STUDENT'S PERCEPTION OF THE ONLINE BASED CHEMISTRY LEARNING PROCESS

Salamah Agung[*1], Tita Pertiwi[2], Evi Sapinatul Bahriah[3]

[1, 2, 3] Chemistry Education, Faculty of Tarbiyah and Teacher Training, UIN Syarif Hidayatullah Jakarta

**Corresponding author: salamah.agung@uinjkt.ac.id*

Abstract. *The COVID-19 pandemic has changed the learning system in Indonesia to online-based learning. Students' perceptions need to be known to understand how students perceive online chemistry learning, especially during the pandemic. A quantitative method is conducted using a Likert-scale questionnaire of 25 items. The questionnaire is trying to explore students' perceptions on three dimensions, namely, material and teaching method, learning atmosphere and environment, and social interactions. Respondents are 385 students of the science program at two public schools in Ciamis regency. The results showed that in general, the majority of students (>50%) perceive online chemistry learning positively, especially with regard to material and teaching method and learning atmosphere and environment. However, the dimension of social interaction is found to have more negative responses (>80%) than positive ones. This is apparent in the communication and interaction between students and their teachers and peers. From this study, it is concluded that while online learning seems to be relatively accepted and prepared by students, the social interactions of students need to be seriously considered as they may affect students' mental health and well-being. Further research is therefore recommended to explore more the extent to which mental health and well-being influence students' performance in online learning.*

Keywords: *Chemistry Learning, Online Learning, Perception, Students.*

INTRODUCTION

The Covid-19 pandemic has dramatically changed the way people work. First detected in December 2019 in Wuhan, Covid-19 made the whole world must take responsive action. One of the areas influenced by this pandemic is education. UNESCO in April 2020 recorded data that at least 1,576,021,818 students or about 91.3% of the total students in 188 countries around the world have been affected by Covid-19. The huge adaptation in educational practices includes the change of a learning method from regular face-to-face teaching to online teaching, the need to have internet access, and the ability to operate devices for online learning [1]. Most countries apply social distancing, mandatory mask-wearing, and the grouping of students into smaller cohorts [2].

Online learning was not part of the daily routine for the majority of schools before the COVID-19 disruption. Teachers around the world had to adapt their teaching to use different modes and methods. Such adjustment requires an investment in time spent on lesson preparation and other work-related tasks [1] to ensure that the objective of learning is not diverted. Students on the other hand face challenges during online learning. Students' access to the internet, learning resources, and digital devices are common obstacles find by students [1][3]. In addition, students also find it difficult to search for support from peers, their teachers, and families [1][4].

The online learning approach, especially in chemistry, faces more challenges than in other subjects [3]. Learning chemistry is always associated with group discussion, working on a calculation that requires interaction between students, interaction with teachers and facilitators, and direct experiences in doing chemistry experiments. Those activities are hardly conducted in an online learning approach.

The impact of Covid-the 19 pandemic is also faced by the Indonesian government. On March 24, 2020, the Minister of Education and Culture of the Republic of Indonesia issued Circular Letter Number 4 of 2020 concerning the implementation of education during the emergency spread of Covid-19. This letter addresses schools to be conducted remotely. As for the learning content, the letter encourages students to be given beneficial learning without necessarily achieving the curriculum objectives. Learning is focusing more on the understanding of Covid-19 to create more awareness on the outbreak. In addition, learning activities should consider the availability and accessibility of online learning tools students can access [5].

Government policies changes over the time. During the two years of this pandemic, students and teachers have been more adaptive with the situation. However, teaching and the learning process remains unstable up to now. Whilst implemented, a face-to-face teaching remains limited with duration and interaction. Science experiments are still searching for the best scenario to give students real experiences. Hybrid learning and virtual labs are the most feasible scheme to provide students with experiments.

Naturally, chemistry learning has unique characteristic in its implementation. Rooted in an inquiry-based learning approach, learning chemistry has found to be equipped with sufficient time, facilities, and competence human resources [6]. When all these necessary supports are limited or not existing, learning chemistry will not achieve favorable objectives.

Indonesia is a country of thousand islands where technology gap among students in different islands is huge. Students in rural areas, for example, may not have access to technology and online learning is hardly implemented. For students in big cities, technology has been considered as their living and thus they are easy to adapt learning to an online approach. Ciamis is one of the regencies that is considered to have considerably well access to technology. With around 1,237,726 million inhabitants, Ciamis regency has 17 public senior high schools that serve around 1991 students [7]. Public schools in general are expected to have minimum standards provided by the government. These include technology access, and teachrs' competencies. A public school in Indonesia is most benefit to have best students' input [8]. However, with considerably low cost for eduational fee, public schools cannot afford to equip themselves with higher standard of educational facilities.

Considering the above situation, this research is aimed at exploring students' perception of online learning in chemistry classes. Studying their perception is beneficial especially when the new teaching method or approach is implemented. Students' perception provides helpful and authentic information on their expectation and experiences [9]. This perception is important particularly to understand how well the students think the chemistry online learning in terms of teaching material and methods, learning atmosphere and environment, and social interactions.

METHOD

This study is part of a quantitate research in which quantitative questionnaire is used and administered to 385 students from two public senior high schools in Ciamis regency. The questionnaire was adapted from Fortune et al [10][11]. The study undertakes three stages, namely, initial, implementation, and final stages. The initial stage is aimed at developing a valid questionnaire. The main questionnaires from the two sources are first reviewed, translated, and adapted for the context of the study. The questionnaire consists of three dimensions, namely, teaching material and methods, learning atmosphere and environment, and social interactions. Likert-scale items are developed in which four scales are anchored by strongly agree to strongly disagree. Compared to open-ended questions, Likert-scale questions are easier to administer and analyze [12].

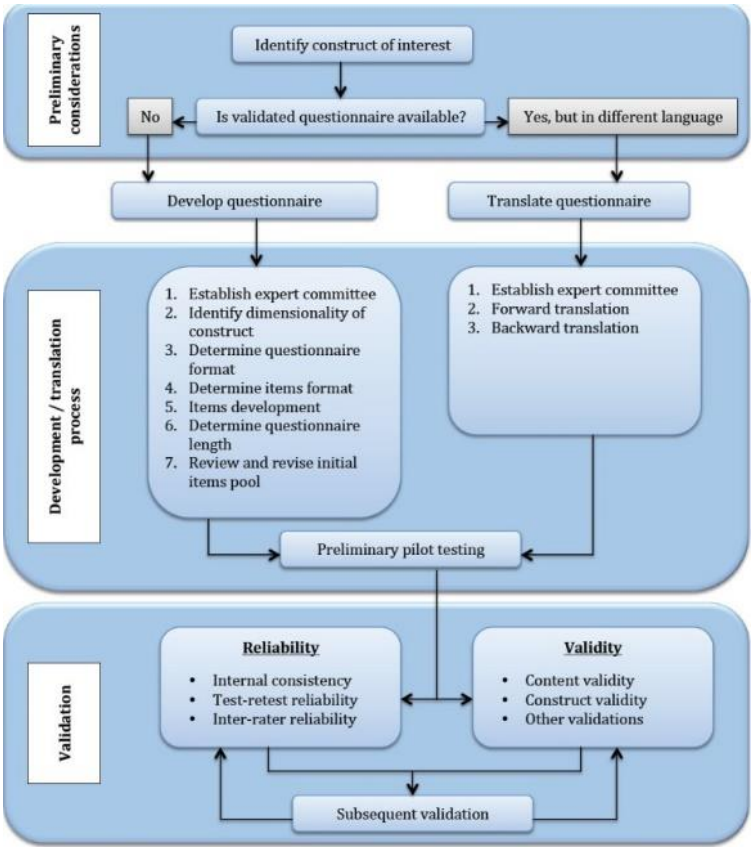

Figure 1. Questionnaire development and translation process [12]

The first draft of the questionnaire contains 42 items, and it is ready for a content validity. The content validity is conducted to make sure that statements made in the items are relevant and in line with the defined dimensions and indicators [13]. Furthermore, the content validity also ensures that the English to Indonesian translations of the items is appropriate. Two lectures of chemistry education serve as the content validator. Very minor revision on the items is followed according to comments from the validators. The items are then reviewed and structured to become a final draft of the questionnaire. An empirical validity and reliability test of the final items of the questionnaire is then conducted by piloting the questionnaire to 65 students with similar characteristics of the targeted students of the study. As much as 25 (twenty-five) valid and reliable items are then recapped to form a final and fixed questionnaire. The questionnaire is put in a google form. The google form is chosen due to its easy use and access by the students [14]. Besides perception items, the form contains an introduction in which a consent form is described for students to understand. Furthermore, items reflecting the profile of the students, such as, name, gender, grade, and name of school, are also added to the form. Once the form is put in the google form it is ready to be administered.

Table 1. Dimension and indicators of the questionnaire

Dimension	Indicator	Item Number	Total Number of Item
Learning material and methods	1. Learn the subject matter better	1,2,3,4,5,6	6
	2. Presentation of material in a special format makes it easier to meet learning needs	7,8,9,10	4
	3. Study materials support students'	11,12,13	3

	learning abilities		
Learning atmosphere and environment	1. The learning environment helps to understand the learning material	14,15, 16	3
	2. Educators or teachers understand the online learning environment and help facilitate the learning process	17	1
Social interactions	1. The online class environment makes it easy for me to communicate with classmates	18,19	2
	2. The online environment makes it easy to interact with teachers	20,21, 22,23	4
	3. Working in groups in online class helpsclassesearn the subject matter	24,25	2

Some examples of items are:

Teachers always use different learning method for students to better understand the chemistry concept (**Teaching material and methods**)

1	2	3	4

Strongly Disagree Strongly agree

I have more confident when learning is conducted online (**Learning athmosphere and environment**)

1	2	3	4

Strongly Disagree Strongly agree

Online learning makes students-teacher interaction easier (**Social interactions**)

1	2	3	4

Strongly Disagree Strongly agree

The second stage, which is the implementation stage, involves the administration of the questionnaire. The google form link is sent to the 385 targeted students. The students come from science program and have experienced in an online chemistry learning for at least two semesters. Teachers of the targeted students helped to share the link to the students during chemistry class, provide time for the students to fill in the questionnaire, and ensure that their students fill in the questionnaire completely. Having this supervision, all the targeted students can finish the questions.

The final stage is the analysis stage. Data from the google form is descriptively analyzed. Data of students' responses is tabulated in percentage. The highest rate defines a positive response, while the lowest percentage shows the negative responses or trends [15].

RESULTS AND DISCUSSION

Twenty-five items of the questionnaire measure the extent to which students perceive online learning method in online chemistry classes. Three dimensions are defined to understand students' perceptions including dimension of materials and teaching methods, atmosphere and learning environment, and social interactions. The result of each dimension is presented below followed by discussion.

Dimensions of Materials and Teaching Methods

Table 2 provides the results obtained from students' responses on the dimension of materials and teaching method. As seen from the table, in general most students (more than 50%) agree and strongly agree with every item concering this dimension. What is interesting about the data in this table is that items 5 and 6 are shown to have most students in disagreement (more than 50%). These two items have negative statements in which disagreement has in fact a perception. The statements in the items are:

No. 5. I feel learning chemistry through online is difficult

1	2	3	4

Strongly Disagree Strongly agree

No. 6. I hardly understand the chemistry concept when it is delivered online

1	2	3	4

Strongly Disagree Strongly agree

Another interesting result is found in item 10. Even though those who responded to the items in this dimension agreed with statements, their responses on item 10 seem to be equal between those who agree and strongly agree, and disagree and strongly disagree, 52% and 48% respectively. This item contains statement about the benefit and wider knowledge students gain with online learning.

The most striking percentage of agreement is seen in item number 2 and number 8, 76% and 77% respectively. Item number 2 asks students' perception of their understanding on chemistry concept when learning it online and item number 8 asks about the use of students' worksheet that helps them understand the chemistry concept while doing online learning.

Table 2. The Percentage of Students' Responses on Items Related to Materials and Teching Methods

Indicator	Item number	Percentage of response				Total responses
		Strongly Agree (SS)	Agree (S)	Disagree (TS)	Strongly Disagree (STS)	
1. Learn the subject matter better	1	54 (14%)	155 (40%)	144 (37%)	32 (8%)	385 (100%)
	2	100 (26%)	194 (50%)	81 (21%)	10 (3%)	385 (100%)
	3	56 (15%)	206 (54%)	90 (23%)	33 (9%)	385 (100%)
	4	38 (10%)	207 (54%)	113 (29%)	27 (7%)	385 (100%)
	5	34 (9%)	105 (27%)	152 (39%)	94 (24%)	385 (100%)
	6	51 (13%)	120 (31%)	149 (39%)	65 (17%)	385 (100%)
2. Presentation of material in a special format (students' worksheet or LKPD) makes it easier to meet learning needs	7	53 (14%)	220 (57%)	106 (28%)	6 (2%)	385 (100%)
	8	78 (20%)	219 (57%)	82 (21%)	6 (2%)	385 (100%)
	9	25 (6%)	197 (51%)	132 (34%)	31 (8%)	385 (100%)
	10	66 (17%)	135 (35%)	160 (42%)	24 (6%)	385 (100%)
3. Study materials support students ability to learn	11	115 (30%)	147 (38%)	95 (25%)	28 (7%)	385 (100%)
	12	83 (22%)	178 (46%)	104 (27%)	20 (5%)	385 (100%)
	13	106 (28%)	159 (41%)	97 (25%)	23 (6%)	385 (100%)

Dimension of learning atmosphere and environment

Table below states a summary of percentage of the students' responses on items related to dimension of learning atmosphere and

environment. From this table, it is apparent that more than 70% of students agree and strongly agree with all the statements. This indicates that students perceive online learning as a helpful atmosphere and environment for them to study chemistry. They also feel their teacher is helpful in facilitating students' learning process using online approach.

Table 3. The Percentage of Students' Responses on Items Related to the Learnaing ALearning and Environment

Indicator	Item number	Percentage of response				Total responses
		Strongly Agree (SS)	Agree (S)	Disagree (TS)	Strongly Disagree (STS)	
1. The learning environment helps to understand the learning material	14	95 (25%)	185 (48%)	100 (26%)	5 (1%)	385 (100%)
	15	101 (26%)	212 (55%)	52 (14%)	20 (5%)	385 (100%)
	16	91 (24%)	209 (54%)	73 (19%)	12 (3%)	385 (100%)
2. Teachers understand the online learning environment and help facilitate the learning process	17	105 (27%)	181 (47%)	71 (18%)	28 (7%)	385 (100%)

Dimension of social interactions

Table 4 presents the results of students' responses on items related to social interactions. It can be seen from the table that five out of eight items in this dimension are responded negatively by the students. Students mostly disagree and strongly disagree (more than 70%) with all the statements concerning the online class environment that make easy communication with their peers. Similar result is also shown with statements on the online working group that helps them better learn. Most students (more than 80%) disagree and strongly disagre with this statement.

However, it is interesting to see how students disagree with online method that makes them easy to communicate and interact with teachers (more than 80% on item 22). Students also perceive negatively or disagree with working in groups during online learning can develop students understanding of the subject. Two items in this indicator are negatively perceived (more than 80% of the students disagree and strongly disagree).

Table 4. The Percentage of Students' Responses on Items Related to Dimension of Social Interactions

Indicator	Item number	Percentage of response				Total percentage
		Strongly agree (SS)	Agree (S)	Disagree (TS)	Strongly disagree (STS)	
1. The online class environment makes it easy for me to	18	25 (6%)	77 (20%)	192 (50%)	91 (24%)	385 (100%)
	19	5 (1%)	139 (36%)	178 (46%)	63 (16%)	385 (100%)

communicate with classmates						
2. The online environment makes it easy to interact with teachers	20	127 (33%)	190 (49%)	56 (15%)	12 (3%)	385 (100%)
	21	101 (26%)	208 (54%)	69 (18%)	7 (2%)	385 (100%)
	22	2 (1%)	75 (19%)	148 (38%)	160 (42%)	385 (100%)
	23	73 (19%)	189 (49%)	103 (27%)	20 (5%)	385 (100%)
3. Working in groups in online class helps students learn the subject matter	24	4 (1%)	37 (10%)	186 (48%)	158 (41%)	385 (100%)
	25	0 (0%)	55 (14%)	174 (45%)	156 (41%)	385 (100%)

DISCUSSION

During the covid-19 pandemic situation, decision regarding education and many other emergency policies were made by both the national and state level. This decision brings about many problems for education as it is issued all at a sudden when no one is ready to a fast response. Online learning has been the sole solution for education to run. Chemistry is one of subject matters that affected significantly when online learning is conducted. This is because the unique charateristics of chemistry in which students are encouraged to develop their scientific thinking and skills through direct experience doing chemistry experiments. Such skills will be well developed when learning is conducted face-to-face and through hands-on activities. This study is aimed at understanding students' perception of online learning in chemistry classes. Their perception can be considered as feedback for which online learning be improved for future study. Feedback has a powerful influence on student learning [9].

According to the results of this study, it is found that students have different perceptions with regards to all indicators in the online learning. Some indicators are perceived positively, and the others are perceived negatively. Positive perceptions are given by the students for all statements related to dimensions of materials and teaching method. This implies that online learning has been accepted by the students and thus they feel that materials and teaching method provided during the online learning are sufficient to make them learn. This may be because students have spent at least one and a half year dealing with online learning and they are now finding their best way with the online learning. Teachers also find their best support for their students after passing through a difficult two-year of remote learning.

As for learning mosphere and environment, students' perceptions are very positive. Students feel comfortable with the online learning, and they think that their teachers have sufficient knowledge and understanding on the online learning issues and thus they can facilitate students learning. This finding broadly supports the work of Fortune in which online learners would rather prefer to take online classes. They have experienced that such classes make them learn best. Furthermore, students perceive teachers who teach in online learning have satisfactorily understanding about online environment and thus they make learning easy [11].

With regards to social interactions, this study revealed more negative perceptions for online chemistry learning. Interaction and communication support during instruction is highly needed by the students. However, such suppor is not accomodated in the online learning. Students of this study seem to prefer face-to-face classess. This can be seen from their attitude that put higher consideation on the interactive modality and instructional support [16]. Students feel it is challenging to

communicate and interact with both teachers and peers. Yet, communication is essential in learning process as it can develop many important skills.

Communication and interaction are related to social-emotional aspect of students. Online learning needs to ensure that social-emotional experiences of the students should establish a healty relationships between students and their peers and students and their teachers [17]. According to Vaillancourt [17], "learning happens in relationships, and healthy relationships promote optimal development" (p. 81). However, this result is contradictory with the research of Fortune [11] who found that online learning makes communication between teachers and students is easy to conduct.

Further on the social interactions is the need to mattering oneself, meaning that students see themselves as significant to others. A student when he or she matters to others tends to experience better mental health and psychological well-being than the one who feels that he or she does not matter to others [18]. This study revealed that during online learning, commnication and interaction between students and their peers and students and their teachers is hardly established. When students do not matter or matter less to others, they may feel demotivated.

CONCLUSION AND SUGGESTION

A questionnaire on students' perception of online learning in chemistry has been distributed to 385 students of science programs from two public senior high schools in Ciamis. Three dimensions of the perception is measured, namely, teaching material and methods, learning atmosphere and environment, and social interactions. This study revealed that students have the most positive perceptions on both teaching material and methods and learning mosphere and environment. On the other hand, more negative perceptions are shown in the dimensions of social interactions. It is therefore concluded that while students may have adapted with the online learning and found the best part to learn chemistry online, they still find it difficult to develop better communication and interaction with their peers and students. Online communication and interaction seem to hinder students' social interactions, and this may lead to their mental health and pscychological well-being. Further research is therefore needed to measure the extent to which students' mental health and psychological well-being are affected by covid-19 as it changes the way students deal with their teaching and learning process. This study contributes to the practice of education particularly when online learthe ning method is applied. Teachers need to understand what students perceive and expect on an online learning process to develop better supports for the students.

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