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Analysis of the Effect Digital Literacy on Communication Skills, Collaboration Skills, and Student Learning Outcomes in Classroom

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Abstract*—Situation during the Covid-19 pandemic in Indonesia has made online learning one of the main solutions for student education. Students need digital literacy to support the achievement of 21st century competencies and learning outcomes in online learning. The purpose of this study was to analyze the correlation between digital literacy and 21st century skills, namely communication skills and collaboration skills, as well as student learning outcomes in the classroom. A structural equation model was created to clearly describe the correlation between these variables. The sample consisted of 89 students from one of the universities in Indonesia who were asked to fill out a questionnaire designed to access digital literacy, communication skills, and collaboration skills, while learning outcomes data were obtained from tests. The results show that digital literacy is positively and significantly correlated with learning outcomes, communication skills, and collaboration skills. This finding provides an explanation that the higher the digital literacy of students, the higher the communication skills, collaboration skills, and student learning outcomes. The results show that digital literacy is positively and significantly correlated with learning outcomes, communication skills, and collaboration skills. This finding provides an explanation that the higher the digital literacy of students, the higher the communication skills, collaboration skills, and student learning outcomes. The results show that digital literacy is positively and significantly correlated with learning outcomes, communication skills, and collaboration skills. This finding provides an explanation that the higher digital literacy of students, the higher communication skills, collaboration skills, and student learning outcomes.*

Keywords—digital literacy, communication skills, collaboration skills, learning outcomes

I. INTRODUCTION

The Covid-19 pandemic has brought major changes to the teaching and learning process throughout the world, including Indonesia. During the Covid-19 pandemic, online learning (online) has become one of the main solutions in education [1]. This policy was taken as a government effort to prevent the spread of the virus. In online learning situations, students are required to be able to use digital technology, be able to find and share information without having to meet face to face, and be able to master 21st century skills as announced by the government even though they are virtual. Therefore, students need to have competencies that can assist in adapting from face-to-face learning to online learning and can support the mastery of 21st century competencies.

One of the competencies that students need to support online learning is digital literacy. Digital literacy is a person's competence in finding, managing, evaluating, integrating, creating, and communicating information through computer devices and web-based environments [2]. When learning online, students will often look for digital references via the internet to complete their academic assignments, interact with friends or teachers through social media or learning management systems (LMS), and collaborate virtually. Digital literacy will assist students in using technology tools for online learning [3], increasing their skills in accessing digital references [4] and managing information and being critical in choosing information from the internet [5] when they are looking for digital references. Digital literacy will also help students evaluate and filter information from various digital sources [6]. These competencies will greatly help students adapt to online learning.

Some researchers suggest that digital literacy is a competency that can be a provision for students to live in the 21st century [7-9] and support students to have good learning outcomes [6]. The results of other studies show that digital literacy has a strong positive correlation with learning outcomes [10-11] and 21st century skills such as communication skills and collaboration skills [12-13]. However, Pagani et al [10] stated that although descriptively there is a positive relationship between digital literacy and learning outcomes, however, by regression analysis, no evidence has been found that digital literacy has a positive effect on learning outcomes. Therefore, in this study it is necessary to model structural equations to describe more clearly the correlation between digital literacy and student learning outcomes, communication skills and collaboration skills.

II. LITERATURE REVIEW

A. Digital Literacy

Digital literacy is defined as the ability to understand and use information from various sources in a variety of formats presented via computers [14-15]. This literacy is not only the skill to operate computer software [3], but the skill to use information communication technology (ICT) to search or find, evaluate, utilize, create or create, and communicate information that requires cognitive skills. and technical [6], [16-17]. A person who can only operate a computer device to search for information or communicate via the internet cannot be said to be someone who is digitally literate. Someone who

is digitally literate must be able to manage information well, have critical thinking skills, have appropriate online behavior [5].

Digital literacy is a competency that covers six aspects, namely accessing, managing, evaluating, integrating, creating, and communicating information individually or collaboratively in a network, computer-supported, and web-based environment for study, work, or recreation [2]. Based on some of these definitions, it can be stated that a digitally literate person is someone who can search for information via the internet, can analyze and evaluate the truth of the information obtained, can use this information to solve problems in his life wisely, can create content through the information obtained, and can communicate it via the internet.

Digital literacy is one of the 21st century literacy that is important for lifelong learning [18] and needs to be owned by students in today's digital era. Digital literacy can equip students to have life skills in the 21st century and have a career in the future. Students who have digital literacy will have better career opportunities in the future because currently many companies, modern organizations, and various public and private institutions use computers and the internet to help complete assignments [6]. Knowledge and skills of finding information, communicating, and utilizing digital tools such as computers are very important in the workplace [6].

Students must also have digital literacy in order to help them succeed in learning. Information technology (IT) skills alone are not enough to help students learn effectively. Digital literacy enables students to be proficient in interacting with files, creating graphics, converting files from one type to another, using web-based tools to complete assignments [19], accessing, managing, integrating, evaluating, and creating information [6]. Digital literacy also allows students to participate in social networks so that they can create and share knowledge [20] and prevent students from plagiarism [21] and hoax news.

B. Communication Skills

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations. Communication is the process of exchanging information, ideas, thoughts, feelings and emotions from people who provide information to people who receive information verbally and non-verbally [22] through speech, gestures, writing, or behavior [23]. The World Economic Forum [24] defines communication skills as the ability to listen, understand, convey and contextualize information through verbal, non-verbal, visual and written means. Communication is the art and process [25] of conveying a message that can be understood by the recipient of the message [26] at the same time through symbolic interaction [27]. Communication begins when a message or information is transferred from the sender (speaker, writer) to the receiver (listener).

Important stages in communication include thinking about what to say, finding the best way to say it, finding the right words, making sure the other person understands, and understanding whatever he says in response [23]. Communication skills have a big role in the success of delivering an interpersonal message because communication is done directly [28]. Without good communication, information or knowledge will not be conveyed properly. If there is a discrepancy between what is intended to be conveyed and what is conveyed, then the learning outcomes will not be effective and even inappropriate decisions can be issued [29].

Communication has many benefits. Communication skills are one of the important generic skills elements possessed by students [22] in the 21st century [24], [30-31] especially later during the learning process. looking for work [22]. These competencies are necessary for the 21st century workforce to be able to work well with teams [24]. Someone who has good communication skills tends to be able to work together and has the opportunity to become a successful person [32], open to other people's ideas and willing to express their views on important matters in the problem solving process [33].

C. Collaboration Skills

Collaboration is a group action to get something done together. Collaboration skills are the ability to participate in every activity to build relationships with others, respect each other's relationships and work as a team to achieve the same goal [34-35]. Collaboration is a very important skill in the learning process. Vygotsky in his socio-cultural theory explains that an important aspect in the learning process is the development of the proximal zone [36] where students cannot achieve new concepts or ideas unless they receive help or feedback from an educator or colleague [37]. Collaboration is considered a skill that is a common requirement in today's world of work. Collaboration is a skill that provides experience to understand each other's strengths and weaknesses. Collaboration enables people to solve the problems they face and achieve common goals [38].

Learners who engage in collaborative learning improve their critical thinking and problem solving skills [39]. Collaboration is very important in learning because collaboration skills can be used by students while in the world of work. In addition, collaboration was identified as an important educational outcome and is one of the key skills of 21st century skills [40-42]. The results show that people with good collaboration skills perform better [43] have the ability to mobilize and energize others to create a shared vision of problem solving [44] facilitating the work of others, can identify and utilize the various abilities of team members [45]. Other studies have found that training students on how to work together (e.g., planning, group decision making, setting goals, setting time, accepting roles, and creating a positive group environment) can increase learning effectiveness [46]. Collaboration skills also have a strong influence on student learning [47]. It was further explained that students who completed their assignments collaboratively had higher scores than students who completed their assignments individually [47]. Some of the benefits of collaboration include effective division of labor; integration of information from various sources of knowledge, perspectives, and experiences; and

increased creativity and quality of solutions stimulated by the ideas of other group members [48]. Collaboration skills can also improve students' social competence, such as conflict resolution skills, helping others, and academic self-concept [49]. Students who work collaboratively in groups can produce more knowledge [50]. Collaboration will create more holistic results and more knowledge than individual work. Communication skills and collaboration skills have a significant role in supporting the success of the digital era [51].

D. Learning Outcomes

Learning outcomes are abilities obtained by students after going through learning activities [52]. Learning outcomes can be defined as a change in a person's behavior that can be observed and measured in the form of knowledge, attitudes, and skills. The change in question can be interpreted as an increase and development that is better than before and from those who do not know to know [53]. Thus, it can be said that learning outcomes are one indicator of the learning process. Learning outcomes are changes in behavior obtained by students after experiencing learning activities [54]. As a final product of the learning process, learning outcomes are assessed as being able to show what students already know and develop [55].

Hamdan & Khader [56] state that learning outcomes are the basis for measuring and reporting student academic achievement, and are the key in developing further learning designs that are more effective and have alignment between what students will learn and their assessment process. Learning outcomes are also a report on what has been obtained by the learner after going through the learning process [57].

Gronlund & Linn [58] stated that learning outcomes include several aspects, namely: (1) knowledge, (2) understanding, (3) application, (4) thinking skills, (5) general abilities, (6) attitude, (7) interest, (8) appreciation, and (9) adjustment. More specifically, Gagne [59] states that learning outcomes include five aspects, namely; (1) verbal information, (2) intellectual skills, (3) regulation of cognitive activities, (4) motor skills, and (5) attitudes. Meanwhile, according to Bloom [59] learning outcomes are in the form of changes in behavior that shape human abilities, Bloom classifies them into three domains, namely the cognitive, affective, and psychomotor domains.

Cognitive learning outcomes are closely related to the development of the taxonomy of learning outcomes. In line with advances in the field of education, according to Bloom's [59] cognitive taxonomy, it also underwent revisions that emphasized the use of the taxonomy in program design, learning and evaluation, as well as harmonizing the three activities. Cognitive learning outcomes according to Bloom which were later revised by Anderson & Krathwohl [60] can be divided into six levels, namely (1) C1 (remembering), (2) C2 (understanding), (3) C3 (applying), (4) C4 (analyze), (5) C5 (evaluate), and (6) C6 (create).

III. Research Question

Based on the introduction and background provided, this article aims to answer the following questions: “How does digital literacy affect communication skills, collaboration skills, and student learning outcomes?”

IV. Methodology

A. Research Design and Participants

The research design is a survey using a questionnaire distributed via google form to Biology Education students at one of the universities in Indonesia. A total of 89 Biology Education level 2 students participated in filling out questionnaires and learning outcomes tests.

B. Instruments

Questionnaires were used to collect data on digital literacy, communication skills, and collaboration skills. While the data collection of learning outcomes by using tests. The digital literacy questionnaire refers to the indicators of accessing, managing, evaluating, integrating, creating, and communicating information from Karpati [2]. The communication skills questionnaire refers to 9 indicators from [61-62] includes information delivery organization, language, delivery, supporting material, main message, main idea and support, writing organization, writing style, and syntax. While the collaboration skills questionnaire refers to three indicators from [61] which include contributing, being responsible, and respecting the viewpoints of others. The learning outcomes test given is in the form of a description of 10 items. All instruments used have been tested for validity and reliability through SEM analysis and the results show that all instruments are valid and reliable.

C. Data Analysis

The data obtained were analyzed using SEM with Partial Least Square (SEM-PLS). Data analysis was carried out with the smartPLS 3.3.3 computer application.

V. Finding

A. Test Indicator (Outer Model)

Description of latent variables and their manifest variables are as follows.

1) The exogenous latent variable of digital literacy has six main indicators, namely accessing, managing, evaluating, integrating, creating, and communicating information. The six main indicators are translated into 25 manifest variables (indicators) which are shown in Table 1.

TABLE I. EXOGENOUS LATENT VARIABLES OF DIGITAL LITERACY AND THEIR MANIFEST VARIABLES

No	Manifest variable (indicator)	Code
1	Operate digital devices	Access1
2	Search for information by keyword	Access2
3	Find relevant information	Access3
4	Can access hyperlink	Access4
5	Can download and store various types of information	Access5
6	Select information by format	Manage1
7	Managing data stored on the computer	Manage2
8	Save information in folder	Manage3
9	Can distinguish official websites based on url	Evaluation1

No	Manifest variable (indicator)	Code
10	Check the author's name and source of information before downloading or copying information	Evaluation2
11	Retrieve relevant information from credible sources	Evaluation3
12	Match information obtained with other sources	Evaluation4
13	Combining information from various credible sources	Integration1
14	Can relate facts from various information	Integration2
15	Can use information to solve problems	Integration3
16	Able to integrate the information obtained into the existing information	Integration4
17	Create new content and avoid plagiarism	Create1
18	Use the information obtained to create content in various digital formats	Create2
19	Able to modify, improve, and integrate existing information to create new content or knowledge	Create3
20	Include links or sources of information on new content created	Create4
21	Interact and communicate via digital devices	Communication1
22	Can share information through various media and applications	Communication2
23	Share valid information	Communication3
24	Know and understand the ethics of communicating in digital media	Communication4
25	Can protect personal data when communicating	Communication5

2) The endogenous latent variable of communication skills has nine main indicators, namely information delivery organization (opi), language, delivery, supporting material (pm), main message (pu), main idea and support (iud), writing organization (ot), writing style (gp), and syntax. The nine main indicators are translated into 15 manifest variables (indicators) which are shown in Table 2.

TABLE II. ENDOGENOUS LATENT VARIABLES OF COMMUNICATION SKILLS AND THEIR MANIFEST VARIABLES

No	Manifest variable (indicator)	Code
1	Presenting material in order from general to specific topics	Opi1
2	inform the audience about what material will be delivered before the presentation begins	Opi2
3	convey information in an organized manner	Opi3
4	use good language and easy to understand	Language1
5	use clear intonation and articulation	Conveyor1
6	appear confident and make eye contact with the audience	Conveyor2
7	provide an explanation of the material with examples, analogies, pictures, graphs, etc. during presentations	Pm1
8	presentation using visual aids or supporting multimedia	Pm2
9	use appropriate references to support the presentation	pm3
10	provide repetition and emphasis on the content of the message so that it can be conveyed clearly	Pu1
11	make written assignments with clear main ideas and supported by relevant and adequate references	IUD1
12	make written assignments with clear main ideas and interrelated explanatory sentences	Ot1
13	using standard Indonesian and in accordance with EYD (enhanced spelling) when writing assignments	gp1
14	make written assignments in clear and straightforward language	gp2
15	make written assignments using correct grammar according to the rules of SPOK (Subject-Predicate-Object-Description)	Syntax1

3) The endogenous latent variable of collaboration skills has three main indicators, namely contribution, responsibility, and respect for other people's points of view. The three main indicators are translated into nine manifest variables (indicators) which are shown in Table 3.

TABLE III. ENDOGENOUS LATENT VARIABLES OF COLLABORATION SKILLS AND THEIR MANIFEST VARIABLES

No	Manifest variable (indicator)	Code
1	Contribute to gathering information for the completion of group assignments	K1, kt1
2	Convey a lot of information related to the topic to a group of friends	K2, kt2
3	Provide enough important and relevant information during presentation	K3, kt3
4	Completing tasks according to their part in the group well	Tggjw1, tgj1
5	Do the assigned tasks without having to be reminded	Tggjw2, tgj2
6	Collect assignments on time	Tggjw3, tgj3
7	Listen when friends share their opinion	Mspol1, mspoll1
8	Never argue with group mates	Maspol2, Maspol2
9	Helping the team to make decisions fairly and impartially	Maspol3, mspoll3

4) The endogenous latent variable of learning outcomes has ten manifest variables (indicators) expressed by HB1, HB2, HB3, HB4, HB5, HB6, HB7, HB8, HB9, and HB10. The initial research model was built by four variables with manifest indicators as shown in Figure 1.

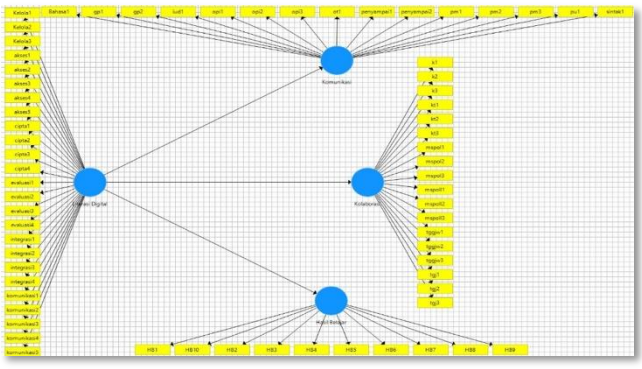

Fig. 1. Initial Research Model

The first step in the SEM test with Partial Least Square (SEM-PLS) is to test the outer model to ensure that the measurement model used is feasible to be used as a measurement (valid and reliable). After testing the outer model, it turns out that not all indicators used are valid and reliable. To get valid results, a test is carried out using the SmartPLS 3.3.3 program as many as several iterations (calculations) to eliminate indicators with a loading factor value below 0.7. In this study, two eliminations of loading factor values were carried out below 0.7. The test results can be seen in Figure 2.

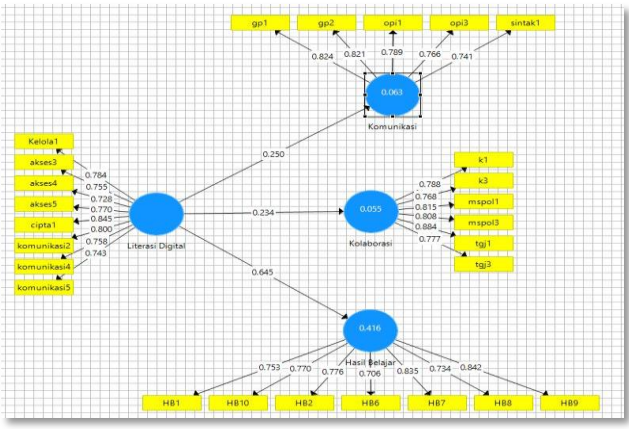

Fig. 2. Research Model with Valid Indicators

An indicator is declared valid if it has a loading factor above 0.7 for the intended construct. If all indicators have a loading factor value above 0.7, it means that convergent validity has been met. The results of convergent validity can also be seen based on the outer loading output shown in Table 4. Based on the SmartPLS output for the loading factor in Table 4 shows that all indicators have a loading factor value above 0.7 so that the indicators used in this study have met convergent validity.

TABLE IV. OUTER LOADING

Construct	*Learning outcomes*	*Collaboration*	*Communication*	*Digital Literacy*	*Status*
HB1	0.753				Valid
HB10	0.770				Valid
HB2	0.776				Valid
HB6	0.706				Valid
HB7	0.835				Valid
HB8	0.734				Valid
HB9	0.842				Valid
Manage1				0.784	Valid
Access3				0.755	valid
Access4				0.728	Valid
Access5				0.770	Valid
Create1				0.845	valid
Communication2				0.800	Valid
Communication4				0.758	Valid
Communication5				0.743	Valid
gp1			0.824		Valid
gp2			0.821		Valid
Opi1			0.789		Valid
Opi3			0.766		Valid
Syntax1			0.741		Valid
K1		0.788			Valid
K3		0.768			Valid
Mspol1		0.815			Valid
Mspol3		0.808			Valid
Tgj1		0.884			Valid
Tgj3		0.777			Valid

Source: processed primary data output

The next validity test is the discriminant validity test. The reflective indicators need to be tested for discriminant validity by comparing the values in the cross loading table. An indicator is declared valid if it has the highest loading factor value in the intended construct compared to the loading factor value in other constructs. The results of the discriminant validity test can be seen from the cross loading value in Table 5.

TABLE V. OUTPUT CROSS LOADING

Construct	*Learning outcomes*	*Collaboration*	*Communication*	*Digital Literacy*	*Status*
HB1	0.753	-0.005	0.024	0.472	Valid
HB10	0.770	0.028	0.120	0.443	Valid
HB2	0.776	0.036	0.110	0.516	Valid
HB6	0.706	-0.010	0.161	0.512	Valid
HB7	0.835	-0.049	0.170	0.502	Valid
HB8	0.734	-0.122	0.051	0.492	Valid
HB9	0.842	-0.148	0.024	0.548	Valid
Manage1	0.394	0.214	0.112	0.784	Valid
Access3	0.530	0.107	0.201	0.755	valid
Access4	0.464	0.195	0.238	0.728	Valid
Access5	0.453	0.096	0.165	0.770	Valid
Create1	0.563	0.188	0.183	0.845	valid
Communication2	0.422	0.236	0.208	0.800	Valid
Communication4	0.514	0.054	0.065	0.758	Valid
Communication5	0.586	0.304	0.310	0.743	Valid
gp1	0.151	0.409	0.824	0.208	Valid
gp2	0.078	0.382	0.821	0.198	Valid

Construct	*Learning outcomes*	*Collaboration*	*Communication*	*Digital Literacy*	*Status*
Opi1	0.133	0.475	0.789	0.236	Valid
Opi3	0.061	0.415	0.766	0.193	Valid
Syntax1	0.013	0.376	0.741	0.116	Valid
K1	0.028	0.788	0.339	0.214	Valid
K3	-0.094	0.768	0.367	0.161	Valid
Mspol1	-0.023	0.815	0.486	0.208	Valid
Mspol3	-0.019	0.808	0.374	0.212	Valid
Tgj1	-0.085	0.884	0.518	0.172	Valid
Tgj3	-0.104	0.777	0.494	0.138	Valid

Source: processed primary data output

Based on the data in Table 5 shows that the loading value of each item on the construct is greater than the cross loading value. The results of this test indicate that all indicators of the four variables are declared valid.

The final step in testing the outer model to ensure that there are no problems related to measurement is to test the reliability by looking at composite reliability and Cronbach's alpha. A latent variable can be said to have good reliability if the value of composite reliability and Cronbach's alpha is greater than 0.7. The results of the Latent Variable Reliability Test can be seen in Table 6.

Based on Table 6 shows that the value of composite reliability and Cronbach's alpha for all latent variables is above 0.7 which indicates that all latent variables are declared reliable.

TABLE VI. RELIABILITY TEST RESULTS OF LATENT VARIABLES BASED ON COMPOSITE RELIABILITY AND CRONBACH'S ALPHA. VALUES

Latent variable	*Composite Reliability*	*Cronbach's Alpha*	*Status*
Learning outcomes	0.888	0.913	Reliable
Collaboration	0.894	0.918	Reliable
Communication	0.851	0.892	Reliable
Digital Literacy	0.904	0.922	Reliable

Source: processed primary data output

B. *Structural Test (Inner Model)*

Model which has met the outer model criteria, then the structural model test (inner model) is carried out, namely by doing the R-Square test or the R^2 Determination Coefficient. The results of the R-Square test can be seen in Table 7.

TABLE VII. R-SQUARE CALCULATION OUTPUT

Construct	*R-Square*
Learning outcomes	0.416
Collaboration	0.055
Communication	0.063

Source: processed primary data output

The value of R-Square (R^2) is used to measure how much influence certain independent latent variables have on the dependent latent variable. Based on Table 7, it can be seen that the coefficient of determination of R^2 or R-Square in this study is as follows.

1) Learning Outcomes are influenced by Digital Literacy by 41.6%, the remaining 58.4% is influenced by other factors not included in the model. This means that learning outcomes are influenced by digital literacy by 41.6% while 58.4% is influenced by other variables not examined in this study.
2) Shows that collaboration is influenced by digital literacy by 5.5%, the remaining 94.5% is influenced by other factors. This means that collaboration skills are influenced by digital literacy by 5.5% while 94.5% is influenced by other variables not examined in this study.
3) Shows that Communication is influenced by Digital Literacy by 6.3%, the remaining 93.7% is influenced by other factors. This means that communication skills are influenced by digital literacy by 6.3% while 93.7% is influenced by other variables not examined in this study.

Then in addition to looking at the influence between each latent variable and the existing R-Square value, to see how well the model in this study can be done by calculating Q-squarepredictive relevance (Q^2). The results of the Q^2 calculation can be seen in Table 8.

TABLE VIII. OUTPUT Q-SQUARE PREDICTIVE RELEVANCE

Construct	*Q^2*
Learning outcomes	0.242
Collaboration	0.029
Communication	0.033

Source: processed primary data output

Based on the calculation results Q^2 in Table 8 is known that learning outcomes have a Q^2 value of 0.242 > 0; collaboration skills have a Q^2 value of 0.029 > 0; and communication skills have a Q^2 value of 0.033 > 0. These results indicate that the model in this study has predictive relevance.

C. *Hypothesis Testing*

Hypothesis testing on the SEM model with PLS aims to determine the effect of exogenous variables on endogenous variables. Hypothesis testing with the PLS SEM methoddone by doing the bootstrapping process with the help of smartPLS 3.3.3. The results of hypothesis testing are shown in Table 9.

TABLE IX. BOOTSTRAPPING OUTPUT OF RESEARCH HYPOTHESIS TEST RESULTS

	Original Sample Estimate (O)	*Sample Mean (M)*	*Standard Deviation (STD)*	*T Statistics (IO/STDEVI)*	*P Values*
Digital Literacy → Learning outcomes	0.645	0.653	0.067	9,668	0.000
Digital Literacy	0.234	0.268	0.098	2,397	0.017

	Original Sample Estimate (O)	*Sample Mean (M)*	*Standard Deviation (STD)*	*T Statistics (IO/STD EVI)*	*P Values*
→ *Collaboration*					
Digital Literacy → *Communication*	0.250	0.280	0.100	2,497	0.013

Source: processed primary data output

The explanation of the results of hypothesis testing in Table 9 is as follows.

1. Digital Literacy variable has a positive and significant effect on Learning Outcomes (t-count > t-table) = 9.668 > 1.967, p value 0.000. Based on the value of the original sample estimate, it is known that the effect of digital literacy on learning outcomes is 0.645, meaning that there is a positive and significant influence. The higher the Digital Literacy, the higher the Learning Outcomes.
2. Digital Literacy variable has no positive and significant effect on Collaboration (t-count > t-table) = 2.397 > 1.967, p value 0.017. Based on the value of the original sample estimate, it is known that the effect of digital literacy on collaboration skills is 0.234, meaning that there is a positive and significant effect. The higher the Digital Literacy, the higher the collaboration skills.
3. Digital Literacy variable has a positive and significant effect on Communication (t-count > t-table) = 2.497 > 1.967, p value 0.013. Based on the value of the original sample estimate, it is known that the effect of digital literacy on communication skills is 0.250, meaning that there is a positive and significant effect. The higher the Digital Literacy, the higher the communication skills.

The results of the t-statistical value based on Bootstrapping output can be seen in Figure 3.

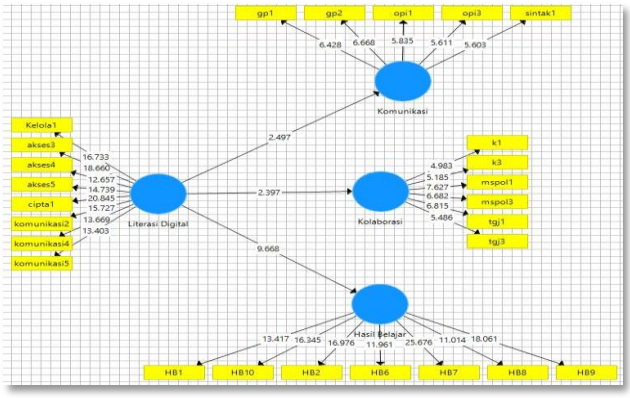

Fig. 3. Bootstrapping Output

VI. Discussion

A. *Digital literacy has a positive and significant effect on learning outcomes*

Based on the results of the study, it shows that digital literacy has a positive and significant influence on student learning outcomes. The results of this study are in line with the results of research by [10-11], [63-64] who concluded that digital literacy has a significant influence on learning outcomes. Students who have good digital literacy have better learning outcomes than students who have poor digital literacy [11], [63]. Digital literacy is the ability that a person has in utilizing information and communication technology to find, evaluate, create, and communicate information that requires cognitive and technical skills [6], [16-17]. Digital literacy also requires functional skills in order to be able to find and select relevant information, evaluate critically, be creative, collaborate with others, communicate effectively and still pay attention to aspects of electronic security and the socio-cultural context that develops in society [64]. Digital literacy applied in schools helps students to discover new things in learning. Students who are accustomed to carrying out literacy activities will improve their ability to read, interpret, and produce valuable texts in learning [65]. Students with good digital literacy skills will support their learning activities including they can access various literatures via the internet, find various credible information to complete their school assignments, and can assignments with various media so as to improve their learning outcomes.

B. *Digital literacy has a positive and significant effect on collaboration skills*

Based on the results of the study, it shows that digital literacy has a positive and significant influence on students' collaboration skills. However, digital literacy can only affect collaboration skills by 5.5% while the rest is influenced by other factors. The results of this study are in line with the research results of [66] which states that digital literacy is not an absolute determinant in the development of 21st century skills in students such as critical thinking skills, creative thinking skills, collaboration skills, and communication skills, but digital literacy can be a supporting factor in mastering 21st century skills that can be taught through schools.

C. *Digital literacy has a positive and significant effect on communication skills*

Based on the results of the study, it shows that digital literacy has a positive and significant influence on students' communication skills. The results of this study are in line with the results of research by [12], [67] which reveal that digital literacy has a significant effect on communication skills. Digital literacy means communicating effectively in a globalized world where much communication is mediated by digital technologies [68]. Digitally literate people are people who are critical and intelligent in using digital communication tools with the knowledge, skills and understanding to be able to choose the right format, tool and media to represent the meaning to be conveyed during communication. Digital literacy allows students to access and use the internet to share information and communication [67]. In addition, students who have good digital literacy will be able to find ideas to

communicate, participate, and share knowledge in the global era. Therefore students with good digital literacy will have good communication skills as well.

CONCLUSION

Based on the results of the study, it can be concluded that digital literacy has a positive and significant influence on communication skills, collaboration skills, and student learning outcomes. The higher the Digital Literacy, the higher the communication skills, collaboration skills, and student learning outcomes in the classroom.

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