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Cognitive Conflict Strategy Integrated with Scientific Literacy in Reducing Misconceptions in Chemical Materials

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Abstract:Cognitive Conflict Strategies are Integrated with Scientific Literacy in Reducing Chemical Misconceptions. Problems with students misconceptions about hydrolysis material still occur frequently, including at Nurul Hayyah High School. Based on the pre test data, the percentage of misconceptions was 38,42% in the medium category. If misconceptions are not immediately reduced, students will have difficulty accepting the next material. One learning strategy that can reduce misconceptions is a cognitive conflict strategy that is integrated with scientific literacy. The implementation of learning with cognitive conflict strategies integrated with scientific literacy took place over two meetings. This research is a quantitative research type of pre-experiment model one group pre test-post test design. This research aims to determine the effectiveness of an integrated cognitive conflict strategy with scientific literacy in reducing misconceptions about hydrolysis material. The research was conducted at Nurul Hayyah Brebes High School with a research sample of class XI MIPA 2. The students misconceptions and interpretation of questionnaire results. The results showed that cognitive conflict strategy integrated with scientific literacy were effective in reducing students misconceptions about hydrolysis material. This was marked by a decrease in the percentage of students misconceptions to 13,68% in the low category. In addition, the effectiveness of the scientific literacy integrated cognitive conflict strategy was also indicated by positive responses from students with an average percentage of 78% in the good category.

Keywords: Misconceptions, Cognitive Conflict, Hydrolysis

Abstrak:Strategi Konflik Kognitif Terintegrasi Literasi Sains dalam Mereduksi Miskonsepsi Materi Kimia. *Problematika miskonsepsi siswa pada materi hidrolisis masih sering terjadi, termasuk di SMA Nurul Hayyah. Berdasarkan data pre test diperoleh persentase miskonsepsi sebesar 38,42% dengan kategori sedang. Jika miskonsepsi tidak segera direduksi, maka siswa akan kesulitan menerima materi berikutnya. Salah satu strategi pembelajaran yang dapat mereduksi miskonsepsi yaitu strategi konflik kognitif yang diintegrasikan dengan literasi sains. Penerapan pembelajaran dengan strategi konflik kognitif terintegrasi literasi sains berlangsung selama dua kali pertemuan. Penelitian ini merupakan penelitian kuantitatif jenis pre-experiment model one group pre test-post test design. Penelitian ini bertujuan untuk mengetahui keefektifan strategi konflik kognitif terintegrasi literasi sains dalam mereduksi miskonsepsi pada materi hidrolisis. Penelitian dilakukan di SMA Nurul Hayyah Brebes dengan sampel penelitian kelas XI MIPA 2. Teknik sampling yang digunakan yaitu purposive sampling. Teknik analisis data yang digunakan berupa analisis miskonsepsi siswa serta interpretasi hasil angket. Hasil penelitian menunjukkan bahwa strategi konflik kognitif terintegrasi literasi sains efektif dalam*

mereduksi miskonsepsi siswa pada materi hidrolisis. Hal itu ditandai dengan menurunnya persentase miskonsepsi siswa menjadi 13,68% dengan kategori rendah. Selain itu, keefektifan strategi konflik kognitif terintegrasi literasi sains juga ditandai dengan respons positif dari siswa dengan rata-rata persentase 78% dalam kategori baik.

Kata kunci: *Miskonsepsi, Konflik Kognitif, Hidrolisis*

▪ INTRODUCTION

Chemistry is a natural science that studies the structure, properties and changes of matter into new substances (Lestari et al., 2021). Studying chemistry requires successive and continuous concepts (Anwarudin et al., 2019). Successive concepts are interpreted as students' initial conceptual understanding which is then aligned with the new concepts they receive (Hasanah et al., 2020). However, the alignment of each student's concept is sometimes not in accordance with the truth of the existing concept. This misalignment of concepts is called a misconception. In general, misconceptions are defined as beliefs that conflict with existing scientific knowledge and it seems that these beliefs are supported by sound reasons (Utami et al., 2020). Misunderstanding of chemical material related to difficulties in understanding chemical material (Hulyadi, 2021). This is because chemical material contains complex and abstract concepts so that students easily experience misconceptions (Laksono et al., 2021).

Based on the results of interviews with the high school chemistry teacher Nurul Hayyah Brebes, it is known that some students experience difficulties in hydrolysis material. This can be seen from the learning outcomes of students who have not met the minimum completeness criteria. Student learning outcomes in hydrolysis material are seen from the daily test scores obtained, namely as many as 42.1% of students have low learning outcomes. According to the teacher, a test has never been held to identify misconceptions, so the teacher does not know the causes of low student learning outcomes, especially in hydrolysis material. Therefore, in this study using diagnostic test analysis four tier to find out whether or not there are misconceptions in students who have difficulty understanding hydrolysis material.

Diagnostic tests serve to identify the extent to which knowledge has been mastered by students and possible reasons for not knowing it (U. L. Hidayah et al., 2018). Instrument four tier multiple choice is the development of a three-level multiple choice diagnostic test (Mubarak et al., 2016). The advantage of the four-level diagnostic test is that it is able to provide complete information. Students' conceptions can be seen through the answers and reasons they choose (Yasthophi & Ritongga, 2019). Therefore, a four-level diagnostic test is considered the most accurate in detecting misconceptions.

Instrument four tier diagnostic test has several levels. The first level of this instrument presents a choice of answers to the questions asked (Priyasmika & Sholichah, 2022). The second level presents various confidence scales to measure students' beliefs in determining answers at the first level. Then the third level of the diagnostic test instrument contains reasons that students must choose in determining answers at the first level. The fourth level presents a confidence scale to measure how confident students are in choosing reasons at the third level. The confidence scale in this instrument includes six scales (Fariyani & Sugianto, 2015); *first scale* that is, if the student only guesses the answer,*second scale*s students are very unsure of the answers chosen, as well *third scale*s students are not sure about the selected answer. The scale range 1 – 3 is classified as a low level of confidence. As for *fourth scale*, students are sure of the answers chosen.*Fifth scale*, students are very confident with the answers chosen and *sixth scale* students are very confident with the answers chosen. The 4-6 scale range is classified as a high level of confidence.

Misconceptions often occur in materials that contain exact (calculations) and are abstract in nature, such as hydrolyzed materials. Hydrolysis materials have the characteristics of microscopic and symbolic concepts, are abstract in nature, and stoichiometric calculations (N. Hidayah et al., 2022). That's why the possibility of

misunderstanding is very large. Misconceptions that occur in students should be addressed immediately so that they are not sustainable. This is because misconceptions can cause students to have difficulty accepting further material (Grace et al., 2022). Reduction of misconceptions is done by applying appropriate models and strategies in learning.

In this study, the reduction of misconceptions uses cognitive conflict strategies integrated with scientific literacy. Scientific literacy is a person's ability to analyze and solve scientific problems with current issues in society (Mellyzar et al., 2022). Scientific literacy is listed in each syntax or stage of a cognitive conflict strategy (Setyarini & Admoko, 2021). The scientific literacy indicators listed cover competency domains one to three, one of which is remembering and applying appropriate scientific knowledge. Students who have scientific literacy skills are students who are able to apply scientific concepts to natural phenomena in everyday life so that scientific literacy is directly proportional to misconceptions (Wahyuningsih et al., 2018). When the level of students' misconceptions is high, it means that they show poor literacy skills (Subyani & Nugroho, 2018).

The effectiveness of using cognitive conflict strategies has been proven by several previous studies. As well as research conducted by Hasanah *et al* (2020) regarding the effect of cognitive conflict strategies to reduce misconceptions in terms of students' initial abilities. The results of his research showed that the group that was treated with cognitive conflict strategies experienced a higher reduction in misconceptions than the control group. The research equation is in the strategy used to reduce misconceptions. However, this study used a cognitive conflict strategy integrated with scientific literacy, in which the students' worksheets used contained indicators of scientific literacy. Therefore, the purpose of this study was to see the effectiveness of a combination of cognitive conflict strategies with scientific literacy in reducing misconceptions about hydrolysis material.

▪ METHOD

Research refers to a quantitative approach. This type of research is pre experimental design with models one group pre test – post test design so that treatment given to one group only (Sugiyono, 2011). Data collection techniques used include tests, questionnaires and interviews. The test instrument used is four tier multiple choice (FTMC) which is able to identify the conception picture that students have through the answers and reasons they choose (Yasthophi & Ritongga, 2019). The FTMC instrument was tested for validity and reliability using biserial point correlations and analysis Kuder-Richardson (K-R-20) with the aim that the instruments used are accurate and reliable. Before repeated teaching using cognitive conflict strategies integrated with scientific literacy, the sample group was measured for their initial ability to use them pre test. The four-level diagnostic test instrument used during the pre test was retested during the post test to determine final abilities, where in this study it was seen that there was a decrease in misconceptions based on the results pre test and post test. The research was carried out at Nurul Hayyah High School, Brebes, Central Java in April – May 2023. The population in this research was all students in class XI of Nurul Hayyah High School. The research samples were taken using techniques Nonprobability sampling type purposive sampling. The sample class was selected based on suggestions from the chemistry teacher, namely class XI MIPA 2, totaling 19 students. This class has a heterogeneous level in terms

of daily test scores. Data analysis techniques in this research include analysis of student misconceptions and interpretation of questionnaire results.

Misconceptions analysis uses percentage data by grouping students according to the criteria of understanding the concept, not understanding the concept, and misconceptions. The four-level diagnostic test interpretation guideline adopts research from Fariyani *et al* (2015) which contains approximately 16 criteria for understanding categories. However, analysis of interpretation of misconceptions in the form of percentage data still requires further analysis to detect misconceptions, namely using Rasch model analysis (Laliyo et al., 2022). Data pre test students were analyzed using Ministep software which produced several interpretations of the data *output*. Data interpretation *output* used in this research are *item measure, person measure,* and *wright map* to analyze students abilities in answering questions. The next analysis technique is questionnaire response analysis by calculating the percentage of each students response to treatment integrated cognitive conflict strategies in scientific literacy. The response is said to be positive if the response category is quite good with a percentage above 70% (Hobri, 2010).

▪ RESULT AND DISCUSSION

Misconceptions can be interpreted as misunderstandings in interpreting a concept so that a new concept is formed that is not in accordance with the understanding of the concept of experts (Mukhlisa, 2021). Based on the results of pre-research interviews at Nurul Hayyah Brebes High School, it is known that some students have difficulty understanding hydrolysis material. This can be seen from the learning outcomes of students who have not met the minimum completeness criteria, so it is necessary to identify whether there are misconceptions. However, to identify misconceptions need the right method. Therefore, this study identified misconceptions using a four-level diagnostic test on salt hydrolysis in class XI SMA Nurul Hayyah Brebes. The four-level multiple choice diagnostic test interpretation technique refers to Fariyani's research *et al* (2015). This study obtained the results of an analysis of several categories of understanding the concept of salt hydrolysis including understanding the concept, misconceptions, and lack of understanding of the concept. There were 10 questions tested, the salt hydrolysis sub-material being tested included the concept of salt hydrolysis, the nature of the salt solution, and determining the pH of a salt solution (N. Hidayah et al., 2022).

Results *pre test* shows that the average student has a misconception of 38.42%. This percentage is the average category of students' understanding of each item worked on. Each item is mapped and recapitulated according to the category of understanding which includes understanding concepts, misconceptions, and lack of understanding of concepts. Based on the data obtained, most students experience misconceptions in the moderate category. This is because the category of misconception level with a percentage of 25.50 to 50.49 is classified as the medium category (Rogayan & Albino, 2019). Thus, it can be said that the percentage of students' misconceptions shows the level of students' ability to answer questions. Based on the analysis of the Rasch model, the level of student ability (*person measure*) can be seen from the logit value obtained. A high logit value indicates a high ability to solve problems, so that students who have high abilities can work on more questions than students who have low abilities. The ability data for each student can be seen in table 1.

Table 1. Person measure data pre test

Person Number	Total Score	Total Count	Measure	Ability
9	9	10	2,41	High
16	9	10	2,41	High
3	7	10	0,92	Medium
11	7	10	0,92	Medium
15	7	10	0,92	Medium
17	7	10	0,92	Medium
10	5	10	-0,02	Medium
14	5	10	-0,02	Medium
2	2	10	-1,52	Low
7	2	10	-1,52	Low
8	2	10	-1,52	Low
19	2	10	-1,52	Low
5	1	10	-2,37	Low
6	1	10	-2,37	Low
12	1	10	-2,37	Low
13	1	10	-2,37	Low
18	1	10	-2,37	Low
1	0	10	-3,67	Low
4	0	10	-3,67	Low

Based on *person measure* obtained, only two students from 19 samples who have high ability. This was also evidenced by the scores obtained by the two students who were able to answer nine questions out of a total of ten items. Students with high ability to solve problems are students number 9 and number 16 with a logit value of +2.41. While students with low ability to solve problems are students number 1 and number 4. Therefore, students number 1 and number 4 may not be able to solve the most difficult problem, namely item number 8 based on the data *item measure* which is obtained. This is evident from the mapping results *pre test*, student number 1 and student number 4 could not answer item number 8, where student number 1 was identified as having a misconception based on the interpretation of the understanding category, and student number 4 was identified as not understanding the concept. Therefore, in table 1 the order of student number 4 is below student number 1 even though both have the same logit value of -3.67. That is because when students experience misconceptions, they still have material concepts but these concepts are incomplete so that they are not in accordance with the truth of existing concepts (Hulyadi, 2021).

Misconceptions experienced by students indicate that students' literacy is lacking, this is because misconceptions are directly proportional to scientific literacy. When students often analyze and solve science problems, they will more easily accept scientific concepts explained by the teacher so that the possibility of misunderstanding is very small. Conversely, when students' literacy is lacking, in the sense that students rarely analyze science issues, then it will be difficult to accept abstract scientific concepts so that misconceptions cannot be avoided.

Misunderstandings that have been attached to students need to be followed up so that they are not fatal, namely by providing appropriate learning strategies (Grace et al., 2022). In this study using a cognitive conflict strategy integrated with scientific literacy, where this strategy is able to reduce misconceptions. Learning situations are deliberately created by the teacher, in which situations students experience a

discrepancy between the information provided and what they know, and this information shakes their cognitive structure (Gusnidar et al., 2017). The advantages of cognitive conflict strategies include being able to reconstruct the understanding that has been attached to students with the new knowledge they receive so that they can reduce misconceptions (Suyanti, 2010).

Learning with cognitive conflict strategies was carried out in two meetings. Several stages or learning syntax uses cognitive conflict strategies, including (Mufit, 2018):

a. Preconception activation, aims to determine the initial abilities possessed by students before starting learning with cognitive conflict strategies. Generally, misconceptions that occur are not due to misunderstandings during the learning process, but students' initial concepts when interacting with the environment and these concepts they bring into the formal classroom. This preconception activation reminds students of things they already know that are related to a new topic.
b. Presentation of cognitive conflict, aims to cause conceptual conflict to occur in students so that they find new concepts that are scientifically correct.
c. Discovery of concepts and similarities, this stage aims to achieve a long-lasting conceptual understanding in students' memories. As for achieving this goal, carried out through experiments and group discussions. Even so, learning in this study was not carried out through direct experiments but watching experiments with the media*you tube*. This is done to streamline time, so that students can still analyze based on the experimental video that is shown.
d. Reflection, aims for the teacher to be able to assess the level of students' understanding of concepts after carrying out the stage of discovery of concepts and equations.

The stages of learning cognitive conflict strategies in this study have been integrated with indicators of scientific literacy competency aspects so that this learning strategy is a harmonious combination to reduce students' misconceptions. Researchers use student worksheets to find out the misconceptions that occur in students. For example, in the first meeting, in the worksheets that were distributed, the researcher asked students to read excerpts of articles about the use of salt, followed by writing the concepts of salt and hydrolysis. This stage is the application of the first domain scientific literacy indicator, namely remembering and applying appropriate scientific knowledge. Some students understand the concept correctly, and some other students experience misunderstandings. This can be seen in the excerpts of student answers, Figure 1.

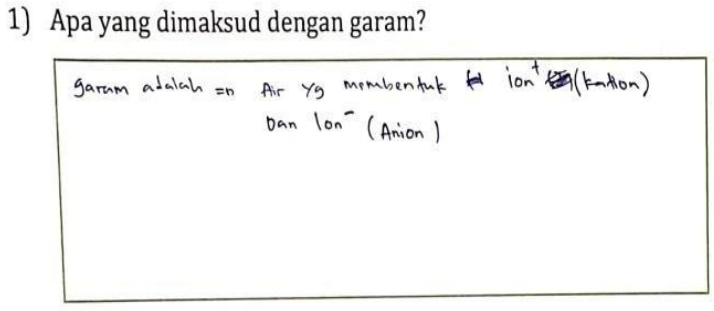


Figure 1. Praconception Activation

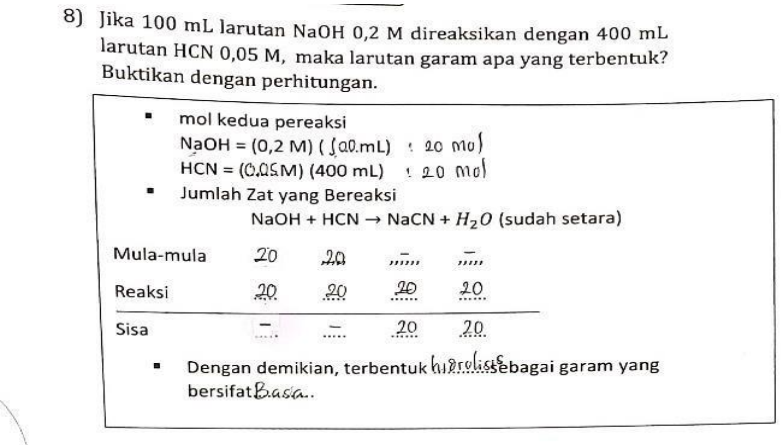
Based on these answers, stating that salt is water which forms positive ions (cations) and negative ions (anions) indicates that the student has a misconception. This is because the concept of salt is actually a mixture of acids and bases (Chang & College, 2005). Cations and anions are part of the salt decomposition reaction,

namely salt hydrolysis. The concept of salt hydrolysis can be interpreted as the decomposition reaction of salt in water to form positive ions and negative ions. This activity of remembering the concepts that have been taught is one of the first steps in learning to use a cognitive conflict strategy called preconception activation.

Preconception activation at the first meeting was in the form of instilling the concept of salt hydrolysis such as the meaning of salt and salt hydrolysis. After students understand the actual concept through learning videos, students are presented with the phenomenon of cognitive conflict. Presenting the phenomenon of cognitive conflict by providing several examples of identifying salt solutions in everyday life, then students are asked to provide hypothesis about the nature of the salt solution based on the data presented and the reasons. This stage is also in accordance with the second domain scientific literacy indicator, namely identifying scientific questions that are explored from the research given. Most students understand the concept of the nature of a salt solution, including (Mulyanti & Nurkhozin, 2017):

1) Salts that produce neutral solutions, come from a mixture of strong acids and strong bases. This is because the solution undergoes perfect ionization so that no ions are hydrolyzed, for example, in the KCl salt which comes from KOH and HCl.
2) Salts that produce alkaline solutions, come from a mixture of strong bases and weak acids. That's because the cations derived from strong bases are very weak so they don't hydrolyze, while the anions derived from weak acids are strong so they experience hydrolysis or are able to react withwater. An example of a salt solution that is alkaline is salt Na_2CO_3 which derive from $NaOH$ and HCO_3.
3) Salts that produce acidic solutions come from a mixture of a strong acid and a weak base. This is because the anions derived from strong acids are very weak so they cannot hydrolyze, while the cations derived from weak bases are strong and therefore undergo hydrolysis. An example of an acidic salt solution is salt NH_4NO_3, which derive from (HNO_3 and NH_4OH).

The next activity in LKPD is the discovery of concepts and equations. Students are guided in working on analytical problems of the properties of salt solutions through calculations. This will further strengthen the concept of hydrolysis because students directly apply the theory they get. A snippet of the discovery of concepts and equations can be seen in Figure 2.


8) Jika 100 mL larutan NaOH 0,2 M direaksikan dengan 400 mL larutan HCN 0,05 M, maka larutan garam apa yang terbentuk? Buktikan dengan perhitungan.

- mol kedua pereaksi
  NaOH = (0,2 M) (100 mL) = 20 mol
  HCN = (0,05 M) (400 mL) = 20 mol
- Jumlah Zat yang Bereaksi

NaOH + HCN → NaCN + H_2O (sudah setara)

Mula-mula	20	20	-	-
Reaksi	20	20	20	20
Sisa	-	-	20	20

- Dengan demikian, terbentuk hidrolisis sebagai garam yang bersifat Basa.

Figure 2. Discovery of concepts and similarities

The last cognitive conflict strategy stage is reflection. Students are asked to write down the results of a summary of the concept of hydrolysis. This reflection aims to make students repeat the concepts they have obtained by writing a summary so that it will further strengthen memory. In addition, one of the groups was appointed to present the summary results they obtained. Learning using cognitive conflict strategies integrated with scientific literacy in this study took place in two meetings. The second meeting emphasized the concept of pH calculation. Thus the basic concept of hydrolysis that students need to understand has been conveyed.

After the learning process was carried out with cognitive conflict strategies, the researcher directed students to work on the questions *post test* which aims to determine the final ability after being given learning using cognitive conflict strategies. based on data *post test* obtained showed a decrease in misconceptions of 24.74%. This is due to misconceptions that were detected at the time *pre test* is 38.42%, and when *post test* decreased to 13.68%. Data comparison *pre test* and *post test* can be seen in figure 3.

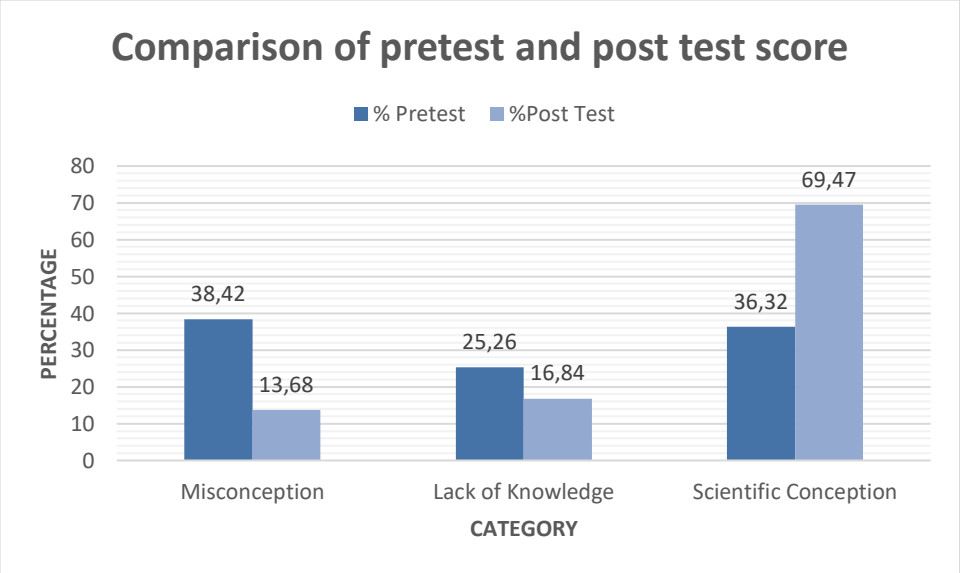


Figure 3. Data comparison *pre test* and *post test*

The data shows the success of using cognitive conflict strategies integrated with scientific literacy in reducing misconceptions about salt hydrolysis. As with data *pre test*, data *post test* also mapped and recapitulated according to the categories of understanding including scientific conception, misconceptions, and lack of knowledge. The percentage of students' misconceptions at the time *post test* shows the number of items answered correctly by students, so that when the percentage of misconceptions is 13.68% it means ability (*person measure*) students increased. This is indicated by the increase in the logit value obtained by students after being given *treatment* using cognitive conflict strategies integrated with scientific literacy, so that misconceptions become reduced.

Based on the logit scores obtained by students, approximately eight students could answer all questions *post test* correctly. This is also evidenced by the recapitulation of results *post test* based on the interpretation of the category of understanding, that most students understand the concept. As with student number 9, when *pre test* in point number 8 experienced a misconception while when *post test*

on these points to understand the concept. Likewise student number 4 when *pre test* could not work on the most difficult questions, namely item number 8 with the category of not understanding the concept, where as when *post test*, student number 4 can do item number 8 correctly and belongs to the scientific conception category. Thus, the scientific literacy-oriented cognitive conflict strategy succeeded in reducing student misconceptions with a significant decrease in misconceptions so that the misconception category of class XI SMA Nurul Hayyah students which was originally "Medium" changed to the "Low" category.

After completing the questions *post test*, students were asked to fill out a cognitive conflict strategy response questionnaire. The results of the response questionnaire analysis obtained an average of 78% in the good category. This percentage was obtained from students responses to the application of cognitive conflict strategies, namely students felt they understood hydrolysis material better and were aware of the misconceptions they had so far experienced. Each question naire statement was scored based on a Likert scale from 1-4. The score is then recapitulated to obtain a percentage of 78%. Based on the percentage obtained, it shows that students respond in a positive category. This is in accordance with previous research conducted by Hasanah (2020) regarding the influence of cognitive conflict strategies to reduce misconceptions in terms of students initial abilities. The research results showed that the experimental group that applied the based learning model with cognitive conflict strategies experienced a decrease in misconceptions and higher learning outcomes compared to the control group. Apart from that, research conducted by Lestari (2021) also showed positive results, namely that the experimental group experienced a decrease in misconceptions and an increase in the level of understanding. Thus, the use of cognitive conflict strategies integrated with scientific literacy is effective in reducing misconceptions that occur in students.

▪ CONCLUSION

Based on research conducted at Nurul Hayyah Brebes High School, it can be concluded that the application of cognitive conflict strategies integrated with scientific literacy is effective in reducing student misconceptions. This was marked by a decrease in the level of student misconceptions and a significant increase in the level of student understanding. The percentage of students misconceptions at the time *pre test* of 38.42% in the moderate category, and at moment *post test* the percentage of misconceptions decreased to 13.68% in the low category. In addition, the effectiveness of the cognitive conflict strategy integrated with scientific literacy is also marked by positive responses from students with an average percentage of 78% in the good category. Thus, the implication of this study is that the selection of appropriate learning strategies can reduce misconceptions that occur in students.

▪ REFERENCES

Anwarudin, A., Nuswowati, M., & Widiarti, N. (2019). Analisis Miskonsepsi Peserta Didik pada Materi Hidrolisis Garam Melalui Tes Diagnostik. *Chemistry in Education*, *8*(1), 1–7.

Chang, R., & College, W. (2005). *Kimia Dasar: Konsep-Konsep inti Jilid 2* (Edisi Keti). Penerbit erlangga.

Fariyani, R., & Sugianto. (2015). Pengembangan Four-Tier Multiple Choice Diagnostic Test Untuk Mengungkap Miskonsepsi Fisika Siswa SMA Kelas X. *Journal of Innovative Science Educations*, *4*(2), 41–49.

Grace, H., Elisabet, M., & Khoiri, N. (2022). Miskonepsi Siswa SMA pada Materi Elektrolit dalam Pembelajaran Kimia. *Jurnal Riset Pendidikan Kimia*, *12*(2), 78–88.

Gusnidar, Netriwati, & Putra, F. G. (2017). Implementasi Strategi Pembelajaran Konflik Kognitif Berbantuan Software Wingeom Dalam Meningkatkan Kemampuan Pemecahan Masalah Matematis. *Jurnal Edukasi Matematika Dan Sains*, *5*(2), 62–69.

Hasanah, N., Hidayat, A., & Koeshandayanto, S. (2020). Pengaruh Strategi Konflik Kognitif Ditinjau dari Kemampuan Awal Siswa untuk Mengurangi Miskonsepsi pada Materi Gelombang Mekanik. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *5*(5), 624–629.

Hidayah, N., Priatmoko, S., Wardani, S., & Nurhayati, S. (2022). Pengembangan Tes Four Tier Multiple Choice (4TMC) untuk Mendeteksi Miskonsepsi Peserta Didik. *Chemistry in Education*, *11*(2), 86–94.

Hidayah, U. L., Supardi, K. I., & Sumarni, W. (2018). Penggunaan Instrumen Lembar Wawancara Pendukung Tes Diagnostik Pendeteksi Miskonsepsi Untuk Analisis Pemahaman Konsep Buffer-Hidrolisis. *Jurnal Inovasi Pendidikan Kimia*, *12*(1), 2075–2085.

Hobri. (2010). *Metodologi Penelitian Pengembangan (Aplikasi pada Penelitian Guruan Matematika)*. Pena Salsabila.

Hulyadi. (2021). Efektivitas Modul Inkuiri Dengan Strategi Konflik Kognitif Dalam Meningkatkan Keterampilan Berpikir Kritis Mahasiswa. *Jurnal Ilmiah IKIP Mataram*, *8*(2), 285–291.

Laksono, P. J., Haliza, D., & Astuti, M. (2021). Desain Tes Diagnostik Three-Tier Multiple Choice dalam Mendeteksi Miskonsepsi Hidrolisis Garam. *Al-TA'DIB: Jurnal Kajian Ilmu Kependidikan*, *14*(2), 110.

Laliyo, L. A. R., La Kilo, A., Paputungan, M., Kunusa, W. R., Dama, L., & Panigoro, C. (2022). Rasch Modelling To Evaluate Reasoning Difficulties, Changes of Responses, and Item Misconception Pattern of Hydrolysis. *Journal of Baltic Science Education*, *21*(5), 817–835.

Lestari, E. A., Harjito, Susilaningsih, E., & Wijayanti, N. (2021). Analisis Miskonsepsi Menggunakan Tes Diagnosa Three-Tier Multiple Choice Pada Materi Stoikiometri. *Jurnal Inovasi Pendidikan Kimia*, *15*(2), 2824–2830.

Mellyzar, M., Lukman, I. R., & Busyraturrahmi, B. (2022). Pengaruh Strategi Process Oriented Guided Inquiry Learning (POGIL) Terhadap Kemampuan Proses Sains dan Literasi Kimia. *Jambura Journal of Educational Chemistry*, *4*(2), 70–76.

Mubarak, S., Susilaningsih, E., & Cahyono, E. (2016). Pengembangan Tes Diagnostik Three Tier Multiple Choice untuk Mengidentifikasi Miskonsepsi Peserta Didik Kelas XI. *Journal of Innovative Science Education*, *5*(2), 101–110.

Mufit, F. (2018). *Model Pembelajaran Berbasis Konflik Kognitif untuk Meningkatkan Pemahaman Konsep dan Meremediasi Miskonsepsi*. Universitas Negeri Padang.

Mukhlisa, N. (2021). Miskonsepsi Pada Peserta Didik. *SPEED Journal : Journal of Special Education*, *4*(2), 66–76.

Mulyanti, S., & Nurkhozin, M. (2017). *Kimia Dasar Jilid 2*. Alfabeta.

Priyasmika, R., & Sholichah, N. (2022). Analisis Miskonsepsi pada Materi Hidrolisis Garam Menggunakan Instrumen Tes Diagnostik Four Tier. *Jurnal Riset Teknologi Dan Inovasi Pendidikan*, *5*(1), 19–28.

Rogayan, D. V, & Albino, M. M. (2019). Filipino Students' Common Misconceptions in Biology: Input for Remedial Teaching. *Online Science Education Journal*, *4*(2), 90–103.

Setyarini, R., & Admoko, S. (2021). Penerapan Strategi Pembelajaran Konflik

Kognitif dalam Mereduksi Miskonsepsi Siswa pada Materi Gelombang Bunyi. *IPF: Inovasi Pendidikan Fisika*, *10*(3), 40–55.

Subyani, N. W., & Nugroho, A. S. (2018). Pengembangan Modul Berbasis Budaya Lokal untuk Meningkatkan Literasi Sains dan Mereduksi Miskonsepsi Sains Mahasiswa Calon Guru SD. *JTIEE (Journal of Teaching in Elementary Education)*, *2*(2), 143–152.

Sugiyono. (2011). *Metode Penelitian Kuantitatif Kualitatif dan R&D* . Alfabeta.

Suyanti, R. D. (2010). *Strategi Pembelajaran Kimia*. Graha Ilmu.

Utami, I., Mulyani, B., & Yamtinah, S. (2020). Identifikasi miskonsepsi asam-basa dengan two tier multiple choice dilengkapi interview. *Jurnal Pendidikan Kimia*, *9*(1), 89–97.

Wahyuningsih, S., Rusilowati, A., & Hindarto, N. (2018). Analisis Miskonsepsi Literasi Sains Menggunakan Three Tier Multiple Choice Test Materi Cahaya. *Jurnal Phenomenon*, *08*(2), 1–15.

Yasthophi, A., & Ritongga, P. S. (2019). Pengembangan Instrumen Test Diagnostik Multiple Choice Four Tier pada Materi Ikatan Kimia. *Jurnal Konfigurasi*, *3*(1), 23–31.