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Student's higher-order thinking skills and collaboration skills in online learning during pandemic

Adilah Afikah[1], Eli Rohaeti[2], Jumadi Jumadi[1], Riki Perdana[3]
[1]Department of Science Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
[2]Department of Chemistry Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
[3]Department of Physic Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

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ABSTRACT

Higher-order thinking skills (HOTS) and collaboration skills are critical for all students, starting from early to senior high school. This study aimed to describe HOTS and collaboration skills in online learning according to gender, type of school, and grade level. This research was descriptive quantitative by explaining and comparing the results of the questionnaires given to students. The respondent of this study was 331 students who were obtained randomly from junior and senior high school in Indonesia. The results showed students' HOTS in online learning; the mean score of the students was 3.82 (moderate). While collaboration skills, the mean score of the students was 3.95 (moderate); collaboration skills domains are positively related to HOTS. According to gender, type of school, and education level, there was no significant difference between students' HOTS and collaboration skills. Based on these findings, teachers can teach to maximize learning, even though it was online, to improve HOTS and collaboration skills in online learning. This can also influence the policies to be taken by higher education to equip prospective educators to adjust themselves in providing learning to students in different conditions and situations.

Corresponding Author:

Eli Rohaeti
Department of Chemistry Education, Faculty of Mathematics and Natural Sciences,
Universitas Negeri Yogyakarta
Caturtunggal, Depok, Sleman, 55281 Yogyakarta, Indonesia
Email: eli_rohaeti@uny.ac.id

1. INTRODUCTION

In the 21st century, the world is experiencing rapid progress in various aspects of human life, including education. Therefore, education practitioners must have 21st century skills to master specific fields and have the thinking skills needed. The 21st century thinking skills are critical thinking skills, communication skills, collaboration skills, and creativity (4C), which are part of higher-order thinking skills (HOTS) [1]. In the current pandemic period, students need all these skills to understand information that dashes and follows the development of science. The coronavirus disease 2019 (COVID-19) pandemic has impacted all aspects, one of which is education. All groups, including teachers, students, and parents, are affected [2]. The government took the steps during the COVID-19 pandemic so that the learning process is not left behind, and students still have the right to gain knowledge by holding distance learning or an online system [3]. Students do not study at school. Teachers must be able to teach online, so teachers must be able to carry out an effective learning process at home [4].

There are many problems, challenges, obstacles, and difficulties in education during this COVID-19 pandemic [5]. Various solutions have been implemented, such as new policies and regulations regulating every aspect of online learning and guidelines to help teachers provide lessons for students when studying at home [6]. However, most of the existing solutions are still challenging to understand, let alone apply [7], so that during the online learning period, students do not get the expected learning outcomes in the curriculum [8]. With the increasingly complex challenges of today, each individual must be responsible for continuously developing knowledge, skills, and other abilities that can deal with existing problems [9]. As individuals and social beings face many situations, events, and events in life, including every element of education, especially students. In this case, making decisions, choosing, discussing, justifying, explaining, and giving suggestions are forms of cognitive processes that are carried out to survive and solve problems in situations, events, and events [10]. This cognitive process trains students' thinking skills to adapt to life, realize changes, and determine strategies that can help develop themselves. This forms systematic thinking for each student to be open to lifelong learning and achieve a high quality of life [11].

The facts show that the HOTS of Indonesian students aged 15 years *(Sekolah menengah pertama/*SMP*)* are still in the low category. The HOTS of these students may be the same when they are at the high school level if they do not get learning changes from various aspects. The results of a survey conducted by the Program for International Student Assessment (PISA) in 2018 showed that students' HOTS in Indonesia experienced a decline in all fields [12]. Currently, education in Indonesia has difficulty adapting to online learning, especially in improving the lag in HOTS [13]. To answer the challenges of today's problems, we are required to think at a high level, be knowledgeable, learn anywhere, and provide or share our knowledge with others, which is also the goal of education [9].

Students need to develop HOTS to solve problems in everyday life and make decisions because higher-order thinking is logical and reflective. HOTS are a combination of four abilities: the ability to solve problems, think creatively, argue, and make decisions. HOTS are Bloom's cognitive domain thinking skills revised by Anderson and Krathwohl into six levels, namely, knowledge, understanding, application, analysis, evaluation, and creation. The levels of knowledge, understanding, and application are lower-order thinking skills, while the levels of analysis, evaluation, and creation are HOTS [14]. HOTS can be the key to future success, so it is essential in education. By employing HOT, students can acquire and understand complex information; they can adapt in different ways to find new knowledge [15]. However, learning with HOTS requires intensive teacher guidance during direct or face-to-face learning [16].

One of the abilities that every individual, including students, must possess is collaboration. This is because collaboration skills involve individuals interacting with each other to continue developing [17], [18]. Collaboration in education is a group consisting of peers who gather to achieve positive goals such as developing understanding, being sensitive to change, and creating meaning from existing interactions. In collaborative learning, it requires strength, support, confidence, creativity, and a sense of responsibility from each individual in the group. By exchanging thoughts, knowledge, perspectives, and diverse experiences in discussions, as well as a sense of responsibility, students will be more motivated to achieve shared learning goals, and creativity can increase from planning change and designing solutions and strategies that are produced together [17], [19], [20].

A learning community shows better learning outcomes than individual learning outcomes. Collaboration in teams makes the experience important for others. They are required to master challenges that they may not overcome on their own, resulting in a feeling of competition [21]. Collaboration skills between students can optimize learning outcomes because they allow students to exchange information and ideas with their friends to improve their understanding of learning material [22]. A productive class during learning is essential; students can share and build knowledge together, learn by collaborating through social interaction [23]. The knowledge formed makes students able to design, investigate, and communicate the data and information they have so that learning becomes student-centered [24]. Collaboration allows people to do more together than alone, so collaboration can increase group reach and efficiency [25].

Collaborative learning can involve interaction between students; students and teachers; and students with social or professional communication by using access to online communication networks that can help the learning process. In this way, learning during the COVID-19 pandemic will continue to train students' collaboration skills and become even more comprehensive to get maximum learning outcomes [26]. Collaborative learning during the COVID-19 pandemic can provide more opportunities for students to bond positively and engage in reciprocal relationships to build collaboration in the classroom and school life from ideas gained in joint efforts. In learning activities, students' collaboration skills must be trained by teachers using multidirectional communication, which can foster positive attitudes in students, such as students being able to appreciate differences of opinion and differences of each individual [27].

Concern for students' HOTS and collaboration during a pandemic in online learning, it is necessary to conduct an independent survey to determine the extent to which students' HOTS and collaboration skills

are developing. Online learning that is carried out is certainly very different from direct learning, so it will significantly affect students' HOTS and collaboration skills. The research questions in this study are: i) What are the different students' HOTS and collaboration skills based on gender?; ii) What are the different students' HOTS and collaboration skills based on the type of school?; and iii) What are the different students' HOTS and collaboration skills based on grade level?

2. RESEARCH METHOD

This research was descriptive quantitative by explaining and comparing the results of the questionnaire given to students about what are the different students' HOTS and collaboration skills in online learning according to gender, type of school, and grade level during the pandemic. The sample in this study focused on students' perceptions of HOTS and collaboration skills in online learning during the pandemic. The purpose of this research was contained in the opening section of the questionnaire, which students filled out. The student sample in this study consisted of junior high school and senior high school students. The entire respondent was 331 students. Consisting of 135 students in grades 7, 8, and 9 of junior high school and 196 students in grades 10, 11, and 12 of senior high school from schools in Riau Province, Indonesia, who randomly and voluntarily filled out the questionnaire distributed by researchers. The questionnaire is packaged in a google form and distributed via WhatsApp broadcast to students. For comparison, the existing data was processed based on three categories: i) Gender, students are distinguished by male or female; ii) Type of school, students are distinguished by public schools and private schools; iii) Grade level, students are distinguished by junior high school (7, 8, 9) and senior high school (10, 11, 12).

In this research, the questionnaire used was a modified questionnaire based on previous research [28]. This questionnaire was developed to collect data on students' HOTS and collaboration skills in online learning during the pandemic. There are 19 items of student's HOTS and collaboration skills in learning. It is grouped in two domains. First domain is HOTS consist of 11 item and domain collaboration skills consist of eight items as presented in Table 1. All items were presented in a 5-point Likert scale (1-disagree, 2-rather disagree, 3-neutral, 4-rather agree, 5-agree).

Table 1. Instrument of students' HOTS and collaboration skills in online learning during the pandemic

Domain	Description	Item
HOTS	I am provided sample tasks or methods to help me understand what I'm supposed to do in a task.	1
	I critically evaluate my own (and others') work. (After a test I can check my answers with a mark scheme and understand what I did wrong).	2
	I have exhibited creative use of my knowledge. (E.g., I have designed a lab activity).	3
	I revisited and improved my assignment because I understood it better at a later step. (E.g., I submitted a second copy of my presentation as I had explained my topic better on it).	4
	I have participated in 'what if' discussions that require me to think beyond what I have covered in my class.	5
	I have participated in an activity that required me to tutor or mentor someone.	6
	I have participated in an activity where I considered and proposed alternatives.	7
	I am able to understand something abstract such as poetry or song.	8
	I have analyzed online case situations and reacted to the posts of their peers' case solutions.	9
	I got the chance to describe my work from my perspective/belief. (e.g., I presented my point of view about racial discrimination).	10
	I have used my knowledge to solve local problems and situations.	11
Collaboration skills	I have had the opportunity to take part in group activities.	12
	I have negotiated with my teacher or peers about something. (e.g., While we were writing an essay, we discussed and negotiated the word limit).	13
	I or my class has created grading rubrics with my teacher.	14
	I have received a grade simply for participating in an activity; like a discussion.	15
	I participate in collaborative and cooperative small group work (this would include: chat discussions; discussions with outside experts; small-group exercises; projects with multiple authors).	16
	I experienced that the process of collaborative work is as important as the final result. (e.g., in a group project I noticed my partner had made good contributions which raised the quality of the final work).	17
	During group work, my team shares with others what we are doing and we react to the progress or final products of other teams. (e.g., Group 1 posts, "hey we are on Q4" and you respond it that comment).	18

Based on analysis by using the Statistical Program for Social Science (SPSS) showed that the reliability of the instrument is high, where the Cronbach's alpha value was 0.859 and the item's validity is shown in Table 2. According to Table 2, all items of the instrument used are valid. Students' HOTS and collaboration skills in online learning were described in several aspects, including HOTS and collaboration skills in online learning, gender, type of school, and grade level. The questionnaire rubrics given are grouped as shown in Table 3. to determine the level of students' HOTS and collaborative abilities in online learning.

Table 2. Reliability and validity instrument

Item	Validity score	Description	Item	Validity score	Description
1	0.243	Valid	11	0.587	Valid
2	0.481	Valid	12	0.491	Valid
3	0.588	Valid	13	0.655	Valid
4	0.531	Valid	14	0.656	Valid
5	0.602	Valid	15	0.628	Valid
6	0.623	Valid	16	0.551	Valid
7	0.642	Valid	17	0.519	Valid
8	0.397	Valid	18	0.456	Valid
9	0.414	Valid	19	0.536	Valid
10	0.541	Valid			

Table 3. Rubric of questionnaire

Range	Level
x≤2.00	Very low
2.00<x≤3.00	Low
3.00<x≤4.00	Moderate
4.00<x≤4.50	High
4.50<x≤5.00	Very high

Data collection was carried out for one week since the questionnaire was the first broadcast. Every time students fill out the questionnaire, the data will be entered into Microsoft Excel, connected to the Google questionnaire form. Before the data is analyzed, the data is grouped and processed first in Microsoft Excel. Data analysis was performed using a quantitative descriptive method using SPSS statistics 25. Descriptive statistics such as frequency, mean, and standard deviation were used to describe the data obtained about students' HOTS and collaboration skills. In addition, linear regression analysis and comparative analysis of the multivariate analysis of variance (MANOVA) test were carried out by considering the assumptions of normality and homogeneity were declared valid to be used.

3. RESULTS AND DISCUSSION

3.1. Student's HOTS and collaboration skills in online learning

Table 4 shows the student's HOTS and collaboration skills in online learning. On the HOTS domain, the highest average indicator is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1), with a score of 4.53 (high). At the same time, the lowest indicator is "I have participated in an activity that required me to tutor or mentor someone" (item 6), with a score of 3.02 (moderate).

Table 4. Student's HOTS and collaboration skills

Item	HOTS mean	Description	Item	Collaborative mean	Description
1	4.53	High	12	4.37	High
2	4.29	High	13	4.23	High
3	3.33	Moderate	14	3.21	Moderate
4	4.06	High	15	3.79	Moderate
5	3.70	Moderate	16	4.35	High
6	3.02	Moderate	17	4.44	High
7	3.59	Moderate	18	3.42	Moderate
8	3.92	Moderate	19	3.83	Moderate
9	3.33	Moderate			
10	4.02	High			
11	4.11	High			
Overall: 3.82 (moderate)			Overall: 3.95 (moderate)		
SD: 1.08			SD: 1.02		

According to the collaboration domain, the highest average is item 17, "I experienced that the process of collaborative work is as important as the final result." with a score of 4.44 (high). At the same time, the lowest indicator is "I or my class has created grading rubrics with my teacher" (item 14) with a score of 3.21(moderate). Table 5 shows the students' HOTS and collaboration skills in online learning using the linear regression test.

Table 5. The students' HOTS and collaboration skills by using linear regression test

Model	Unstandardized coefficients		Standardized coefficients	t	Sig
	B	Std. Error	Beta		
(Constant)	1.334	0.154		8.674	0.000
Collaborative	0.628	0.038	0.669	16.313	0.000

3.2. Student's HOTS and collaboration skills in online learning based on gender

Table 6 shows the student's HOTS and collaboration skills in online learning according to gender. There are 89 male students and 242 female students in total. On the HOTS domain, the highest mean indicator for male students is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1)" with a score of 4.51 (high). At the same time, the lowest indicator is "I have participated in an activity that required me to tutor or mentor someone" (item 6), with a score of 3.20 (moderate). On the other hand, the highest mean indicator for female students is the same as males are (item 1), with a score of 4.54 (high). Moreover, the lowest indicator is the same with males are (item 6), with a score of 2.90 (low).

On the collaboration domain as presented in Table 6, the highest mean indicator for male students is "I experienced that the process of collaborative work is as important as the final result" (item 17), with a score of 4.27 (high). At the same time, the lowest indicator is "I or my class has created grading rubrics with my teacher" item (14) with a score of 3.26 (moderate). On the other hand, the highest mean indicator for female students is the same as males are (item 17), with a score of 4.50 (high). Moreover, the lowest indicator is the same with males are (item 14), with a score of 3.19 (moderate). Thus, HOTS and collaboration skills in online learning during the pandemic by gender with the highest average number were owned by female students.

To further obtain a better understanding, the MANOVA test was conducted to prove whether there were significant differences in students' HOTS and collaboration skills in online learning based on gender. There are significant differences in students' HOTS and collaboration skills based on gender, where the sig value is (0.000<0.05). Table 7 shows the significant differences in students' HOTS and collaboration skills in online learning based on gender.

Table 6. Student's HOTS and collaboration skills based on gender

Item	Male mean	Description	Female mean	Description
1	4.51	High	4.54	High
2	4.23	High	4.31	High
3	3.34	Moderate	3.33	Moderate
4	3.92	Moderate	4.12	High
5	3.70	Moderate	3.8	Moderate
6	3.20	Moderate	2.9	Low
7	3.65	Moderate	3.57	Moderate
8	3.58	Moderate	4.04	High
9	3.34	Moderate	3.33	Moderate
10	3.85	Moderate	4.07	High
11	4.04	High	4.14	High
12	4.26	High	4.44	High
13	4.05	High	4.29	High
14	3.26	Moderate	3.19	Moderate
15	3.89	Moderate	3.75	Moderate
16	4.13	High	4.43	High
17	4.27	High	4.5	High
18	3.57	Moderate	3.36	Moderate
19	3.84	Moderate	3.82	Moderate
Overall: 3.83 (moderate)			Overall: 3.89 (moderate)	
SD: 1.05			SD: 1.01	

Table 7. MANOVA test based on gender

Source	Dependent variable	Type III sum of squares	df	Mean square	F	Sig
Gender	Collaboration	0.223	1	0.223	0.419	0.127
	HOTS	0.351	1	0.351	0.280	0.191

The existence of gender differences has influenced several scientific studies from various disciplines. Gender is one of the dimensions that influence the conceptualization of processes in education. Gender differences affect individual attitudes and knowledge [29]. The existence of gender differences that

cause differences in achievement or achievement in education is the gender gap [30]. One of them is in terms of knowledge, namely HOTS, differences in biological growth, especially in terms of gender, are factors that can influence [31], [32]. Gender is related to the thinking, acting, and reasoning of a man and a woman [33]. HOTS by gender are based on language skills and problem-solving skills [10].

The results of this study showed that gender influenced students' HOTS, with the results of HOTS of female students having higher HOTS than male students, but the difference was not significant. This is by previous research [34] regarding students' HOTS based on gender, which focused on measuring thinking abilities, namely remembering, understanding, applying, analyzing, evaluating, and creating. The results showed that female students with insignificant differences owned female students' highest HOTS. In a different study [35], gender differences significantly affect students' HOTS. This is because male and female students have different basic skills; male have spatial skills while female students have collaboration skills. Students' HOTS in problem-solving are different [15]. Meanwhile, there is no effect of gender differences on students' HOTS [36].

HOTS as a thinking process aim to produce collaborative abilities with non-competitive efforts [10]. The results of this study found that gender influenced students' collaboration skills, with the average result of female students' collaboration skills being higher than male students, with no significant difference. This is explained in several studies showing female have faster and more vocabulary growth and can manage language better, while male have more difficulty managing language properly [37]. Female have superior linguistic and verbal abilities than male [38], [39]. Several studies have also found that female have more skills or better social behavior than male. This is because of the interaction effect [30]. From the results, the collaboration between students makes students practice more diligently in learning because they get enthusiasm from other students. By collaborating, students can appear brave in front of the class without fear, for example, giving and answering questions [40].

3.3. Student's HOTS and collaboration skills in online learning based on type of school

The student's HOTS and collaboration skills in online learning were described according to the type of school. There are 181 public school and 150 private school in total. On the HOTS domain as displayed in Table 8, the highest mean indicator for public school is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.52 (high). At the same time, the lowest indicator is "I have participated in an activity that required me to tutor or mentor someone" (item 6) with a score of 3.16 (moderate). On the other hand, the highest mean indicator for private school is the same with the public is (item 1) with a score of 4.54 (high). Moreover, the lowest indicator is the same with the public is (item 6) with a score of 2.86 (low).

Table 8. Student's HOTS and collaboration skills based on type of school

Item	Public mean	Description	Item	Private mean	Description
1	4.52	High	1	4.54	High
2	4.33	High	2	4.24	High
3	3.50	Moderate	3	3.14	Moderate
4	4.10	High	4	4.01	High
5	3.70	Moderate	5	3.70	Moderate
6	3.16	Moderate	6	2.86	Low
7	3.64	Moderate	7	3.54	Moderate
8	3.94	Moderate	8	3.89	Moderate
9	3.30	Moderate	9	3.37	Moderate
10	4.01	High	10	4.03	High
11	4.15	High	11	4.07	High
12	4.44	High	12	4.28	High
13	4.25	High	13	4.20	High
14	3.35	Moderate	14	3.04	Moderate
15	3.88	Moderate	15	3.68	Moderate
16	4.34	High	16	4.37	High
17	4.45	High	17	4.42	High
18	3.44	Moderate	18	3.39	Moderate
19	3.88	Moderate	19	3.77	Moderate
Overall: 3.91 (moderate)			Overall: 3.82 (moderate)		
SD: 1.06			SD: 1.07		

On the collaboration domain (Table 8), the highest mean indicator for public school is "I experienced that the process of collaborative work is as important as the final result" (item 17), with a score of 4.45 (high). At the same time, the lowest indicator is "I or my class has created grading rubrics with

my teacher" item (14) with a score of 3.35 (moderate). On the other hand, the highest mean indicator for private school is the same with the public is (item 17) with a score of 4.42 (high). Moreover, the lowest indicator is the same with the public is (item 14) with a score of 3.04 (moderate). Thus, HOTS and collaboration skills in online learning during the pandemic by type of school with the highest average number were owned by public school. Table 9 shows the significant differences in students' HOTS and collaboration skills in online learning based on the type of school.

Table 9. MANOVA test based on type of school

Source	Dependent variable	Type III sum of squares	df	Mean square	F	Sig
Type of school	Collaboration	.953	1	.953	2.820	.094
	HOTS	.660	1	.660	2.210	.138

Differences in the types of schools used as places of study by students influence students' HOTS and collaboration skills [41] which found that students attending private schools had HOTS that outperformed students in public schools. This is because private school students generally have better access to mobile learning than students in public schools. In addition, the existence of more adequate facilities and infrastructure makes students from private schools maximize learning. However, the results of this study are very different from the results of our study. From the results of research, it is found that students who study in public schools have HOTS and higher collaboration skills than students who study in private schools, but the difference is not significant. This is because, currently, state schools continue to provide adequate facilities and infrastructure for their students.

3.4. Student's HOTS and collaboration skills in online learning based on grade level

Students' HOTS and collaboration skills in online learning were described according to their grades. There were five students at grade 7, 56 students at grade 8, 74 students at grade 10, 50 students at grade 10, 58 students at grade 11, and 88 students at grade 12. The results can be seen in Table 10. In grade 7, the highest HOTS in online learning are "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.80 (high) and "I have constructed, built, or enacted something that is abstract in theory or idea. Like a poem or a song" (item 8) with a score of 4.80 (high) while the lowest mean is "I have analyzed online case situations and reacted to the posts of their peers' case solutions" (item 9) with a score of 3.40 (moderate). The highest collaboration skills are the "I have had the opportunity to take part in group activities" (Item 12) with a score of 5.00 (high) and "I participate in collaborative and cooperative small group work (this would include: chat discussions; discussions with outside experts; small-group exercises; projects with multiple authors)" (item 16) with a score of 5.00 (high) while the lowest is "During group work, my team shares with others what we are doing, and we react to the progress or final products of other teams (e.g., Group 1 posts, 'hey we are on Q4' and you respond it that comment)" (item 18) with a score of 2.60 (low).

In grade 8, the highest HOTS in online learning is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.57 (high). At the same time, the lowest mean is "I have analyzed online case situations and reacted to the posts of their peers' case solutions" (item 9), with a score of 3.17 (moderate). The highest collaboration skill is "I have had the opportunity to take part in group activities" (Item 12) with a score of 4.53 (high), while the lowest is "I or my class has created grading rubrics with my teacher." (Item 14) with a score of 3.36 (moderate).

In grade 9, the highest HOTS in online learning is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.47 (high). At the same time, the lowest mean is "I have participated in an activity that required me to tutor or mentor someone" (item 6), with a score of 2.83 (low). The highest collaboration skill is "I have had the opportunity to take part in group activities" (Item 12) with a score of 4.39 (high), while the lowest is "I or my class has created grading rubrics with my teacher." (Item 14) with a score of 3.16 (moderate).

In grade 10, the highest HOTS in online learning is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.51 (high). At the same time, the lowest mean is "I have participated in an activity that required me to tutor or mentor someone" (item 6), with a score of 2.92 (low). The highest collaboration skill is "I experienced that the process of collaborative work is as important as the final result. (e.g., in a group project I noticed my partner had made good contributions which raised the quality of the final work)." (Item 17) with a score of 4.62 (high) while the lowest is "During group work, my team shares with others what we are doing and we react to the progress or final products of other, teams. (e.g., Group 1 posts, 'hey we are on Q4' and you respond it that comment)" (item 18) with a score of 3.12 (moderate).

In grade 11, the highest HOTS in online learning is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.59 (high). At the same time, the lowest mean is "I have participated in an activity that required me to tutor or mentor someone" (item 6), with a score of 3.29 (moderate). The highest collaboration skill is "I participate in collaborative and cooperative small group work (this would include: chat discussions; discussions with outside experts; small-group exercises; projects with multiple authors)" (Item 16) with a score of 4.45 (high) while the lowest is "I or my class has created grading rubrics with my teacher" (item 14) with a score of 3.50 (moderate).

In grade 12, the highest HOTS in online learning is "I am provided sample tasks or methods to help me understand what I'm supposed to do in a task" (item 1) with a score of 4.52 (high). At the same time, the lowest mean is "I have participated in an activity that required me to tutor or mentor someone" (item 6), with a score of 2.80 (low). The highest collaboration skill is "I experienced that the process of collaborative work is as important as the final result. (e.g., in a group project I noticed my partner had made good contributions which raised the quality of the final work)." (Item 17) with a score of 4.55 (high) while the lowest is "I or my class has created grading rubrics with my teacher" (item 14) with a score of 2.91 (low). Table 11 shows significant differences in students' HOTS and collaboration skills based on grade.

Table 10. Student's HOTS and collaboration skills based on grade

Item	Grade			Item	Grade		
	7	8	9		10	11	12
1	4.80	4.57	4.47	1	4.51	4.59	4.52
2	3.80	4.25	4.36	2	4.26	4.37	4.26
3	4.00	3.48	3.28	3	3.38	3.44	3.15
4	4.40	4.16	3.88	4	4.10	4.17	4.05
5	4.60	3.70	3.80	5	3.80	3.80	3.60
6	4.20	3.32	2.83	6	2.92	3.29	2.80
7	4.40	3.61	3.38	7	3.86	3.71	3.49
8	4.80	3.68	4.04	8	3.82	3.91	3.98
9	3.40	3.17	3.18	9	3.36	3.31	3.56
10	4.60	3.88	3.74	10	4.08	3.95	4.31
11	4.60	4.09	3.92	11	4.18	4.17	4.18
12	5.00	4.53	4.39	12	4.36	4.44	4.17
13	4.80	4.17	4.16	13	4.30	4.41	4.13
14	4.40	3.36	3.16	14	3.18	3.50	2.91
15	4.20	3.82	3.64	15	3.94	4.00	3.65
16	5.00	4.25	4.23	16	4.40	4.45	4.39
17	4.60	4.18	4.43	17	4.62	4.36	4.55
18	2.60	3.41	3.42	18	3.12	3.79	3.39
19	4.20	3.84	3.68	19	3.76	4.02	3.84
Overall	4.33	3.86	3.78	Overall	3.89	3.98	3.83

Table 11. MANOVA test based on grade level

Source	Dependent variable	Type III sum of squares	df	Mean square	F	Sig
Grade	Collaboration	2.405	5	0.481	1.621	0.154
	HOTS	3.270	5	0.654	1.951	0.086

It was found that students' HOTS were increasing from each grade level [42]. For example, grade 8 students have better skills than grade 7 students with a significant difference. This is because learning at a higher grade level makes students more able to explore their reading, to listen, speaking, and writing skills. It is also found that there is no difference in collaboration skills between grades 10, 11, and 12. Student collaboration skills can be formed from the sense of concern that students have for other students. Students concerned with the circumstances around them will have a high value of collaboration skills. Students' collaboration skills can be trained in many school activities, such as classroom learning activities in the form of discussions to solve problems, completing assignments given in groups, learning activities outside the classroom in the form of participating in organizations and extracurricular activities [22].

These results are different from the findings in this study. HOTS and collaboration skills in students based on grades 7, 8, 9 junior high schools and 10, 11, 12 senior high schools are not fixed. Grade 7 students had HOTS on average than grade 8 and 9 students. Grade 9 students had the lowest average HOTS. Grade 11 students have higher HOTS on average than grade 10 and 12 students. Grade 12 students have the lowest HOTS average. Students have not been able to change their way of learning to hone HOTS when learning in class is getting more difficult. While the collaboration skills of students are like that because the higher the grade level of students, the more students focus on themselves.

Gender differences (male and female), different types of schools (public and private schools), and different grade levels (grades 7, 8, 9 junior high school and 10, 11, 12 senior high schools) caused differences in HOTS and collaboration abilities of students in each aspect, with insignificant differences. Students are expected not to make the differences in existing elements as an excuse to learn and not to maximize learning. In the current pandemic conditions, with online learning, students must maintain the spirit of understanding, explore their potential, and be serious in learning to have good HOTS. With the limited scope of learning that does not involve direct interaction between students, students are expected to be still able to interact optimally with other students. Students can interact through online communication to discuss with each other about learning conduct questions and answers so that students' collaboration skills can increase.

4. CONCLUSION

Overall, students' HOTS and collaboration skills are at a moderate level. Collaboration skills domains are positively related HOTS. There is no significant difference in students' HOTS and collaboration skills by gender. However, female students' HOTS and collaboration skills are higher than male students. There are no significant differences in students' HOTS and collaboration skills based on the type of school. However, public schools' HOTS and collaboration skills have a higher mean than private school. In addition, there are also no significant differences in students' HOTS and collaboration skills based on grade (7th, 8th, 9th and 10th, 11th, 12th).

The limitation of this study is measuring students' HOTS and collaboration skills in online learning in generally subjects. Further research can be carried out by measuring student's HOTS and collaboration skills in online learning in a specific subject and investigating the causes of students' low student's HOTS and collaboration skills in online learning not only at the middle to high levels but also the primary school level. It is hoped that the government, schools, teachers, and the community can continue encouraging online learning during the pandemic so that students' HOTS and collaboration skills can be improved.

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BIOGRAPHIES OF AUTHORS

Adilah Afikah is a Ph.D Candidate, Department of Educational Science, Graduate School, Universitas Negeri Yogyakarta, Colombo Street No.1 Yogyakarta, Yogyakarta 55281, Indonesia. Her research focuses on chemistry and science education. She can be contacted at email: adilahafikah.2021@student.uny.ac.id.

Eli Rohaeti is a Professor and Teacher Educator at Department of Chemistry Education, Universitas Negeri Yogyakarta, Colombo Street No.1 Yogyakarta, Yogyakarta 55281, Indonesia. Her research interests in chemistry education, higher education, 21st Century teaching and learning, polymer chemistry. She can be contacted at email: eli_rohaeti@uny.ac.id.

Jumadi is a Professor and Teacher Educator at Department of Science Education, Universitas Negeri Yogyakarta, Colombo Street No.1 Yogyakarta, Yogyakarta 55281, Indonesia. His research interests in physic education, science education. He can be contacted at email: jumadi@uny.ac.id.

Riki Perdana is a Ph.D. Candidate, Department of Physics Education, Graduate School, Universitas Negeri Yogyakarta, Colombo Street No.1 Yogyakarta, Yogyakarta 55281, Indonesia & Lecturer in Department of Physics Education, Universitas Negeri Yogyakarta, Indonesia. His research focuses on physics education. He can be contacted at email: rikiperdana@uny.ac.id.