-Observation Test: Observation Sheet Ket. Communication and Collaboration	• HOTS-based Essay Test: analyze (C4), evaluate (C5), create (C6) • Non-Observation Test: Observation Sheet Ket. Communication and Collaboration
5	Sources and Media Sources	Textbooks, Hand Outs, LKM, online libraries (Website). Media: Preparations, Video, Internet Network	Source: Textbook, Hand Out, LKM, online library (Website). Media: Preparations, Video, Internet Network

Based on Table 1, the Model Lecturer has already carried out a plan (Plan) by making a complete document for two cycles of the learning process (lesson design). The content in the document follows the CPMK and Sub-

CPMK formulations. Overall, the documents are relevant to the problems in this research.

The result of the test

Data on written test results in 2 LS cycles which state the percentage of students with HOTS cognitive abilities in 4 categories are presented in Table 2.

Based on Table 2, student learning outcomes show that there has been no increase in cognitive abilities in the two learning cycles. The percentage of students with assessment results in the VERY GOOD category was the same between Cycle I and Cycle II, as much as 50%. Even in Cycle II, there was a decrease in the GOOD category from 22% to 17%, while the NOT GOOD category increased from 17% to 23%.

Table 2. Categories of Student Cognitive Ability in 2 Learning Cycles

Value Range	Category	Frekuansi/total		Percentages (%)	
		Cycle I	cycle II	cycle I	Cycle II
80 – 100	Very good	9	9	50	50
72 – 79	good	4	3	22	17
64 – 71	Less good	2	2	11	11
≤ 63	Not good	3	4	17	22
Total		18	18	100	100

Observation results

The results of the observation of 21st-century skills, namely (1) communication skills and (2) collaboration, are quantitatively presented in Figure 1 and Figure 2.

Based on Figure 1 above, students' communication skills increased from cycle I to Silkus II, with a significant percentage in each category. Based on Figure 2 above, student collaboration abilities resulting from learning observations for two cycles show an increase from the low category to the higher category (competent) in all aspects, namely: (1) Able to have the ability to collaborate or coordinate group members, (2) Able to cooperate between groups, (3) Able to carry out the principles of cooperation in group activities, (4) Able to adapt in various roles and responsibilities, and (5) Able to communicate using a logical and structured flow of thought.

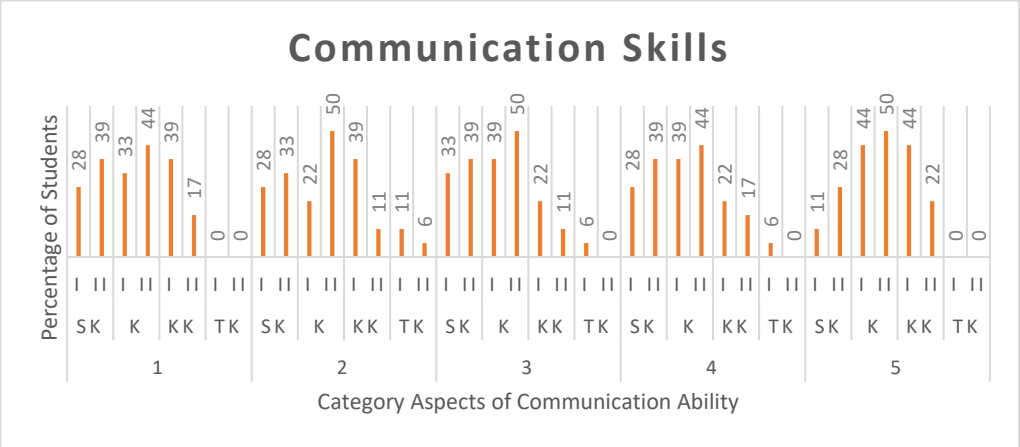

Figure 1. Percentage of Students in Communication Skills

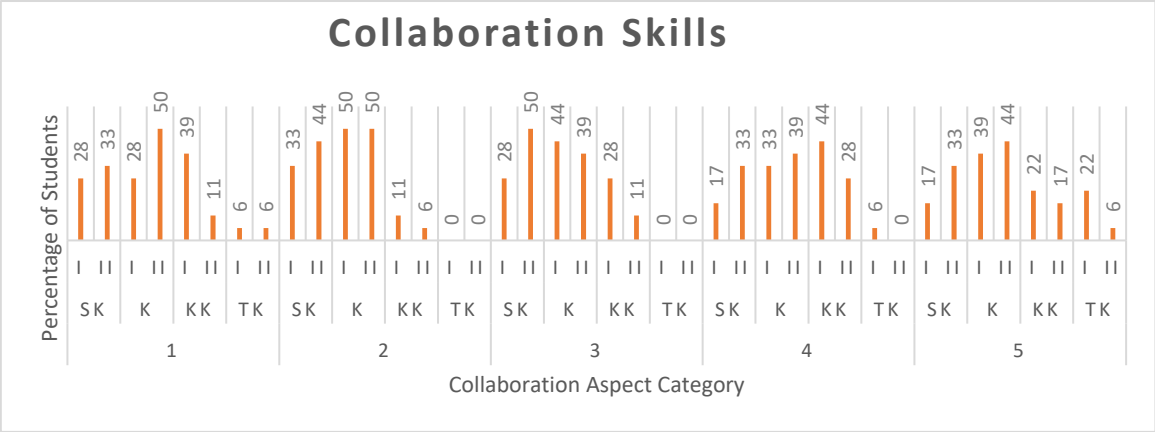

Figure 2. Percentage of Students in Collaboration Ability

Information:

- Very Competent (VC), Competent (C), Less Competent (LC), and Incompetent (I).I = Siklus I; II = Siklus II
- Aspek Komunikasi:

1. : Have the attitude to be able to listen and respect the opinions of others.
2. : Have a confident attitude in communicating and expressing the ideas you have
3. : Have an honest attitude and responsibility for the ideas or ideas that have been put forward
4. : Able to use spoken and written language according to the content of the other person
5. : Able to communicate using a logical and structured flow of thought.

Able to have empathy and respect the different perspectives of others in working in groups. However, collaboration skills in Aspect (1) and Aspect (5) are still included in the I Category as much as 6% of students at the end of Cycle II. In addition, the development of students' 21st Century skills was qualitatively obtained from the observations by observers conveyed at the time of reflection or see, as presented in Table 3 below.

Table 3. Summary of Observer's See/Reflection Results

No	Observer Name	Observer Profession	Result See/Reflection
1	Lailatul Fitriyah	Active Student of Biology Education Semester 8	• Students at the beginning of learning still look confused • After the learning process is carried out in an active student manner (Student Center Learning) by giving assignments in groups, students look enthusiastic. • Students are seen using various sources/media using laptops • Students have shown critical thinking, communication, and collaboration skills that occur in Group 1; all members work together • • Students still have difficulty formulating problems and determining time estimates • Students look interested and enjoy observing tissue through a microscope

No	Observer Name	Observer Profession	Result See/Reflection
2	Sitta Amaliyah, S.Si., M.Si.	Biology education lecturer	• At the beginning of learning, students are not active. • Students seem slow in responding to the learning model • Furthermore, student interaction has been good, and some students actively ask questions • Critical thinking skills have begun to appear by asking questions, clarifying the tasks that must be done • Creative and innovative thinking is still invisible • Good communication skills • Students seem to have difficulty, and the student's initial knowledge is not yet supportive, for example, the skills in using a microscope • Students have not been able to manage their time
3	Nur Laili Suci Anggraeni, S.Pd.	Guru Mitra	• At the beginning of learning, students still look confused • Furthermore, interaction has occurred in two directions, interaction with learning resources using IT via cell phones and laptops • Students have cooperated, communicated in seeking • Students have thought critically by asking questions • Collaboration between group members • Presentation, less systematic (cultural) • Students still have difficulty in the learning process with the inquiry model • Valuable experience and results of observing preparations under a microscope can use HP photos.
4	Seroja Miftahul Jannah, S.Pd.	Partner Teacher	• At the beginning of learning, students are still tense, but their apperception is very good • Interaction: good • 21st Century skills are visible • Confusion in doing the task: problem formulation • Students presenting should communicate with all members who appear facing students from other groups.
5	Minhah Nabilah	Active Student of Biology Education Semester 8	• Students are confused because they do not have initial knowledge. There was minim interaction at the beginning, and they were afraid to argue and adapted to the group • But then, the interaction was outstanding; students were led to give opinions • Students look active, high curiosity • Collaborative interactions are still lacking; most of them explore themselves. • Critical: spontaneous answers; keywords • Communication: discussions expressing opinions, sharing, sharing assignments • Difficulty: pouring ideas, lots of evidence, filling out worksheets • Understanding through investigation, self-confidence increases • Attitude: less visible, more passionate • Enthusiasm at the end wanes

No	Observer Name	Observer Profession	Result See/Reflection
6	Ir. Ruspeni Daesusi, M. Kes.	Biology education lecturer	• Sources: Internet and ppt, but students need reference books • Achievement of 21st Century skills supported by learning models • Creative: less. It needs to be interspersed with cases • Students can understand material related to facts • Inquiry Model: accommodates 21st-century student's ket • Valuable lessons: the inquiry model can be applied to other subjects.
7	Ismatun Naila, S.Pd., M.Pd.	PGSD Lecturer	• Students are still confused/questioning • Some students are still silent/not involved • Learning Resources, using HP Internet media • Student readiness is still not ready • Several students shared and communicated; some used cell phones for other purposes. • learning a lot from this lesson and can be applied in PGSD • Disciplined student, no one chats, enthusiastic, does not hesitate to ask for guidance
8	Kamaliyah Rahmayanti, S.Pd., M.Pd.	Biology education lecturer	• Critical thinking, collaboration, each member sharing opinions • Good communication, presentation • At the beginning of learning, students still looked confused by the presence of observers. • Students seem to have difficulty in formulating a problem which is one of the inquiry model syntaxes • In Group 2, students used complete learning resources on cell phones: textbooks, ppt, and online. • Students still need guidance in learning • About 60% of students seem not to have mastered the material • The underdeveloped 21st Century skills are creative and innovative • Students are still not ready for the SCL process.

This research is a study (research lesson) conducted on the Subject of Animal Tissue and Body Structure (JSTH) in the Biology Education Study Program, FKIP UMSurabaya, with the Application of the Inquiry Model with syntax from Dow and Friend (Dow et al., 2002). The initial study, according to the stages of the Lesson Study (LS) Cycle, Plan-Do-See, namely the study of learning at the planning stage (Plan). The Model Lecturer and other lecturers in a small team prepare lesson plans in several forms of documents, including (1) RPS, (2) SAP, (3) Teaching Materials, (4) LKM, (5) Resources and Media, and (6) Assessment Instruments, like Lesson Study (LS) in Japan, teachers work in small teams to plan, teach, observe, analyze, and refine individual class lessons, which are called research lessons. (Research lessons). Teachers explore how LS practice creates multiple pathways for improving teaching and how the knowledge that teachers create can help advance teaching practice in their field (Cerbin & Kopp, 2006).

This plan's study aims to determine the topics and objectives for student learning

(Cerbin & Kopp, 2006). in this lesson, the learning outcomes for the Animal Tissue and Body Structure (JSTH) Course (CPMK) that students must achieve at the end of the course are being able to analyze the interrelationships of animal body tissues and structures microscopically. Moreover, macroscopically with animal body functions utilize the results in the form of biology learning resources or media in schools, integrating religious attitudes (faith, noble character), science process skills (logical, systematic, critical, creative, innovative reasoning), and academic ethics (honest, conscientious, responsible). And then an entrepreneurial spirit (dare to take risks and critically see opportunities). This CPMK contains competency demands that students must have in facing a new era, namely life in the 21st Century and the Industrial Revolution Era 4.0 (RI 4.0). 21st Century Competence and RI 4.0 Era include (1) critical thinking skills and problem-solving, (2) creative and innovative thinking skills, (3) communication skills, and (4) collaboration skills (P21 Framework for 21st-century learning, 2009; Trilling & Fadel, 2009; Roudlon, 2022).

In the Do stage, as many as 2 LS Cycles, learning using the Inquiry Learning Model shows the results that the cognitive ability at a high level, higher order thinking skills (HOTS) in the very high-level category (TST) is still the same, as many as 50% of students. It shows that increasing HOTS is not enough to do two learning cycles. King and colleagues (1998) suggested that over a long period, individuals develop high-level skills (intellectual abilities) that are useful for solving a broad spectrum of complex and complex problems (King et al., 1998). Meanwhile, the achievements of communication and collaboration skills in the 2 study cycles (LS) have begun to develop. The average student's communication skills show improvement in all aspects. For instance, there is the attitude of being able to listen to and respect the opinions of others and the attitude of being confident in communicating and expressing ideas that are owned. In addition, the attitude of being honest and responsible for ideas or ideas that have been put forward, using spoken language and writing according to the content of the interlocutor, and communicating using a logical and structured flow of thought. Meanwhile, student collaboration skills still need improvement, especially in terms of the ability to collaborate or coordinate with group members, having a sense of empathy, and respecting the different perspectives of others in working in groups.

In general, observers at the LS See/Reflection stage, as summarized in Table 3, suggest that HOTS, communication skills, collaboration, creativity and innovation, and critical thinking have emerged in every learning process. Practical learning uses the Inquiry Learning Model. King suggested that the increase in HOTS, communication skills, and collaboration is primarily determined by the selection of learning strategies and methods (King et al., 1998). The Inquiry Learning Model chosen in this LS is based on the competency analysis that students must achieve, where learning outcomes include thinking skills (cognitive process dimension) and knowledge (knowledge dimension) (Anderson et al., 2001). The Inquiry Learning Model enables the development of HOTS, student communication, and collaboration skills, as illustrated in each syntax: (1) Students are involved with scientific questions, events, or phenomena. This stage connects with what they know before, creates dissonance with their ideas, and motivates them to learn more; (2) Students explore ideas through direct experience, formulate and test hypotheses, solve problems, and make explanations about what they observe; (3) Students analyze and interpret data, synthesize their ideas, build models, and clarify concepts and explanations

with teachers and other sources of scientific knowledge; (4) Students expand their understanding and abilities and apply what they have learned to new situations; (5) Students, with teachers, review and assess what they have learned and how they have learned it (Dow et al., 2002).

In this LS, students study in groups to make HOTS achievements more effective, and student communication and collaboration skills. Small group activities such as student discussions, peer tutoring, and cooperative learning can effectively develop thinking skills. In addition, learning activities must involve challenging assignments, teacher encouragement to stay on task, and ongoing feedback about group progress (King et al., 1998).

This lesson study wants to change the professional work culture of teachers who usually work alone when planning instructional activities and assignments (Cerbin & Kopp, 2006). Lesson study originating from Japan has been practiced in Indonesian schools, and its application has even been extended to universities. In Indonesia, a Lesson study is defined as a model of developing the teaching profession through collaborative and sustainable learning assessment based on collegiality and mutual learning principles to build a learning community (Hendayana & dkk., 2006; Susilo, 2013; Zubaidah, 2010). The results of Lesson study research show that collaborative learning results in a better quality of learning (Suratno et al., 2010; Wikanta et al., 2014, 2017). "Lesson Study" conducted by the JICA-IMSTEP project reported that based on the results obtained, there were four changes that occurred in learning in Indonesia, namely; (1) piloting activities have brought about a change in the primary method of learning; (2) the learning structure has changed with more emphasis on experiments or practical activities; (3) changes to students' reactions during learning are also an important aspect that the teacher feels; (4) not to forget that the teachers and lecturer-observers reflect on the observed learning together (Saito et al., 2005).

Lesson study is the improvement of teaching and the process of building knowledge derived from primary Japanese education. However, teacher professional development is driven by the need to broaden and update teacher practice, skills, and confidence. The need for professional development can be caused by changes in curriculum, new classroom technology, advances in pedagogy, or all of them. However, the actual effort of teacher professional development is to improve student outcomes, whether focused on understanding, skills, attitudes, or engagement (Doig & Groves, 2011).

Both in schools and in tertiary institutions, the end of these LS activities must be at least two tangible products, namely: (a) producing detailed and usable lesson plans and (b) in-depth studies of lessons that investigate teaching and learning interactions, explaining how students respond to instructions, and how instructions might be further modified based on the evidence gathered (Cerbin & Kopp, 2006). In addition, lesson study in Japan by education practitioners is used to reform schools through lesson study for learning communities, LSLC (Saito & Sato, 2012). In line with this research, Lesson study in tertiary institutions is a training ground for lecturers and student teacher candidates to carry out scientific research in teaching and learning, as well as actual studies which form the basis for specific knowledge about the core concepts and ideas of teaching disciplines (Cerbin & Kopp, 2006).

CONCLUSION

The results of 2 cycles of LS in the Biology Education Study Program FKIP UMSurabaya can be concluded, namely: The model lecturer team, together with colleagues, have planned

learning by choosing a learning model, preparing teaching materials, media based on the learning achievements of the subjects specified in the study program curriculum. The observer has revealed student activities during the learning process, illustrating the increase in HOTS, communication skills, and student collaboration. The learning process using the Inquiry Learning Model has facilitated improving the skills of the 21st Century students of Biology Education teacher candidates at UMSurabaya. The suggestions from the results of this study include: (1) LS practice is linked to the problems of prospective teachers at school (research lesson); (2) LS practice needs to be done with additional cycles; (3) LS practice is applied to field practice of prospective teacher students; (4) LS practice needs to be expanded by forming a learning community between lecturers at LPTKs and teachers at school.

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REFERENCES

Anderson, L. W., Krathwohl Peter W Airasian, D. R., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *Taxonomy for_ Assessing a Revision 0F Bl00 M'S Tax0N0My 0F Educati0Nal Objectives*. https://www.uky.edu/~rsand1/china2018/texts/Anderson-Krathwohl - A taxonomy for learning teaching and assessing.pdf

Arifa, F. N., & Prayitno, U. S. (2019). Peningkatan Kualitas Pendidikan: Program Pendidikan Profesi Guru Prajabatan dalam Pemenuhan Kebutuhan Guru Profesional di Indonesia. *Aspirasi: Jurnal Masalah-Masalah Sosial*, *10*(1), 1–17. https://doi.org/10.46807/aspirasi.v10i1.1229

Azhar. (2009). Kondisi Lptk Sebagai Pencetak Guru. *Tabularasa PPS UNIMED*, *6*(1), 1–13.

Baba, T. (2007). Japanese Education and Lesson Study : An Overview. *Japanese Lesson Study in Mathematics: Its Impact, 1*, 2–71. http://www.worldscibooks.com/etextbook/6339/6339_chap01.pdf

Cerbin, W., & Kopp, B. (2006). Lesson Study as a Model for Building Pedagogical Knowledge and Improving Teaching. *International Journal of Teaching and Learning in Higher Education*, *18*(3), 250–257. http://www.isetl.org/ijtlhe/

Doig, B., & Groves, S. (2011). Japanese lesson study: Teacher professional development through communities of inquiry. *Mathematics Teacher Education and Development*, *13*(1), 77–93.

Dow, P., Duschl, R. A., Dyasi, H. M., Kuerbis, P. J., Lowery, L., McDermott, L. C., Rankin, L., & Zoback, M. Lou. (2002). *Inquiry and the National Science Education Standard: a Guide for Teaching and Learning*. National Academy Press.

Fadhilla, S. A. (2022). *Memahami Peran Guru Pada Abad 21 Serta Tantangan*. https://thesiscommons.org/8ct9y

Farid Anfasa Moeloek, Wirakartakusumah, M. A., & Indrayanto, G. (2010). Paradigma

Pendidikan Nasional Abad XXI. In *Badan Standar Nasional Pendidikan*.

Fauzi. (2016). Menggagas LPTK Masa Depan : Ikhtiar Mengatasi Problem Pendidikan di Indonesia dari Hulu. *PERSPEKTIF Ilmu Pendidikan*, *30*(1), 59–66.

Hendayana, S., & dkk. (2006). *Lesson Study: Suatu Strategi untuk Meningkatkan Keprofesionalan Pendidik (Pengalaman IMSTEP-JICA)*. UPI Press.

Jafaruddin. (2019). *Kompetensi Profesional Guru Dalam Meningkatkan Prestasi Belajar Siswa Sman 1 Kuta Cot Glie Kabupaten Aceh Besar*. https://media.neliti.com/media/publications/242979-kompetensi-profesional-guru-dalam-mening-61991242.pdf

Kemenristekdikti. (2018). *Pedoman Penyelenggaraan Program Pendidikan Profesi Guru*.

King, F., Goodson, L., & Rohani, F. (1998). *Higher Order Thinking Skills: Definition, Teaching Strategies, & Assessment*. A Publication of the Educational Services Program, Now Known as the Center for Advancement of Learning and Assessment. https://informationtips.files.wordpress.com/2016/02/higher-order-thinking-skills_.pdf

Memorata, A., & Santoso, D. (2016). Peningkatan Kualitas Pembelajaran Dan Hasil Belajar Merakit Personal Komputer Menggunakan Structured Dyadic Methods. *E Journal Students UNY*, *c*, 1–9.

Muslimin. (2020). Program penilaian kinerja guru dan uji kompetensi guru dalam meningkatkan prestasi kerja guru. *Indonesian Journal of Education Management & Administration Review*, *4*(1), 197–204. https://jurnal.unigal.ac.id/index.php/ijemar/article/view/4384

Nita, R. (2021). Peran Guru Di Era 4.0 Dalam Pendidikan. *Seri Publikasi Pembelajaran*, *1*(2), 1–12. https://www.researchgate.net/publication/351775976

P21 Framework for 21st-century learning. (2009). Framework for 21st-century learning. *P21 Partnership for 21st Century Learning*, 2. http://www.p21.org/our-work/p21-framework

PASK. (2019). *Data UKG*. Kementrian Pendidikan Dan Kebudayaan. https://npd.kemdikbud.go.id/?appid=ukg

Pratidhina, E. (2020). Education 4.0: Pergeseran pendidikan sebagai konsekuensi revolusi industri 4.0. *Humanika*, *20*(1), 1–12. https://doi.org/10.21831/hum.v20i1.29290

Premono, A. (2005). Kurikulum Pendidikan Teknik Mesin LPTK (Lembaga Pendidikan Tenaga Kependidikan) yang dapat Menghasilkan Guru Teknik Mesin Yang Berkualitas. *Prosiding Seminar Nasional Tahunan Teknik Mesin IV*, 35–38. http://prosiding.bkstm.org/prosiding/2005/G5-07.pdf

Roudlon. (2022). Tantangan Guru Di Era Revolusi Industri 4.0. *Jurnal Pendidikan Dan Humaniora*, *6*(1), 965–975. https://e-journal.man1lamongan.sch.id/2022/06/07/tantangan-guru-di-era-revolusi-industri-4-0/

Saito, E., Imansyah, H., & Ibrohim. (2005). Penerapan Studi Pembelajaran (Lesson Study) di Indonesia: *Mimbar Pendidikan*, *XXIV*(3).

Saito, E., Murase, M., Tsukui, A., & Yeo, J. (2014). Lesson Study for Learning Community. *Lesson Study for Learning Community*, 1–28. https://doi.org/10.4324/9781315814209

Saito, E., & Sato, M. (2012). Lesson study as an instrument for school reform: A case of Japanese practices. *Management in Education*, *26*(4), 181–186. https://doi.org/10.1177/0892020612445101

Sato, M. (2013). *Mereformasi Sekolah: Konsep dan Praktek Komunitas Belajar*. PELITA/IDCJ.

Setianingsih, W. (2018). LPTK Dan Profesionalisme Calon Guru. *Prosiding Profesionalisme Guru Abad XXI, Seminar Nasional IKA UNY*, 79–88.

Slamet Hw, S. H., Subadi, T., Sutama, S., & Khotimah, R. P. (2017). Peningkatan Kompetensi Guru Sekolah Dasar Melalui Lesson Study (Sosialisasi LS bagi Guru

SD N 1,2 Gentan Baki-Sukoharjo). *Warta LPM*, *13*(1), 55–64. https://doi.org/10.23917/warta.v13i1.3216

Sonia, T. N. (2019). Menjadi Guru Abad 21: Jawaban Tantangan Pembelajaran Revolusi Industri 4.0. *Prosiding Seminar Nasional Teknologi Pendidikan Pascasarjana UNIMED*, 191–199.

Sudjana, N. (2008). *Penilaian Hasil Proses Belajar Mengajar*. PT Remaja Rosdakarya.

Sujana, I. M., & Narasintawati, L. S. (2012). Lsson Study sebagai Alternatif Pengikatan Kompetensi Calon Guru di LPTK. *Jurnal Ilmu Pendidikan FKIP UMRAM*, *20*(1), 1–18.

Suratno, T., Agus, Murniasih, & Sholahuddin. (2010). Implementasi Lesson Study pada Pengajaran Deret Aritmatika di Sekolah Avicenna. *Jurnal Pendidikan Dasar*. http://file.upi.edu/Direktori/JURNAL/PENDIDIKAN_DASAR/Nomor_14-Oktober_2010/Implementasi_Lesson_Study_pada_Pengajaran_Deret_Aritmatika_di_Sekolah_Avicenna.pdf

Susilo, H. (2013). Lesson Study Sebagai Sarana Meningkatkan Kompentensi Pendidik. *Seminar Dan Lokakarya PLEASE 2013 Di Sekolah Tinggi Theologi Aletheia Jalan Argopuro 28-34*, 1–32.

Trilling, B., & Fadel, C. (2009). *21St Century Skills: Learning For Life in Our Times*. Jossey-Bass. https://doi.org/10.1145/1719292.1730970

Wardhana, A. (2021). Peluang Dan Tantangan Sdm Pada Era Revolusi Industri 4.0. In *cv. Media Sains Indonesia* (Issue October). https://www.researchgate.net/publication/355192040_PELUANG_DAN_TANTANGAN_SDM_PADA_ERA_REVOLUSI_INDUSTRI_40

Widiadi, A. N., & Utami, I. W. (2016). Praksis Lesson Study For Learning Community Dalam Pembelajaran Ilmu Pengetahuan Sosial Pada Sekolah Menengah Pertama Melalui Kolaborasi Kolegial Guru Dan Dosen. *Jurnal Teori Dan Praksis Pembelajaran IPS*, *1*(2), 77–88. https://doi.org/10.17977/um022v1i22016p077

Wikanta, W., Hadi, R. S., Fikriyati, A., Studi, P., Biologi, P., & Studi, P. (2014). *Peningkatan Kualitas Pembelajaran Kimai Organik Berbasis Karakter Melalui Praktik Lesson Study pada Program Study Pendidikan Biologi FKIP UMSurabaya*. 33–45.

Wikanta, W., Suharti, P., Listiana, L., & Daesusi, R. (2017). Lesson Study of Brave and Confident Attitude Transformation of Student in Expressing Opinion through Colaborative Learning in Biology Lecturing in UMSurabaya. *Proceeding 8th International Conference on Lesson Study*. http://icls8.hamzanwadi.ac.id

Zubaidah, S. (2010). Lesson Study Sebagai Salah Satu Model Pengembangan Profesonalisme Guru. *Jurnal Inspirasi Pendidikan*, *2*(1), 1–14.

Zuhera, Y., Habibah, S., & Mislinawati. (2017). Kendala Guru dalam Memberikan Penilaian Terhadap Sikap Siswa dalam Proses Pembelajaran Berdasarkan Kurikulum 2013 di SD Negeri 14 Banda Aceh. *Ilmiah Pendidikan Guru Sekolah Dasar*, *2*(1), 73–87.

Zulfitri, H., Setiawati, N. P., & Ismaini. (2019). Pendidikan Profesi Guru (PPG) sebagai Upaya Meningkatkan Profesionalisme Guru. *LINGUA, Jurnal Bahasa & Sastra*, *19*(2), 130–136.