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ANALYSIS OF STUDENTS' CRITICAL THINKING SKILLS BY APPLYING FLIPPED CLASSROOM LEARNING MODEL BY USING POWTOON APPLICATION ON THE TOPIC OF SALT HYDROLYSIS

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ABSTRACT

This study aims to determine students' critical thinking skills by applying flipped classrooms using the Powtoon application on the topic of salt hydrolysis. This study, which included 36 participants—15 men and 21 women—used a descriptive methodology and was carried out at one of Jakarta's public high schools. The instrument used was an observation sheet to observe the flipped classroom model's learning process, critical thinking skills tests, reflective journals, and depth interviews. The flipped classroom method entails four steps: pre-class by studying independently and providing stimuli. In-class by fostering critical thinking; and post-class by evaluating. Combining asynchronous and synchronous activities was the process. Students learn independently during the pre-class stage by answering pre-learning questions and watching videos. During the class phase, Zoom meetings are used for synchronous learning to discuss salt hydrolysis applications in particular contexts. Discussion assignments on the salt hydrolysis case help students learn asynchronously after class. The study results showed that the flipped classroom using the Powtoon application can be an alternative for distance learning and can influence the students' critical thinking at a very good level. It also helps them be more active and critical in learning, like exchanging opinions with others and doing assignments on the topic of salt hydrolysis.

Keywords: *Powtoon, Critical thinking, Flipped classroom, Salt hydrolysis*

INTRODUCTION

Education always develops along with the times. Currently, education is hampered due to the Corona Virus Disease (Covid-19) that has appeared since 2019 and spread worldwide. It impacts various fields, such as education, that challenge the teacher to present innovative and varied learning [1]. To make distance learning enjoyable and high-quality, teachers must pay attention to variations in learning activities when using

learning models and distance learning platforms [2]. Additionally, the Ministry of Education and Culture announced that all teachers must enhance their instructional strategies to keep students motivated to learn, even though distance learning to organize the learning process during this emergency period. The flipped classroom model, a blended learning type, is a substitute for implementing distance learning. The term "classroom flip" to describe the flipped classroom model [3]. This flipped classroom model was initially designed to combine face-to-face and online activities in reverse [1]. The teacher's media were used for online concept delivery activities, and face-to-face activities were filled with application discussion [4]. the term "inverting the classroom", was introduced in 2000 with the same concept as the flipped classroom [1].

The flipped classroom is a pedagogical strategy that gives students a chance to study on their own before meeting in class face-to-face [5]. Thus, in face-to-face learning, teachers and students interact more to help students solve learning problems and improve learning quality. The use of the flipped classroom model has been demonstrated in many studies to improve students' thinking abilities and comprehension of concepts [3,6,7]. This model also affects students' non-academic outcomes, such as learning mastery, interest and curiosity [8], and learning motivation [9-10]. The flipped classroom's advantages are that students are more active, creative, independent, critical of their approach to problems, and open to new experiences [11].

A learner's activeness can be observed when they actively ask questions, search for information from various sources, work on tasks, deal with issues, and train and evaluate themselves. It follows 21st-century skills. Critical thinking is one of the 21st-century skills that students must deal with. [12-13]. Thinking skills are divided into two, namely Higher Order Thinking Skills (HOTS) and Low Order Thinking Skills (LOTS). One aspect of higher-order thinking skills is critical thinking skills [14]. Therefore, critical thinking skills are very important for students to have. But according to data from the International Student Assessment (PISA), Indonesian students still need to improve their critical thinking abilities. [15]. However, based on the results of researchers' observations during practical teaching for pre-service teachers at a public high school in Jakarta, students in 10th grade have critical thinking skills at a fairly good level but still need to be developed. One learning model that can improve students' critical thinking skills is the flipped classroom, even during pandemic situations, by distance learning [16]. Students can participate in activities inside and outside the classroom, such as understanding the concept and studying, as well as in-class activities like completing assignments, discussing concept that has not been understood, and solving problems [17]. As a result, this model can potentially address critical thinking issues [18].

The availability of the internet and other instructional resources is necessary to facilitate the flipped classroom process. The Powtoon application presents content presentations or presentations with videos displays that contain a variety of animations to

inspire students to be more enthusiastic about learning [19]. Therefore, the experience can be improved and more enjoyable using images and videos. The application has many features, including cartoon animation, handwriting, transition effects, and timeline arrangement, that are easy enough for users to use to make animated videos [20].

Salt hydrolysis was used in this study because students consider this topic quite difficult [21]. By using the Powtoon application in the flipped classroom learning model, students will find it easier to understand the concept [22]. Otherhand this topic was chosen because it fits the model learning environment in that it includes activities typically done in class. Because it is quite hard to understand by yourself, the teacher can explain the concept of salt hydrolysis by watching videos at home [1]. Based on the problem's identification, this study examines students' critical thinking abilities using flipped classroom learning models and the powtoon application of salt hydrolysis. Therefore, this study can observe the process of the flipped classroom model and learn about students' critical thinking abilities through Powtoon applications on the topic of salt hydrolysis.

METHODS

Descriptive research was used in this study. This method describes or analyzes research results [23]. This approach aims to provide a comprehensive and in-depth description of students learning activities and to carry out the Powtoon application on salt hydrolysis material to determine the critical thinking skills of students in flipped classrooms learning model.

Research Design

The research design can see completely below: see Figure 1.

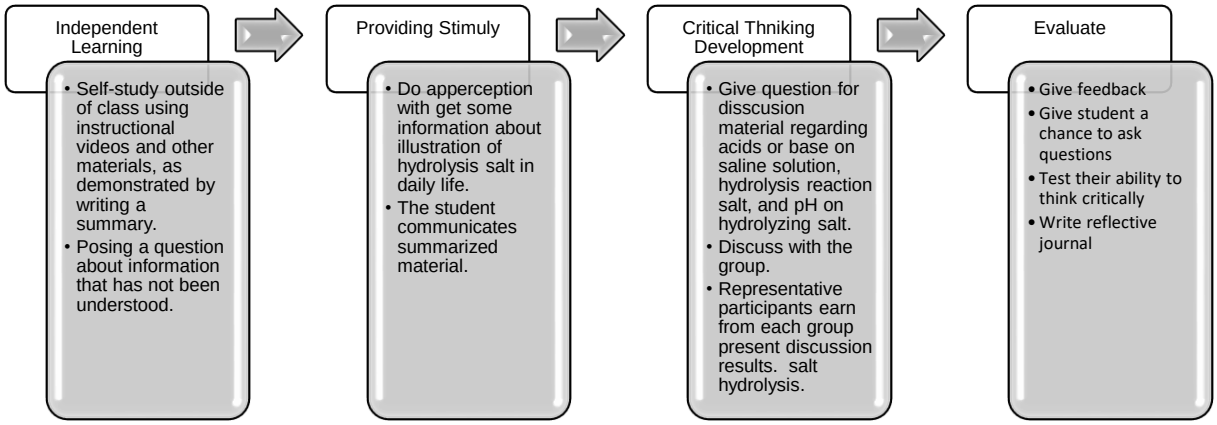


Figure 1. Research Design of Flipped Classroom Model by Bishop and Verleger [24].

Participants

This study was conducted on 36 grade 11 students consisting of 15 male students and 21 female students at a public high school in Jakarta during the even semester of the 2020/21 academic year.

Instrument

Data were gathered using observation sheets, in-depth interviews, reflective journals, and critical thinking tests. An observation sheet was used to observe how the flipped classroom model was running

while learning about salt hydrolysis. Two observers observed the teaching process. The semi-structured interview method aims to obtain students' perspectives and ideas in greater depth without relying on alternative responses from researchers. Interviews regarding students' critical thinking skills on salt hydrolysis following the flipped classroom learning process can be seen in Table 1.

To measure students' critical thinking ability, the test was taken to gauge their critical thinking abilities after they had completed the process of learning about salt hydrolysis. The critical thinking test questions are made by changing the pointers in SCIT 1020; what's more, they are made toward the end of the growing experience. Based on critical thinking indicators, the results of ability tests are processed and analyzed. The critical thinking indicators used in this study are a. Identify the question at issue; b. Conceptual understanding; c. Idea Connection; d. Assumption; and e. Inference. The critical thinking test instrument was validated by several experts in the fields of chemistry and educational evaluation. An example of the question used in the interview and critical thinking test can be seen in Table 1.

Table 1. The Interview questions about The Flipped Classroom Process and Students' Critical Thinking Ability on The Topic of Salt Hydrolysis and Critical Thinking Test

	The Flipped Classroom Process Interviews	Students' Critical Thinking Ability on Salt Hydrolysis Interviews	The Critical Thinking Test
The Questions	• *Have you ever heard of or know about the model flipped classroom learning?* • *Do you think the flipped classroom learning model helps you understand the learning process?* • *Do you prefer the flipped learning model classroom to other learning models? Explain!* • *What are the advantages and disadvantages of the flipped classroom learning model?*	• *Please share your knowledge of salt hydrolysis!* • *Describe your knowledge of a solution salt's basic or acidic properties!* • *How can a salt solution be identified as acidic or base? Give an instance!* • *Did you know that there are salts that have been partially, completely, or completely not hydrolyzed during the hydrolysis reaction? Explain!* • *Can you provide a precise formula for determining a salt solution's pH?* • *Make sense of how you decide the pH of a salt arrangement! Demonstrate it with models!* • *Give three examples of salt that are frequently used daily.*	*One of Critical Thinking Test Questions:* *NaCN is a salt that can be utilized in the gold mining because of its high reactivity with metal. This salt compound is alkaline and partially hydrolyzed when dissolved in water.* *a) Why is NaCN alkaline and partially/fully hydrolyzed? Use the process of salt hydrolysis to demonstrate and explain!* *b) The salt compound NaCN's potential pH value is unknown.*

Analysis

This study used qualitative data analysis methods from Miles, Huberman, and Saldana [25]. First, the data were analyzed qualitatively and described in a comprehensive account of the flipped classroom model process. Then, the data obtained are grouped into categories that lead to research objectives and presented in graphical form, and conclusions are drawn based on the data processing results. Data analysis consists of data reduction, data presentation, and conclusion. Then, we used various methods, such as member checking,

persistent observation, prolonged engagement, and persistent subjectivity, to ensure that the data were accurate.

RESULTS AND DISCUSSION

The flipped homeroom is an educational procedure that allows understudies to concentrate all alone before meeting in the class eye to eye [5]. As a result, students and teachers interact more in face-to-face instruction to assist students in resolving learning issues and enhancing learning quality. Several studies have shown that the flipped classroom model improves students' thinking skills and understanding of concepts [3,6,7]. In addition, the flipped classroom also affects students' non-academic outcomes, like learning mastery, interest and curiosity [8], and learning motivation [9-10]. The data obtained during the research can be explained as follows:

Implementation of the Flipped Classroom Learning Model

This study uses the flipped classroom learning model by following three stages, before-during-after class activities. The following is an analysis of the implementation of the flipped classroom learning process and how the students' critical thinking skills at each stage were developed:

Independent Learning

The independent learning stage is carried out by students at home and outside the classroom using learning videos made by the teacher and other teaching materials. For example, one of the teaching materials using google classroom can be seen below in Figure 2.

Figure 2. Teaching Materials in Google Classroom.

Learning videos are made using Powtoon, so students are more interested in the presented topics. Student interest was shown at the first meeting, students were already interested in learning videos and were more enthusiastic about learning the concept. Findings from the following reflective journals and student interviews indicate that they find video-based learning interesting and fun.

"*Learning is fun when you see the learning videos provided*."
(Reflective student journal 31, 17 February 2021)

"*Today's lesson was good enough because the teaching, presentation, and videos were clear and understandable*."
(Interview of students 20, 21 February 2021)

Studying using videos from the powtoon application makes students interested in watching the video, makes students more enthusiastic about learning the content and is expected to encourage participants to educate in developing critical thinking skills. [26] reported that its features provided a comprehensive, engaging, and interactive display for quickly and easily creating animated media presentations and

videos. Figure 3 depicts the front view of the video made with the Powtoon application.

Figure 3. Display of Videos with the Powtoon app

Students must also compose a summary based on the studied concept when learning independently. Before learning begins, students gather these summaries in Google Classroom. It is intended that students already understand the concept before learning it in class or at school, and the summary can be reviewed during lessons or tests. As a result, students are better prepared to take part in learning. In addition, due to the teacher's inadequate teaching materials, students are directed to learn the concept from various sources. This topic aims to challenge students to seek information from various reliable sources, including books, online articles, YouTube, and other sources, to help them improve their critical thinking skills. Based on the interview about do they use any resources to find out about the concept of chemistry can see below:

"I don't just use one source to ascertain whether the information from that source is correct or not."
(Interview of students 6, 21 February 2021)

From the interview excerpt above, students do not only use one source in studying the material to ascertain whether information from that source is reliable. It shows students can process information well and identify material using several sources. In this case, students are developing independence and critical thinking skills on problem identification indicators and making conclusions [27].

Giving Stimulus

The stage of providing students with stimulation so that they can actively participate in learning is known as the stimulus-giving stage. The observer makes the following observations based on their observations of the learning process:

"There is motivation given by the teacher to students so that students participate actively in learning."
(Observer note 1, March 10, 2021)

Based on observer 1's notes, giving motivation can make students actively participate in learning. After flipped classroom learning, students have motivation, and satisfaction in learning, and continue to learn inside and outside the classroom even in a pandemic [28].

Learning at this stage, the teacher also provides a stimulus through the apperception process so that students can more easily understand the chemistry concept. In the learning process, some students respond well to the stimulus provided by the teacher. So, it can be said that students are developing critical thinking skills on indicators of connecting ideas. This shows that the apperception process succeeded in making students curious to understand the material more deeply.

Development of Critical Thinking

The critical thinking development stage is developing students' critical thinking skills. At this stage, the teacher guides students during the discussion so that the discussion becomes focused. The student's Google Classroom discussion room is active, and Figure 4 shows the recorded discussion.

Figure 4. Students' discussion via Google Classroom

Students are directed to exchange information about the material (see Figure 4) that has been studied during the independent study and ask each other if there is a concept that is not understood. Then the teacher provides discussion topics related to the material, and students can seek information from various sources and discuss it with their group members. Student responses regarding this activity are as follows:

"The advantage is that students become more active and think positively because discussions in each lesson make students active and critical."
(Interview of students 14, 14 March 2021)

Based on these interviews, the flipped classroom can make students more active in learning and understanding the material. Discussion activities also make students more critical because students have to answer questions given by the teacher and exchange opinions with group members. It means that students are developing critical thinking skills on assuming indicators. This shows that the discussion process made students develop critical thinking skills.

Learning Evaluation

The learning evaluation stage is where the process is systematic to obtain information about the effectiveness of learning that can help students achieve goals optimally. Therefore, learning evaluation can determine the results of learning that have been done and whether the learning objectives have been achieved or not achieved [29].

Students are given critical thinking skills test questions to determine the level of achievement of critical thinking after learning using the flipped classroom learning model. Students seem to have been able to do the problem well. Students' interviews can see below:

"*There is table salt (NaCl), English salt ($MgSO_4$), baking soda ($NaHCO_3$), and others. This is because there are so many uses for salt, let alone salt hydrolysis, mainly for flavouring and daily household needs. There are also many more such as bleaching clothes, dissolving soap, water purification, fertilizers, etc*."
(Interview of students 13, 14 March 2021)

This shows that students' critical thinking skills have emerged in the conclusion indicator. Students also write reflective journals related to the learning that has been done at the meeting.

"*After today's lesson, I remember the [H+] and [OH-] formulas. But I'm still confused or in trouble when given reasonable questions*."

(Reflective student journal 3, 24 February 2021)

Based on the reflective journal, students can convey their feelings and responses to the learning that has been done. A flipped classroom makes it easier for students to understand salt hydrolysis material [30] because the models can improve learning outcomes [31].

After learning, the teacher interviewed several students regarding the learning that had been carried out. Based on interviews, that students' critical thinking skills have emerged, as we can see in this interview recap:

"*Salt hydrolysis is the breakdown of salt in the water to produce acids and bases. Salt hydrolysis can be tested through the litmus test. Hydrolysis is divided into two, namely total hydrolysis and Partial. There are neutral, acidic, and basic salts. Neutral salt is formed from a strong acid and a strong base, an acid salt is formed from a strong acid and weak bases, and basic salts are formed from a strong base and a weak acid.*"

(Interview of student 13, 14 March 2021)

Students can communicate a clear conclusion based on the interview. For example, students discuss hydrolysis, and it is obvious, accurate, and logical that salt hydrolysis is the process by which salts break down in the water to release their original acids and bases.

Analysis of Students' Critical Thinking Ability

The critical thinking indicators used in this study are a. Identify the question at issue; b. Conceptual understanding; c. Idea Connection; d. Assumption; and e. Inference. The indicators are categorized into five levels, the highest level (excellent), level 4 (very good), level 3 (good), level 2 (good enough), level 1 (poor), and the lowest level, level 0 (very bad).

The level of achievement of students' critical thinking skills is divided into five levels, weights 20% at each level. First, based on the students' critical thinking skills tests, the students' critical thinking skills scores were produced, as seen in Table 2. Then the data in the table is described in graphical form, which can be seen in Figure 5

Table 2. Data on the Level of Achievement of Students' Critical Thinking Ability

Levels	Description of Levels	Score Range	Indicators				
			Problem Identification	Conceptual Understanding	Ideas Connection	Assumption	Inference
4	Very good	17-20	18	1	3	16	19
3	Well	13-16	11	9	16	17	3
2	Pretty good	9-12	3	17	8	0	10
1	Not good	5-8	4	6	3	2	1
0	Very Less Good	0-4	0	3	6	1	3

Description of the chart:
1 = Identify the question at issue indicator
2 = Conceptual Understanding indicator
3 = Idea Connection indicator
4 = Assumption Indicator
5 = Inference Indicator

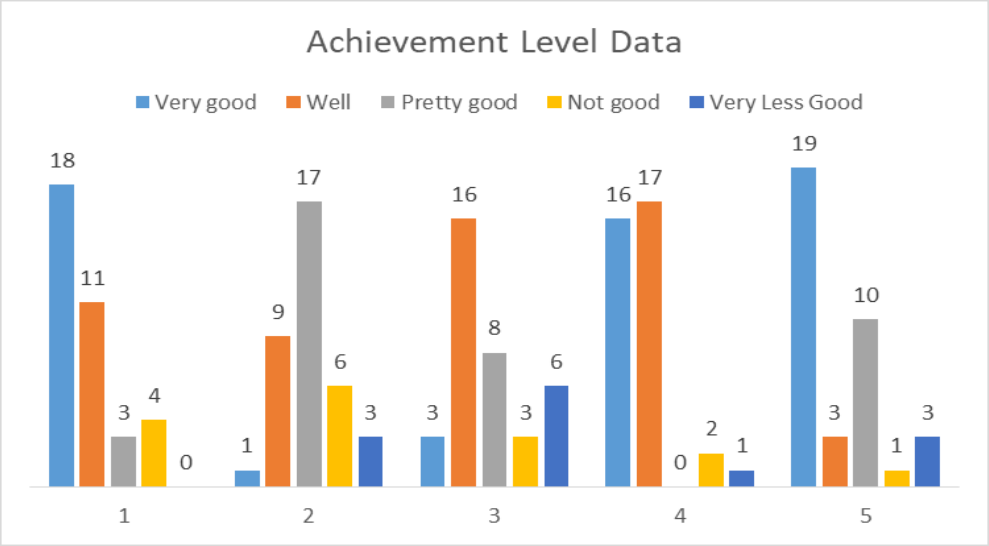


Figure 5. Bar Chart of Achievement Level Data

Identify the question at issue

Problem identification is identifying, searching, and gathering information from a problem. Students can identify a problem based on case studies and questions on critical thinking skills test questions. Students get a maximum score of 20 divided into the following five assessment intervals into the critical thinking ability test questions in the problem identification indicator. Figure 5 shows that as much as 50.00% or 18 students have reached a very good level or level 4. Achievements at level 4 can be proven through the following students' written test answers (see Figure 6):

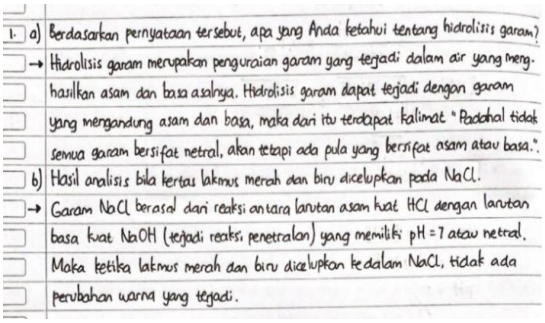

1. a) Berdasarkan pernyataan tersebut, apa yang Anda ketahui tentang hidrolisis garam?
→ Hidrolisis garam merupakan penguraian garam yang terjadi dalam air yang meng-
hasilkan asam dan basa asalnya. Hidrolisis garam dapat terjadi dengan garam
yang mengandung asam dan basa, maka dari itu terdapat kalimat "Padahal tidak
semua garam bersifat netral, akan tetapi ada pula yang bersifat asam atau basa.".
b) Hasil analisis bila kertas lakmus merah dan biru dicelupkan pada NaCl.
→ Garam NaCl berasal dari reaksi antara larutan asam kuat HCl dengan larutan
basa kuat NaOH (terjadi reaksi penetralan) yang memiliki pH = 7 atau netral.
Maka ketika lakmus merah dan biru dicelupkan kedalam NaCl, tidak ada
perubahan warna yang terjadi.

Figure 6. Written test students' answers

Based on the answers to the written test Figure 6, the student identified the problem. Students can overcome misconceptions that often occur on the topic of salt hydrolysis. Students already understand that not all salt is neutral, but some salts are acidic and basic [32]. Students can distinguish between neutral, acidic, and basic salts. The difference also depends on the strength of the acid and base. In addition, students can also associate the material with experiments using litmus paper. For example, when red litmus paper and blue litmus paper are dipped in NaCl solution, the paper will not change color of the litmus paper because NaCl is neutral.

Based on learning outcomes, most students reached level 4 or very well, reaching 50.00% or 18 students on the problem identification indicator. In addition, learning outcomes show that students' critical thinking skills are very good and optimal, so students are reliable in optimizing critical thinking skills.

Conceptual Understanding

Conceptual understanding is the ability of students to explain and apply

concepts to solve problems. Students are expected to be able to understand the chemical concept and respond with clear and appropriate concepts based on critical thinking skills test questions [33]. On the critical thinking ability test questions in the conceptual understanding indicator, students get a maximum score of 20, which is divided into the following five assessment intervals.

Figure 5 shows that as many as 47.22% or 17 students have reached a fairly good level or level 2. Achievements at level 2 can be proven through the following students' written test answers:

Based on the written test answers, students answered ambiguously; the concept used is sometimes inaccurate. For example, several students could distinguish each salt solution but had not yet determined which one included complete/total hydrolysis, partial/partial hydrolysis, and not hydrolysis [34]. Besides that, the students' answers did not match the questions. Some students could answer why only weak acids or weak bases can undergo salt hydrolysis reactions, even though the concepts used were not quite right.

The research results show that most students have reached level 2 or are good enough, which reaches 47.22% or 17 students on conceptual understanding indicators. In addition, students have been able to do the test questions better and correctly, even though there are still statements that are not appropriate. Therefore, students' critical thinking skills on indicators of conceptual understanding have started to optimize and develop. There is a significant positive relationship between critical thinking skills and students' mastery of concepts [35].

Ideas Connection

Connecting ideas is the ability to combine ideas or ideas between one concept and another [36]. Students can understand the chemical concept and respond with clear and appropriate concepts based on critical thinking skills test questions. In the critical thinking ability test questions for connecting ideas, students get a maximum score of 20 divided into five assessment intervals.

Figure 5 shows that as many as 44.44% or 16 students have reached a good level or level 3. Achievements at level 3 can be proven through the following students' written test answers:

"The statement that NH_4Cl does not hydrolyze is false." Because
$NH_4Cl \rightarrow NH^{4+} + Cl^-$
In this equation, NH^{4+} is a weak base and Cl^- is a strong acid. So NH_4Cl is acidic and experiencing partial hydrolysis."
(Interview of students 10 March 2021)

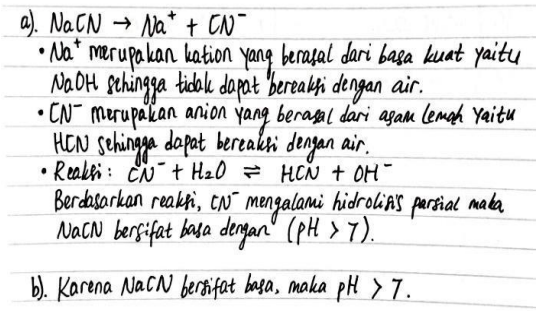
Based on the students' answers, the student could show the interrelationships between concepts, but it was still not good. For example, students can relate the concept of acid-base with the concept of salt hydrolysis, where students associate the properties of acid-base solutions with various types of salt hydrolysis. But the students' answers seemed to lack explaining the concept of chemistry in more depth. The students only explained that NH4Cl undergoes salt hydrolysis based on its nature alone. The research results show that most of the students have reached level 3 or good which reaches 44.44% or 16 students on the

indicator of connecting ideas. Some students can think critically well, so students are considered competent.

Assumption

Assumptions are the ability to express opinions that can be proven through information or facts [37]. Therefore, students can understand the concept and respond with clear and appropriate concepts based on critical thinking skills test questions. Students get a maximum score of 20 divided into the following five assessment intervals into the critical thinking ability test questions in the assume indicator.

Figure 5 shows that as many as 47.22% or 17 students have reached a good level or level 3. Achievements at level 3 can be proven through the following students' written test answers:


a). $NaCN \rightarrow Na^+ + CN^-$
- Na^+ merupakan kation yang berasal dari basa kuat yaitu NaOH sehingga tidak dapat bereaksi dengan air.
- CN^- merupakan anion yang berasal dari asam lemah yaitu HCN sehingga dapat bereaksi dengan air.
- Reaksi: $CN^- + H_2O \rightleftharpoons HCN + OH^-$

Berdasarkan reaksi, CN^- mengalami hidrolisis parsial maka NaCN bersifat basa dengan (pH > 7).

b). Karena NaCN bersifat basa, maka pH > 7.

Figure 7. Written test students' answers

Based on the answers to the written test, student nine could convey assumptions consistently, but the justification was insufficient. For example, students can distinguish acid-base compounds and their properties. Students can name the components of NaCN: NaCN is composed of a weak acid (HCN) and a strong base (NaOH), so it is basic. In addition, students can explain the NaCN hydrolysis reaction process and prove that NaCN undergoes partial hydrolysis with a possible pH value of NaCN > 7 because it is alkaline. But the students could not categorize which included the NaCN ionization reaction and the NaCN hydrolysis reaction.

The research results show that most students have reached level 3 or good, which reaches 47.22% or 17 students on the assume indicator. In addition, some students can think critically well, so students are considered competent.

Inference

Students can understand the topic l and respond with clear and appropriate concepts based on critical thinking skills test questions [38]. Students get a maximum score of 20 divided into the following five assessment intervals into the critical thinking ability test questions in the concluding indicator.

Based on Figure 5 shows that as much as 52.78% or 19 students have reached a very good level. Achievement at a very good level or level 4 can be proven through the following student-written test answers about why expectorant-type cough medications work to treat coughs.:

"*This expectorant cough medicine works by loosening the respiratory tract so sufferers can expel excess mucus/phlegm. The function of this cough medicine is to treat coughs with phlegm. An example of this cough medicine is Guaifenesin, Ipecacuanha*."

(Written test answers, Student 16)

Based on the answers to the written test, student 16 can conclude correctly and logically, supported by sufficient evidence.

Students concluded that expectorant-type drugs work by loosening the respiratory tract to overcome coughing up phlegm [39]. In addition, students strengthened the evidence by mentioning examples of expectorant cough medicines, namely Guaifenesin and Ipecacuanha. The study results showed that most of the students had reached level 4 or very well, which reached 52.78% or 19 students on the concluding indicator. Students' critical thinking skills are very good and optimal, so students are reliable in optimizing critical thinking skills.

Based on the critical thinking skills test results, students reached the highest percentage level at the good achievement level (level 2) of 58.33% or 17 students. Students can think critically well and are competent. Achievements at this level may be caused by several factors, such as at the flipped classroom learning stage, there are independent learning activities, discussions, and assignments, to bring out and develop students' critical thinking skills [40]. In addition, learning videos made using the Powtoon application can attract students to learn the topic. However, some students still have not reached a good level of achievement due to constraints during learning. Some problems in online learning, such as unsupportive networks and lack of focus in participating in learning, make learning outcomes not achieve good learning achievements. Based on the results of critical thinking skills tests, students still have weaknesses in conceptual understanding abilities, so students need to study the contect of chemistry repeatedly both before and after learning.

CONCLUSION

Based on the research results, learning that has been carried out using the flipped classroom learning model on salt hydrolysis through the Powtoon application can develop students' critical thinking skills. The study results showed that the flipped classroom using the Powtoon application can be an alternative for distance learning and can influence the students' critical thinking at a very good level. It also helps them be more active and critical in learning, like exchanging opinions with others and doing assignments. However, indicators of students' critical thinking skills still need to be developed indicators of conceptual understanding. Students must understand the concept well, not only knowing salt hydrolysis in general but especially in determining the pH of salt hydrolysis because it is different from determining the pH of acid-base and solutions buffers.

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