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Analysis of Students' Initial Ability Based on Generic Science Skills in Reaction Rate Material

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Abstract: *Students' initial abilities can be measured through the instrument of scholastic test items which include; general understanding knowledge, general reasoning, quantitative knowledge. The research aims to determine the validity of the developed test instrument. This study used the Research and Development method in class XI B as many as 36 students. This study used a scholastic test instrument (20 questions) and a final chemistry evaluation (20 questions). The results of the validation test obtained 87.08% for Material Aspect, 87.92% for Construction Aspect, 89.17% for Language Aspect, and 100% for Additional Rules. The scholastic test instrument consists of 20 questions that are tested on students namely; 17 valid questions and 3 invalid questions. The results of the final evaluation of the ability test contained 20 items tested on students, 18 questions were valid and 2 questions were invalid. The test of the scholastic ability test obtained is; 3% "very poor", 16% "poor", 39% "enough", 14% "good" and 28% "very good", while the final chemical evaluation test was; 0% is "very less". 11% "poor", 31% "poor: 25% "good" and 33% "very good".*

Keywords: *Initial ability; science generic skills; reaction rate.*

INTRODUCTION

Education is a right and obligation for every school, one of the main activities in the educational process at school is learning activities. Chemistry learning is an important aspect of educational operations, so that the quality of learning chemistry must be continuously developed and perfected (Cholifah et al., 2019). Chemistry is a branch of science that studies objects, their characteristics, structure, composition, and changes caused by interactions with other objects which are called chemical reactions (Sumarni, 2010).

Students' initial abilities are abilities that already exist within students before they start learning. Initial ability to follow chemistry lessons is important for teachers to know because it is a prerequisite knowledge to take part in learning and to find out how far students already know the material to be presented, so teachers can design better learning

(Mashami & Khaeruman, 2020); (Gais & Afriansyah, 2017).

Increased student understanding can be measured by their initial abilities during the learning process, this initial ability is supported by Generic Science Skills which students learn. According to (Khabibah et al., 2017) Science Generic Skills is a combination of scientific knowledge and skills that are part of 21st century skills (Haviz et al., 2018). The initial ability of students is important for the teacher to know before starting learning, because the teacher can find out whether students already have the prerequisite knowledge to take part in learning and to what extent students already know what material will be presented, as well as being a benchmark in understanding a new concept, so that the learning outcomes will be better than before (Muthmainah et al., 2019).

In research conducted by (Izetbigovic et al., 2019) it is said that KGS as an initial ability is needed in learning chemical concepts so that students can learn and understand chemical concepts more easily. Previous research conducted by (Widarti et al., 2020) said that students with low initial abilities would have difficulty learning during learning. Low initial ability is characterized by difficulties in understanding concepts, performing calculations and difficulty interpreting chemical reactions (Mulyatiningsih, 2013). The difficulties faced by students in learning chemistry are generally due to the existence of a concept that must be understood and the relationship between one concept and another (Ware & Rohaeti, 2018), so chemistry is considered a difficult subject for students (Rosidah et al., 2017).

LITERATURE REVIEW

Students' initial abilities are the actual abilities possessed by students before participating in the teaching and learning process. Analysis of students' initial abilities was carried out to seek and find information or data about students' abilities before participating in teaching and learning activities in the classroom (Fenica et al., 2017). Students' initial abilities include things such as intelligence level, creativity, language skills, learning speed, learning motivation levels, attitudes towards learning assignments, interest in learning, feelings in learning, mental and physical conditions (Magdalena et al., 2020).

Generic skills can be grown when students go through the process of learning chemistry, one of which is to learn various concepts and solve various scientific problems (Suryani et al., 2020) In learning chemistry, one of which is the material on the Reaction Rate, it is very necessary to develop generic science skills (Adri et al., 2020). Generic science skills also provide opportunities for students to be actively involved in learning so that interactions occur between skills and concepts, principles and theories that have been discovered or developed (Indrawati, 2012).

The Higher Order Thinking Skill ability is a high-level thinking skill that demands critical, creative, analytical thinking regarding information and data in solving problems (Adri et al., 2020). High-level thinking is a type of thinking that tries to explore questions regarding existing knowledge regarding issues that are not clearly defined and do not have definite answers (Nurmala & Mucti, 2019).

In mathematical ability, analytical skills are needed, namely the ability to analyze or divide something into its parts and be able to explain the relationship between these parts (Ismawati & Hanifah, 2020). Every student does not necessarily have the same analytical skills (Khabibah et al., 2017). Previous research stated that the higher the analytical ability, the higher the achievement of learning chemistry in chemical material, including some material in chemistry that contains a lot of chemical calculations (Cholifah et al., 2019).

One of the chemistry learning materials that requires an understanding of mathematical analysis and modeling is reaction rate material (Purba et al., 2022). For example, if a student understands exponential material, the student will easily calculate the rate order in the reaction rate material (Maysaroh et al., 2021). In everyday life can not be separated from various chemical reactions. Some of the chemical reactions that occur around us are fast and can be observed directly, slow or very fast reactions, or very slowly so that it cannot be observed because the time is very short or very long and the chemical reactions that occur have their respective rates (Dibyantini & Azaria, 2020); (Ismawati & Hanifah, 2020).

In this study using reaction rate material as learning material in measuring students' initial ability tests. The following is the reaction rate material (Astuti, 2015). The reaction rate can be expressed as a decrease in the amount of reactants for each unit of time or an increase in the amount of reaction products for each unit of time. The measure of the amount of substance in a chemical reaction is generally expressed as the molar concentration or molarity (M) (Agustin, 2013).

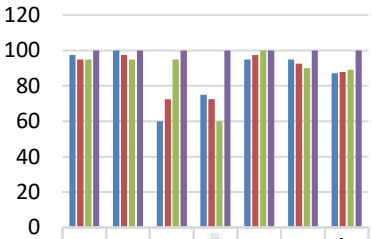
METHODS

This study uses Research and Development (R&D). The population in this study were all students of class XI MIPA as many as 6 classes. Sampling used a purposive sampling technique, with research data obtained using validation sheets and questionnaires. The research instrument used in this study used test instruments, to test the ability of the scholastic test and test the ability of chemistry. The test instrument used was arranged in the form of multiple choice with five options.

RESULT AND DISCUSSION

Validation Against Material Experts

Based on the results of the questionnaire tabulation of lecturers and teachers, the results of the validation tabulation are obtained as follows:



	D1	D2	G1	G2	G3	G4	Average
Material Aspect	97,5	100	60	75	95	95	87,08
Contruction Aspect	95	97,5	72,5	72,5	97,5	92,5	87,92
Language Aspect	95	95	95	60	100	90	89,17
Additional Rules	100	100	100	100	100	100	100,0

Figure 1. Material Expert Validation Questionnaire Graph

Based on Figure 1 above, the results of the validation test by the expert validator can be seen that the average percentage results obtained for Material Aspects are 87.08%, Construction Aspects are 87.92%, Language Aspects are 89.17%, and Additional Rules are 100%. This shows that the initial ability test instrument based on generic science skills on reaction rate material is "Appropriate" to use.

Table 1. Validation Achievement Level Qualifications

No.	Achievement Level	Category	Information
1.	81-100%	Very good	Very decent,
2.	61-80%	Good	Decent
3.	41-60%	Pretty good	Not feasible,
4.	21-40%	Not good	Not feasible,
5.	<20%	Very Less Good	Very not feasible

Based on the value category table above, it can be concluded that the validation of the item questions given is very good.

Validation of Learners

Based on research that has been conducted at SMA Negeri 2 Percut Sei Tuan, students who answer "correctly" have a value of 1 and if "wrong" have a value of 0. Then the validation results were obtained for the early ability instrument of the scholastic test with 36 the number of respondents to the scholastic test with 20 items. with the acquisition of 17 valid questions and 3 invalid questions according to the results of the tabulation of respondents' answers. Meanwhile, the results obtained from the validation results for the initial ability instrument of the chemical test based on 36 respondents to the chemical test on the reaction rate material with 20 items with the acquisition of 18 valid questions and 2 invalid questions according to the results of the tabulation of respondents' answers.

Difficulty Level of Scholastic Test Instruments

The results of the scholastic test show that the 20 questions given to students can be seen in Figure 2.

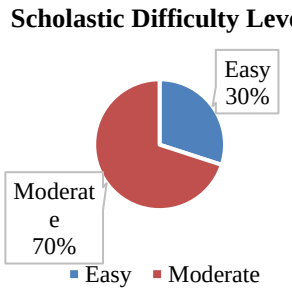


Figure 2. Scholastic Test Difficulty Level Test

If seen based on the graph above, the difficulty level of the items in the medium category is 70%, while the difficulty level of the items in the easy category is 30%.

Difficulty Level of Chemical Test Instruments

The results of the scholastic test show that the 20 questions given to students can be seen in Figure 3.

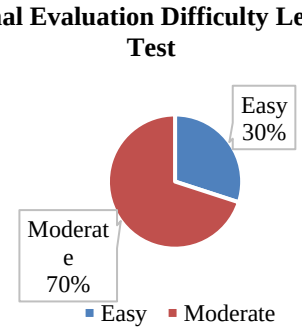


Figure 3. Graph of Chemical Difficulty Level

If seen based on the graph above, the difficulty level of the items in the medium category is 70%, while the difficulty level of the items in the easy category is 30%.

Scholastic Test Different Power

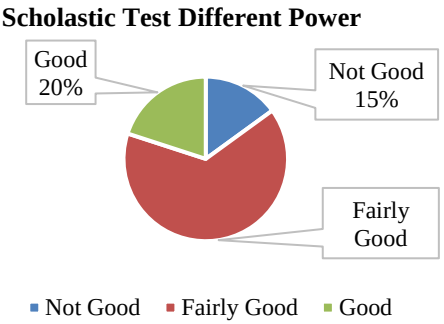


Figure 4. Graph of Scholastic Differential Power

If seen based on the graph above, the different power of the ability test for the scholastic test with the "Good" category is 20%; the "sufficient" category of 65%; category "Not Good" as much as 15%.

Different Power Final Evaluation Test

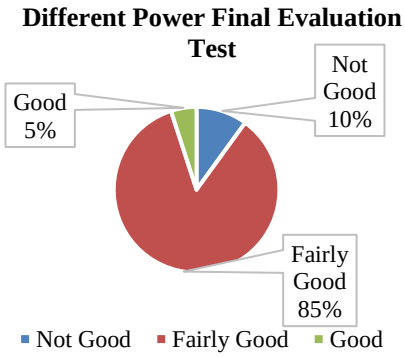


Figure 5. Graph of Chemical Distinguishing Power

If seen based on the graph above, the differential power of the chemical test ability test with the "Good" category is 5%; category "Enough" as much as 85%; and with the "Not Good" category as much as 10%.

Scholastic Test Distructor

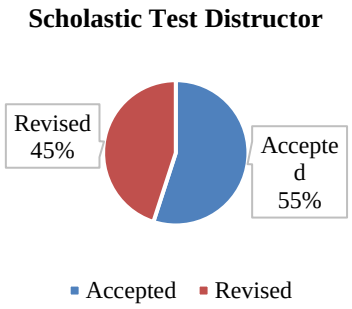


Figure 6. Scholastic Test Distructor Graph

The graph above states that 55% of the questions given with the constructor are accepted and 45% of the questions that need to be revised.

Final Evaluation Test Distructor

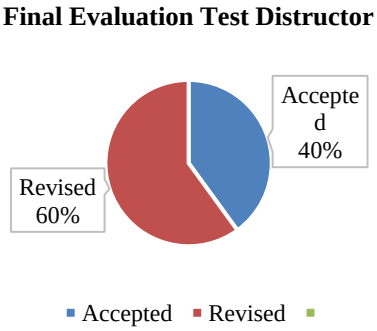


Figure 7. Graph of Chemical Test Distructors

The graph above states that the questions given with the constructors received were 40%% and the questions that needed to be revised were 60%.

Scholastic Test Reliability

The formula used for the reliability test is the Kuder Richardson formula (KR-21) with the criteria that if $r_{11} > r_{table}$ then it is said that all of the item items are reliable.

The high or low reliability of an instrument is known from the "reliability coefficient" which is symbolized by r_{11}. The high and low reliability of an instrument is known

from the reliability coefficient which is symbolized by r_{11}. Where the price of r_{11} ranges from 0.0-1.0.

$$q = 1 - p \qquad (1)$$

$$r_{11} = \left(\frac{K}{K-1}\right)\left(\frac{S^2 - \sum pq}{S^2}\right) \qquad (2)$$

$$S^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{N}}{N} \qquad (3)$$

Information:
r_{11} = Test reliability coefficient
K = Number of test items
S^2 = Score variance
P = The proportion of subjects that answered correctly
q = The proportion of subjects who answered incorrectly
X = Total score

The results of the scholastic ability test test of 17 valid questions, based on the table above it can be seen that r_{count} = 0.7775 with r_{table} = 0.329, by comparing the prices of rcount with rtable, it can be determined the reliability of the test items with the criteria $r_{count} > r_{table}$ or 0.7775 > 0.329 it can be concluded that all of the item questions are reliable (Maysaroh et al., 2021)

Final Evaluation Reliability

The results of the chemical ability test of 18 valid questions, based on the table above it can be seen that r_{count} = 0.8009 with r_{table} = 0.329, by comparing the prices of rcount with r_{table}, the reliability of the test items can be determined with the criteria $r_{count} > r_{table}$ or 0.8009 > 0.329 it can be concluded that all of the item questions are reliable.

Scholastic Test Trial

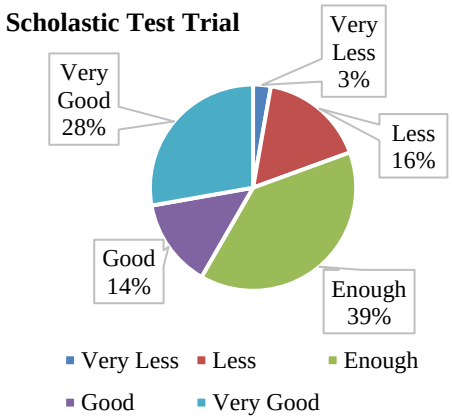


Figure 8. Graph of Scholastic Test Results

Based on the figure, it was found that the results of the early scholastic ability test obtained student learning outcomes, namely 3% very less, 16% less, 39% sufficient, 14% good and 28% very good.

Final Evaluation Test Trial

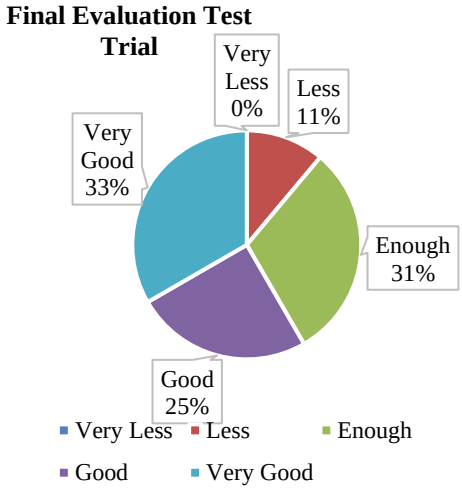


Figure 9. Graph of Chemical Test Results

Based on the picture, it was found that the results of the chemistry initial ability test obtained student learning outcomes, 0% very less, 11% less, 31% less, 25% good and 33% very good.

CONCLUSION

The test instruments given to expert validators were 2 Medan State University lecturers and 4 teachers. The results of the validation test by the expert validator can be seen that the average percentage results obtained for Material Aspects are 87.08%, Construction Aspects are 87.92%, Language Aspects are 89.17%, and Additional Rules are 100%. This shows that the initial ability test instrument based on generic science skills on reaction rate material is "Appropriate" to use.

Based on the validity test of the scholastic test, 17 valid question data were obtained and 3 invalid questions, while the chemistry ability test validity test obtained 18 valid question data and 2 invalid questions.

The results of students' initial ability tests were divided into 5 categories, namely very less, less, enough, good, very good. The results of the initial scholastic ability test obtained student learning outcomes, namely 3% very less, 16% less, 39% sufficient, 14% good and 28% very good. The results of the chemistry initial ability test obtained student learning outcomes, 0% very less, 11% less, 31% less, 25% good and 33% very good.

REFERENCES

Adri, H. T., Yudianto SA, Mawardini, A., & Sesrita, A. (2020). Using Animated Video Based on Scientific Approach To Improve Students Higher Order Thinking Skill. *Indonesian Journal of Social Research (IJSR)*, *2*(1), 9–17. https://doi.org/10.30997/ijsr.v2i1.23

Agustin, R. R. (2013). Pengembangan Keterampilan Generik Sains Melalui Penggunaan Multimedia Interaktif. *Jurnal Pengajaran Matematika Dan Ilmu Pengetahuan Alam*, *18*(2), 253–257. https://doi.org/10.18269/jpmipa.v18i2.58

Astuti, S. P. (2015). Pengaruh Kemampuan Awal dan Minat Belajar terhadap Prestasi Belajar Fisika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *5*(1), 68–75. https://doi.org/10.30998/formatif.v5i1.167

Cholifah, E. N. U., Yamtinah, S., & VH, E. S. (2019). Hubungan Kemampuan Analisis dan Matematika dengan Prestasi Belajar Siswa pada Materi Larutan Penyangga Kelas XI SMA Negeri 4 Surakarta. *Jurnal Pendidikan Kimia*, *8*(2), 179–184. https://jurnal.uns.ac.id/jpkim

Dibyantini, R. E., & Azaria, W. (2020). Pengaruh Penerapan Model Pembelajaran Berbasis Masalah Terhadap Kemampuan Generik Sains Siswa Pada Materi Larutan Penyangga. *Jurnal Inovasi Pembelajaran Kimia*, *2*(2), 81. https://doi.org/10.24114/jipk.v2i2.19561

Fenica, I., Muderawan, I. W., & Widiartini, P. (2017). Implementasi Model Pembelajaran Inkuiri Untuk Meningkatkan Aktivitas Belajar Siswa Pada Mata Pelajaran Kimia. *Jurnal Pendidikan Kimia Indonesia*, *1*(1), 1–6. https://doi.org/10.23887/jpk.v1i1.12807

Gais, Z., & Afriansyah, E. A. (2017).

Analisis Kemampuan Siswa dalam Menyelesaikan Soal High Order Thinking ditinjau dari Kemampuan Awal Matematis Siswa. *Jurnal Mosharafa; Jurnal Pendidikan Matematika*, *6*(2), 255–266. https://doi.org/10.31980

Haviz, M., Karomah, H., Delfita, R., Umar, M. I. A., & Maris, I. M. (2018). Revisiting Generic Science Skills as 21st Century Skills On Biology Learning. *Jurnal Pendidikan IPA Indonesia*, *7*(3), 355–363. https://doi.org/10.15294/jpii.v7i3.12438

Ismawati, P., & Hanifah. (2020). Implementasi Pendekatan Saintifik Terhadap Kemampuan Kognitif Sains Anak Usia 5-6 Tahun Di Ra Annur Assalafy Tumpang Pacarkeling Kejayan Pasuruan. *Thufuli : Jurnal Ilmiah Pendidikan Islam Anak Usia Dini*, *2*(1), 1–13. https://doi.org/10.33474/thufuli.v2i1.6825

Izetbigovic, M. A., Solfarina, & Langitasari, I. (2019). Penerapan Model Discovery Learning untuk Meningkatkan Keterampilan Generik Sains Siswa. *EduChemia (Jurnal Kimia Dan Pendidikan)*, *4*(2), 164–174. https://doi.org/10.30870/educhemia.v4i2.6118

Khabibah, E. N., Masykuri, M., & Maridi. (2017). The Analysis of Generic Science Skills of High School Students. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, *158*, 251–256. https://doi.org/10.2991/ictte-17.2017.48

Mashami, R. A., & Khaeruman, K. (2020). Pengembangan Multimedia Interaktif Kimia Berbasis PBL (Problem Based Learning) untuk Meningkatkan Keterampilan Generik Sains Siswa. *Hydrogen: Jurnal Kependidikan Kimia*, *8*(2), 85–96. https://doi.org/10.33394/hjkk.v8i2.3138

Maysaroh, S., Luliani, E., & Wulandari, A. (2021). Hubungan Pemahaman Konsep Matematika terhadap Hasil Belajar Kimia. *Prosiding Seminar Nasional Pendidikan STKIP Kusuma Negara III SEMNARA 2021*, 214–221. http://jurnal.stkipkusumanegara.ac.id/index.php/semnara2020/article/view/1138

Muthmainah, S., Masykuri, M., & Prayitno, B. A. (2019). Pengaruh Pembelajaran Poe (Predict Observe Explain) Melalui Metode Eksperimen Dan Demonstrasi Terhadap Hasil Belajar Ditinjau Dari Kemampuan Awal Dan Keterampilan Generik Sains Siswa. *INKUIRI: Jurnal Pendidikan IPA*, *8*(1), 12–20. https://doi.org/10.20961/inkuiri.v8i1.31782

Purba, J., Sutiani, A., Panggabean, F. T. M., Isnaini, M., & Hutahaean, H. D. (2022). 1,2,3 ,. *TIK Dalam Pendidikan*, *9*(1), 52–59. https://jurnal.unimed.ac.id/2012/index.php/jipk/article/view/19561

Rosidah, T., Astuti, A. P., & Wulandari, V. A. (2017). Eksplorasi Keterampilan Generik Sains Siswa pada Mata Pelajaran Kimia di SMA Negeri 9 Semarang. *Jurnal Pendidikan Sains (Jps)*, *5*(2), 130–137. https://jurnal.unimus.ac.id/index.p

hp/JPKIMIA/article/view/2997

Sumarni, W. (2010). Penerapan Learning Cycle sebagai Upaya Meningkatkan Keterampilan Generik Sains Inferensia Logika Mahasiswa Melalui Perkuliahan Praktikum Kimia Dasar. *Jurnal Inovasi Pendidikan Kimia*, *4*(1), 521–531. https://jurnal.uns.ac.id/jpkim

Suryani, M., Jufri, L. H., & Putri, T. A. (2020). Analisis Kemampuan Pemecahan Masalah Siswa Berdasarkan Kemampuan Awal Matematika. *Mosharafa: Jurnal Pendidikan Matematika*, *9*(1), 119–130. https://doi.org/10.31980/mosharafa.v9i1.605

Ware, K., & Rohaeti, E. (2018). Penerapan Model Problem Based Learning Dalam Meningkatkan Kemampuan Berpikir Analitis Dan Keterampilan Proses Sains Peserta Didik Sma. *JTK (Jurnal Tadris Kimiya)*, *3*(1), 42–51. https://doi.org/10.15575/jtk.v3i1.2219

Widarti, H. R., Sigit, D., & Irianti, D. (2020). Pengaruh Kemampuan Awal terhadap Kemampuan Interkoneksi Multi Representasi Siswa pada Materi Larutan Penyangga. *J-PEK (Jurnal Pembelajaran Kimia)*, *5*(1), 40–46. https://doi.org/10.17977/um026v5i12020p040