Guided Inquiry-Based Learning System Integrated With Flipped Classroom On Salt Hidrolysis: An Innovative In Discord

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Abstract— In the era of technological advancement, social media is used to support the learning process. Where the objective of this research is to develop a discovery-based learning system integrated with a flipped classroom using Discord on the topic of salt hydrolysis phase F class XI SMA/MA and to determine the validity and practicality levels of the developed learning system. The type of research used is Educational Design Research (EDR) with the Plomp model, where the stages of this research include preliminary research and prototype development. Content validity and construct validity were analyzed using the Aiken's V scale, while practicality was obtained from the practicality questionnaire given to students and teachers. A product is considered valid if it achieves a V value ≥ 0.8 and very practical if the practicality score is above 86%. Based on the research results, the average content validity score and construct validity score were 0.88 and 0.91, respectively, both categorized as valid. In addition, the results of the practicality test questionnaire were 90% for students and 96% for teachers, both categorized as very practical. Thus, it can be concluded that the developed learning system is suitable for use in the learning process with the potential to enhance the quality of education, especially in the field of chemistry, with a high level of practicality.

Keywords— Learning System; Guided Inquiry; Flipped Classroom; Discord; Salt Hidrolysis

I. INTRODUCTION

The Merdeka Curriculum is a breakthrough in the Indonesian education system designed to create more relevant, in-depth, and enjoyable learning experiences for students. Launched by the Ministry of Education, Culture, Research, and Technology, this curriculum aims to meet the challenges of the times by granting greater autonomy to schools and teachers in designing learning processes that align with the unique characteristics and needs of each student. The independent curriculum can be implemented in a guided inquiry learning model. Students are expected to be engaged and cooperative throughout the learning process. The guided inquiry model is one of the most successful learning approaches. By connecting existing knowledge, guided inquiry is an active learning technique that allows students to build their own understanding [1]. Students can enhance their problem-solving skills by using the guided inquiry model [2].

Because it encourages students to use learning resources and collaborate in groups, guided inquiry is a successful teaching strategy in the subject of chemistry [3]. The research [4], in which students look for and discover the concepts being studied on their own, is emphasized in research on the inquiry-based blended learning model with a flipped classroom technique. In a blended learning environment, which combines in-person instruction in the classroom with online instruction via Moodle, the teacher's job is to facilitate learning. The available films and interactive materials will encourage students to study by introducing them to intriguing mathematical ideas, providing an entertaining educational experience and igniting their critical thinking.

Flipped classroom is a learning method that reverses conventional ideas, with theoretical exercises completed at home and their application occurring in the classroom or at school [5]. The flipped classroom approach is applied in two conditions: synchronous and asynchronous [6]. Synchronous learning occurs simultaneously. Asynchronous learning, on the other hand, takes place at different times and locations [7]. When compared to the conventional conference approach, the flipped classroom, which combines both learning environments, is known to enhance student learning activities and outcomes [8]. From the research [9], it was found that the application of the flipped classroom learning model is effective in improving students' understanding of thermochemistry concepts. This is shown by the t-$_{test}$ results, where thitung = -3.542 and t$_{table}$= -2.126 (α = 5%), so t$_{count}$ < t$_{table}$, thus H0 is rejected and the N-Gain value is 0.43 (moderate category). According to the research [10] , which applies the flipped classroom learning system based on guided inquiry with the Edmodo learning system on the subject of salt hydrolysis, this learning method is valid and practical, making it very useful in the learning process.

In a learning process, there is certainly a learning system where this learning system can take the form of social media that can support active learners in their education. One of the social media platforms that is rarely used in the learning process among the current generation is the social media platform Discord. Game players often connect through the social media application Discord, where there is a communication feature [11]. Where this communication feature also makes it easier for teachers to deliver learning materials to students effectively [12]. Then there are the extensive features of Discord, which include voice notes, channels, categories, chats, and video conferences, as well as its free and unlimited usage, which are some of its advantages.

The results [13] of this study indicate that using as many of the features that Discord offers as possible, such as text and voice chat, distribution of text and voice chat, peran system, and bot, as well as combining Discord with other media, can be a factor that makes it an engaging and interactive learning tool. According this study [14], there are a number of advantages to using the Discord app as an online learning tool for speaking courses. Because of its voice channel features, which enable speech interaction in Discord rooms, and its effectiveness, practicality, and lightweight design, the Discord software makes learning more comfortable for students. It can be used on a variety of devices. Additionally, several relevant studies have shown that Discord text and voice channels function well as learning tools [15].

The study[16], used Discord instruction along with flipped classroom and guided inquiry learning about reaction rate demonstrates the experimental group's N-gain value was greater at 0.70 than that of the control group, which was 0.33. Additionally, the results of the t-test showed that the means were statistically significant, with t-count = 8.11 > t-table = 1.99. This research how effective this educational approach is in improving student learning outcomes.Therefore, the researchers developed a guided inquiry-based learning system integrated with a flipped classroom using the Discord application on the topic of salt hydrolysis. By analyzing the validity and practicality levels of the developed learning system.

II. METHOD

The type of research conducted is Educational Design Research (EDR) with the Plomp development model, which includes the following stages: preliminary research, development or prototyping, and the prototyping phase.
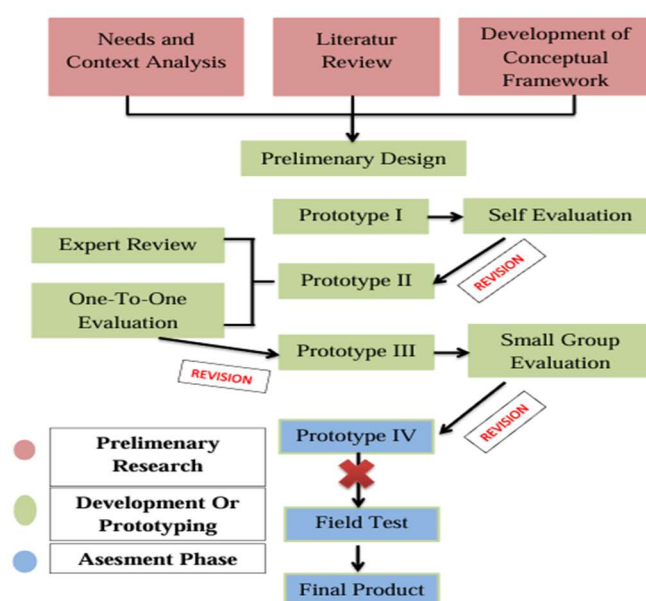
Figure 1. Education Design Research (EDR) Stages [17]

The needs analysis was conducted through interviews with 3 chemistry teachers from 3 different schools. Then, the context analysis was carried out by analyzing the Chemistry learning outcomes Phase F class XI SMA/MA, as well as the learning objectives to learning objectives flow material on salt hydrolysis. Literature study is conducted to search for and understand sources related to the development to be carried out, as well as to find solutions to problems through scientific journals. Based on the identified problems and their relation to several existing theories, a conceptual framework is formed. In the stage of development or prototype creation, the following are carried out: analysis, design, evaluation, and revision. At this stage, after designing prototype 1, formative evaluation is conducted.

Formative evaluation is carried out in the form of self evaluation development of prototype 2. Next, expert review and one-to-one evaluation are conducted, aimed at determining the validity of the developed model. Validation was conducted by 3 chemistry lecturers, and one-to-one evaluation was carried out by interviewing 3 students from SMAN in Padang. After obtaining the results and making revisions, prototype 3 was produced. Then, a small group test was conducted on prototype 3 by testing it with 9 students, which yielded results and revisions that will produce prototype 4. At this stage, a practicality test of the developed model is conducted.

Content validation and construct validation were carried out using a content validation questionnaire consisting of aspects of content components, presentation components, linguistic components, and graphic components. Then, the construct validation questionnaire consists of aspects of display components and ease components. The validated data were analyzed using the Aiken. Formula with the following assessment categories: valid ($V \geq 0.80$), invalid ($V < 0.80$) [18]. Where the formula:

$$V = 1\frac{\sum s}{n(c-1)}$$

$$S = r - lo$$

Explanation:

S = Score set by the validator minus the lowest score in the category

r = as the score of the chosen category and, as the lowest score in the score category

n = many validators

c = many categories selected (highest validity score).

The practicality test for students and the practicality test for teachers were obtained from student questionnaires that consist of several aspects, namely: ease of use, time efficiency, and benefits. Where the formula used to analyze the obtained results is:

$$NP = \frac{R}{Sm} \times 100$$

Explanation:

NP = Percentage value sought/expected

R   = Raw score obtained by the student

SM = Ideal maximum score of the relevant test

100 = Fixed number

[19].

III. RESULT AND DISCUSSION

A. Prelimenary Research

From the results of the observations conducted, several significant gaps in chemistry education in schools in Padang have been revealed. These findings are crucial for designing innovative solutions in the future. The representation of the investigation results shows that the guided inquiry learning model has not been implemented evenly. This becomes a constraint because the inquiry model is very important for developing students' critical thinking and problem-solving skills. In addition, the learning media used do not yet fully encompass various representations, especially at the submicroscopic level. However, the understanding of abstract chemistry concepts heavily relies on students' ability to visualize particles and their interactions at the atomic and molecular levels. And this indicates the need for the development of more comprehensive and innovative teaching materials.

In the results, there are also issues in utilizing social media like WhatsApp for learning, where important information shared by teachers is often missed due to the numerous responses and messages from students in the group. This shows that although WhatsApp is easily accessible, its structure does not support organized communication. Then about Discord, in reality, Discord, as a potential social media platform to support the learning process, is not yet well-known by the three schools. Discord offers more structured features such as separate text and voice channels, dedicated discussion rooms, and file-sharing capabilities, all of which can facilitate learning interactions more effectively compared to regular instant messaging applications. Therefore, the implementation of guided inquiry models, the provision of various learning representations, and the more effective use of social media in chemistry education are necessary.

Literature study the learning system is a structured component that includes four important elements: human factors, materials, facilities, equipment, and procedures [20]. Based on the analysis results [21], it was found that the V values for content and construct validity are 0.88 and 0.89, respectively, both categorized as valid. The practicality results show a score of 92% for students and 93% for teachers, both categorized as practical. Therefore, the learning system created can be relied upon and is useful for teaching. So the learning system created can be useful and utilized for teaching

Then guided inquiry Research conducted [22], the research results show: (1) the teaching materials on the basic chemical law in the books used in high schools/Islamic high schools meet the BSNP criteria with a fairly valid criterion and do not need revision; (2) the developed module meets the BSNP criteria, the data obtained are content feasibility = 3.68; language feasibility = 3.57; presentation feasibility = 3.70; graphic feasibility = 3.50 with valid criteria and do not need revision; (3) the trial of the guided inquiry-based module can improve students' learning outcomes by 80%; (4) students' learning outcomes using the guided inquiry-based module are greater than the KKM score. So, guided inquiry research conducted by [22] showed that in the trial of

the guided inquiry-based module, it could improve students' learning outcomes by 80%; and the learning outcomes of students using the guided inquiry-based module were higher than the KKM score

Student learning outcomes can be better with flipped classroom learning compared to other teaching methods. From the research [9], it was found that the application of the flipped classroom learning model is effective in improving students' understanding of thermochemistry concepts. This is shown by the t-test results, where thitung = -3.542 and ttabel = -2.126 (α = 5%), so $t_{counts} < t_{table}$, thus H0 is rejected and the N-Gain value is 0.43 (medium category). So application of the flipped classroom learning model is effective in enhancing students' understanding of thermochemistry concepts. The ability to integrate other digital tools is becoming increasingly important as a flexible and innovative teaching tool.

Research conducted by [23], shows that the use of Discord in the classroom has significant potential to enhance students learning experiences. The innovative features offered by Discord can serve as a solution to support more effective and relevant digital learning in this modern era. This research recommends the use of Discord as an alternative learning medium that can enhance the learning process. Therefore, the learning system created is reliable and beneficial for education. This research [16]comprehensively examines the effectiveness of integrating three innovative learning Discord, flipped classroom, and guided inquiry to improve student learning outcomes on the topic of reaction rates. The research results show that this combined approach is very effective, as evidenced by significant improvements in students' conceptual understanding and skills.

The conceptual framework is obtained based on problem identification derived from needs and context analysis, supported by literature study results. The conceptual framework is developed through the analysis of needs and context, designed to identify, define, and explain concepts related to the research topic. Additionally, the formulation of the conceptual framework also aims to provide direction in the research process to be conducted, ensuring that the research is focused.

B. Development Or Prototyping

Prototype I

The first step in the development or prototyping phase is product development, which results in prototype 1. Figure 2 shows the cycle of the flipped classroom learning based on guided inquiry. This learning system combines classroom and out-of-class learning. Guided discovery-based learning using the Discord application starts with the stages: preparation, orientation; exploration and concept formation that begins (asyncronous); application; and closure (Syncronous).
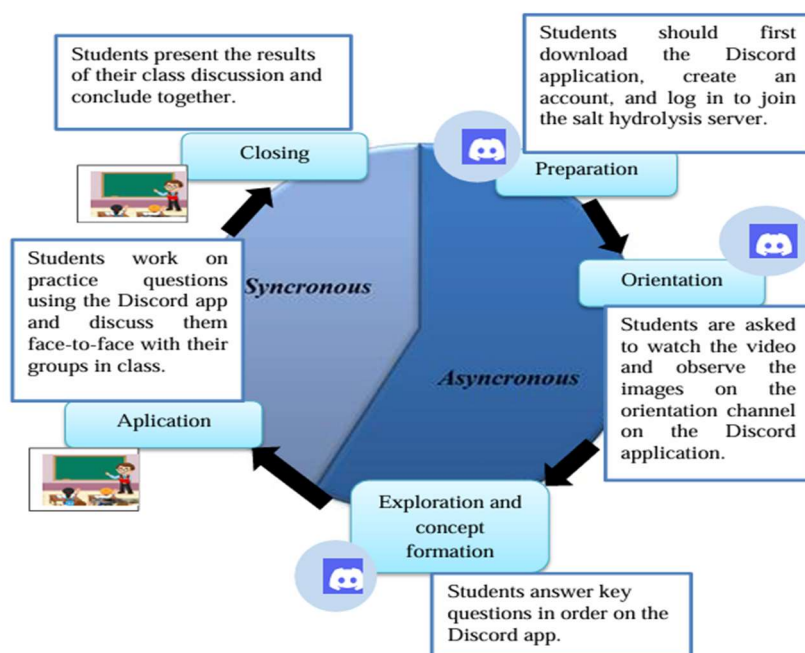
Figure 2. Flipped classroom learning cycle based on guided inquiry[24]

All lesson plans that have been structured based on the guided inquiry model in sequence will be uploaded and included in the Discord application. This lesson plan is based on the guided inquiry model explained through the following stages: Orientation, orientation is the first syntax of guided inquiry that includes a video. The content of the video includes the presentation of learning objectives, the flow of learning objectives, explanations of prerequisite materials, and motivation for the students. Students must master one of the prerequisite materials before studying salt hydrolysis, namely "neutralization reactions." Students need to understand neutralization reactions well to help them comprehend the material on salt hydrolysis. Exploration and concept formation, exploration and concept formation in this syntax, where a model is provided for students to answer key questions sequentially in order to discover a concept.

Key questions are structured based on the provided model, such as image models, tables, and others. After answering the key questions, students have discovered the concept of the material being studied. Application, students will be given practice questions to be worked on in groups through the Discord application. The practice questions are provided to expand the understanding of concepts that students have acquired in the previous stage, namely the exploration and concept formation stage. In conclusion, after working on the practice questions in groups during the application stage, students will present their discussion results in front of the class, followed by drawing conclusions by the students and validation by the teacher.

Prototype II

After obtaining prototype I, a self evaluation was conducted through the completion of a checklist questionnaire filled out by the researcher regarding the components of the complete design of the guided inquiry-based learning system integrated with flipped classroom using the Discord application on the topic of salt hydrolysis. The results after the self evaluation revision can be seen in (figure 3).
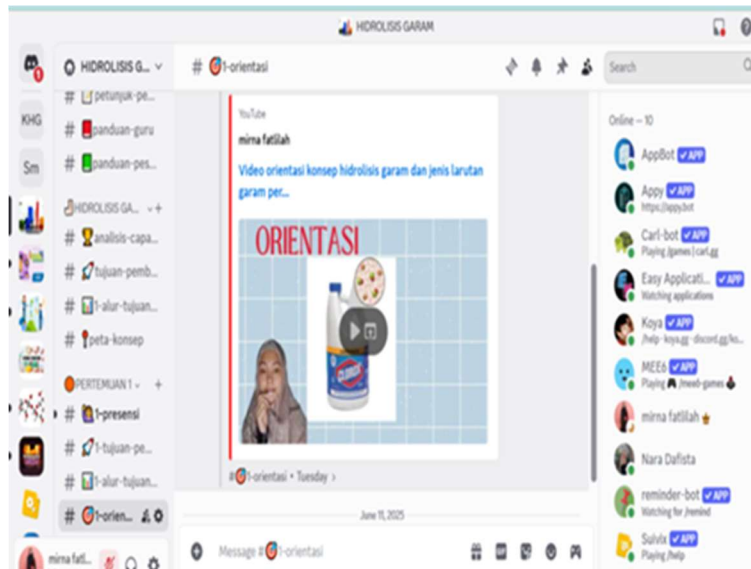
Figure 3. Results after revising the self-evaluation at the orientation on Discord

The learning system design that has been planned and uploaded to Discord has been implemented well, but there are shortcomings in the orientation section. Orientation channel should contain videos that include CP, TP, prerequisite material, and motivation. From the existing shortcomings in the orientation channel, revisions were made so that the learning system used later becomes more motivating for students in the learning process, and prototype II was obtained.

Prototype III

The obtained Prototype II will subsequently undergo formative evaluation in the form of expert review and one-to-one evaluation. Here are the results of the content validation data analysis obtained from expert assessments and revised based on the suggestions from the validators in table 1.

Table 1. Analysis of content validation results The

Assesment Aspects	V	Content Of Validity
Content	0,86	Valid
Presentation	0,87	Valid
Language	0,90	Valid
Graphic	0,90	Valid
Average	**0,88**	**Valid**

The expert review assessment results were analyzed using Aiken's V formula for 5 validators [18] , yielding an average content validity value of 0.88 with a valid category In the aspects of content components, presentation components, linguistic components, and graphic components, the average validity values (V) were obtained in sequence as follows: 0.86, 0.87, 0.90, 0.90, with all aspects categorized as Valid. After obtaining the results of the content validation data analysis, the results of the construct validity data analysis were also obtained in table 2.

Table 2. Analysis of construct validation results Based

Assesment Aspects	V	Category Of Validity
Display	0,91	Valid
Convenience	0,91	Valid
Average	**0,91**	**Valid**

For construct validity, the average validity value 0.91 with a valid category, which includes 2 assessment aspects in this construct validity: the display component aspect and the ease component aspect, with an average 0.91, all categorized as valid. The average score was obtained from revisions carried out based on the suggestions and comments from 3 lecturers at Padang State University and 2 teachers at SMAN 8 Padang. From the average score of content and construct validity, it can be concluded that the developed learning system product meets the validator's assessment criteria. Next one-to-one evaluation were obtained from interviews with 3 eleventh-grade students at SMAN 8 Padang with high, medium, and low cognitive abilities who have studied the topic of salt hydrolysis based on recommendations from the chemistry teacher at SMAN 8 Padang. The purpose of conducting this individual evaluation is to see the students' responses to the obtained prototype II.

One-to-one Evaluation was obtained through interviews with three eleventh-grade students from SMAN 8 Padang who have studied the topic of salt hydrolysis and possess different levels of cognitive ability, namely students with high, medium, and low cognitive levels. The interview was conducted to obtain students' responses to prototype 2. The students opened each channel present in meeting 1, starting from the orientation channel to the closing channel. After that, the students were asked to provide feedback on the material presented and the appearance on Discord through an interview. The conclusion from the One-to-one Evaluation interview shows that all students of different ability levels consider the appearance of images, language, instructions, and models used to be very clear and very easy to understand. This helps them in answering key questions and does not cause difficulties in using the Discord application. A valid prototype 3 was formed.

Prototype IV

After obtaining the valid prototype III, a practicality test was conducted with 9 students and 2 chemistry teachers from SMAN 8 Padang, referred to as a small group test. After that, students and teacher were asked to respond to the guided inquiry-based learning system integrated with the flipped classroom using the Discord application through the student practicality questionnaire and the teacher practicality questionnaire as shown in figures 4 .

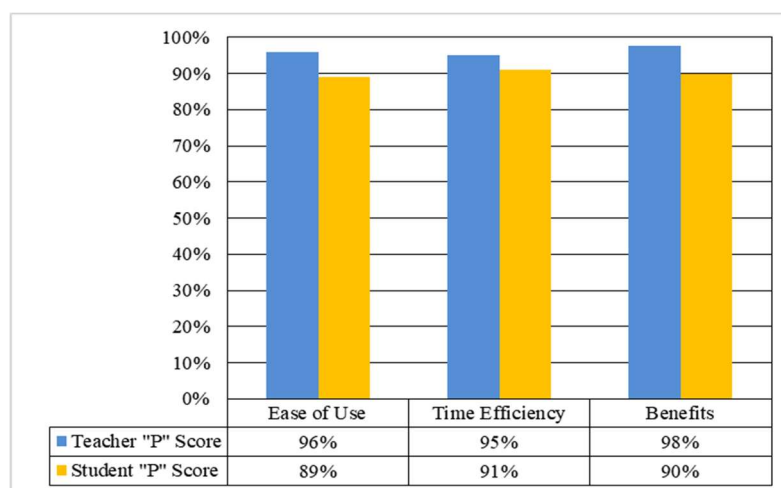|	Ease of Use	Time Efficiency	Benefits
Teacher "P" Score	96%	95%	98%
Student "P" Score	89%	91%	90%

Figure 4. Analysis of student practicality results and teachers practicality results

The results obtained, in the practicality test for students, the aspect of ease of use received a score 89% (very practical category), the aspect of time efficiency received a score 91% (very practical category), and the aspect of usefulness received a score 90% (very practical category). For the teacher's practicality test, the aspect of ease of use received a score 96% (very practical category), the aspect of time efficiency received a score 95% (very practical category), and the aspect of usefulness received a score 98% (very practical category). From the practicality sheets filled out by students and teachers, the average practicality score for students 90%, which falls into the very practical category. The average practicality score for teachers 96%, also in the very practical category.

Then, there were suggestions and comments from the teachers at one of the SMAN 8 Padang stating that the learning system using the Discord application, which is close to the daily lives of the students, needs to be further developed as it can help increase students' learning motivation. The students also gave positive feedback regarding the developed learning system, stating that learning with the Discord application is very interesting and enjoyable, students are more enthusiastic about learning, especially in chemistry lessons, it sharpens their understanding of the concept of salt hydrolysis, and the language used is very clear and easy to understand, making it easy to answer key questions. From the practical value of students and teachers, it can be concluded that the developed learning system is suitable for use in the learning process. Next, the analysis of the answers to the key question in model 3 for 3 students can be seen in table 3.
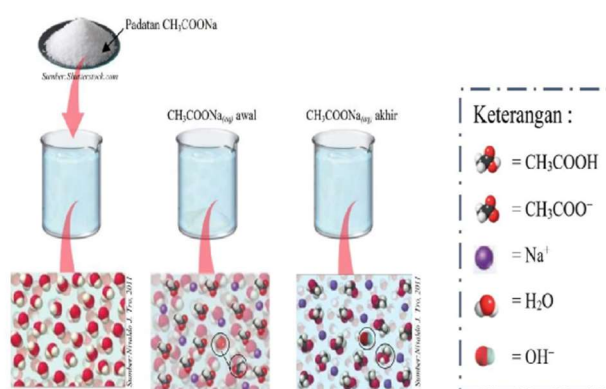
Figure 5. Model of the exploration and concept formation stage

From the model above, the responses of 3 students were analyzed to understand how well the students comprehend the given model.

Table 3. Description of student responses

Student	Response
1	Model 3 is a type of some hydrolyzed salt solution where the salt decomposition occurs at its anion.
2	Model 3 is a type of partially hydrolyzed salt solution formed from a weak acid and a strong base, where the hydrolyzed ion is the ion from the weak acid.
3	Model 3 is a type of partially hydrolyzed salt solution formed from a weak acid and a strong base, where only the ion from the weak acid, CH_3COO^-, undergoes hydrolysis. Therefore, it is referred to as a type of partially hydrolyzed salt solution with its anion.

Figure 5 is one of the models from the stages of exploration and concept formation provided to help students discover a concept through key questions. Students are expected to understand the model and answer the key questions well so that they can

understand the types and explanations of salt solutions thoroughly. Based on the response from student 1, it can be seen that the student's level of understanding is limited and does not align well with the textbook. Then, based on the response from student 2, it can be seen that the student's level of understanding is fairly aligned with the textbook, as the student clearly provided an answer but there are still some shortcomings. And based on the response from student 3, it can also be seen that the student's level of understanding is very good and aligns well with the textbook, as the answer given is correct, clear, and accurate, with the hydrolyzed ionic compound written from the provided model.

In answering a key question, students must be provided with a clear model that includes 3 levels of multiple representations chemistry , namely macroscopic, submicroscopic, and symbolic[25]. This is to ensure that students' understanding is well-formed and that they can easily grasp the concept of the material. Students must understand all three levels, because if they only understand the macroscopic level, they can only rely on images and have difficulty observing phenomena in depth, or if they only understand the submicroscopic level, they can only observe, or if they only understand the symbolic level, they can only rely on chemical symbols to find concepts. These three components work together to provide different chemical representation illustrations that aid students in understanding concepts. Students will have misconceptions in the absence of these three components, and learning will gain greater significance with the aid of chemical examples [24].

IV. CONCLUSION

The guided inquiry-based learning system integrated with the flipped classroom using the Discord application on the hydrolysis of salts material phase F class XI SMA/MA has been validated with a value of V = 0.88 for content validation and V = 0.91 for media or construct validation. And categorized as very practical, with a percentage of 90% from students and 96% from teachers. The guided inquiry-based learning system integrated with the flipped classroom using the Discord application on the salt hydrolysis material Phase F Class XI SMA/MA can be developed using the Plomp model.

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REFERENCES

[1] D. M. Hanson, "Designing Process-Oriented Guided-Inquiry Activities. Faculty Guidebook – A Comprehensive Tool for Improving Faculty Performance, 1–6.," 2005.

[2] V. Aumi and M. Mawardi, "Validity And Practicity Of Flipped Guided Inquiry Based Learning (FGIL) Model In Chemical Kinetics For Year 1 Students," *Int. J. Progress. Sci. Technol. (IJPSAT*, vol. 26, no. 1, pp. 142–147, 2021, [Online]. Available: http://ijpsat.ijsht-journals.org

[3] F. Q. Aini, Z. Fitriza, F. Gazali, M. Mawardi, and G. Priscylio, "Perkembangan Model Mental Mahasiswa pada Penggunaan Bahan Ajar Kesetimbangan Kimia berbasis Inkuiri Terbimbing," *J. Eksakta Pendidik.*, vol. 3, no. 1, p. 40, 2019, doi: 10.24036/jep/vol3-iss1/323.

[4] Kardena and M. Mawardi, "Model Pembelajaran Inkuiri Blended Learning Strategi Flipped Classroom dengan Media Interaktif untuk Meningkatkan Kemampuan Berpikir Kritis," 2019.

[5] M. Agustini, "MENINGKATKAN AKTIVITAS DAN HASIL BELAJAR SISWA MENGGUNAKAN MODEL FLIPPED CLASSROOM MELALUI.," 2021.

[6] M. Mawardi, Z. Fitriza, O. Suryani, S. Sukmawati, and V. Aumi, "Penerapan Model Pembelajaran Flipped Classroom Berbasis Guided Inquiry (FGIL) Pada Pembelajaran Kimia SMA di Kabupaten Agam Sebagai Model Untuk Pembelajaran Digital di Masa Pandemi Covid 19," *Pelita Eksakta*, vol. 4, no. 2, p. 176, 2021, doi:

10.24036/pelitaeksakta/vol4-iss2/170.

[7]   U. A. Chaeruman, "Merancang Model Blended Learning Designing Blended Learning Model," *J. Teknodik*, pp. 053–063, 2019, doi: 10.32550/teknodik.v17i4.577.

[8]   W. P. Waer and M. Mawardi, "Integrasi Model Inkuiri Terbimbing Dan Pendekatan Flipped Classroom Pada Pembelajaran Materi Sifat Koligatif Larutan Untuk Siswa Kelas XII SMA/MA," *Edukatif J. Ilmu Pendidik.*, vol. 3, no. 3, pp. 1029–1037, 2021, doi: 10.31004/edukatif.v3i3.498.

[9]   Teguh Wibowo and Sidiq Subagiyo, "Flipped Classroom: Inovasi Pembelajaran untuk Meningkatkan Pemahaman Konsep Termokimia Siswa," *J. Pendidik. dan Pembelajaran Sains Indones.*, vol. 5, no. 2, pp. 135–143, 2022, doi: 10.23887/jppsi.v5i2.52786.

[10]   Z. W. Nengsih and M. Mawardi, "Pengembangan Sistem Pembelajaran Flipped Classroom Berbasis Inkuiri Terbimbing pada Materi Hidrolisis Garam," *Edukatif J. Ilmu Pendidik.*, vol. 3, no. 4, pp. 1231–1244, May 2021, doi: 10.31004/edukatif.v3i4.546.

[11]   J. P. Raihan and Y. R. Putri, "Pola komunikasi group discord PUBG.FUN melalui aplikasi dicord," *Photosynthetica*, vol. 5, no. 3, p. 4161, 2018, [Online]. Available: http://link.springer.com/10.1007/978-3-319-76887-8%0

[12]   A. Rakhmawan *et al.*, "Analisis Pemanfaatan Aplikasi Discord Dalam Pembelajaran Daring Di Era Pandemi Covid-19," *Pros. Semin. Nas. Pendidik. FKIP*, vol. 3, no. 1, pp. 55–59, 2020, [Online]. Available: https://jurnal.untirta.ac.id/index.php/psnp/article/view/9905

[13]   M. B. Huda, "Pemanfaatan Discord Sebagai Alternatif Media Pembelajaran Secara Daring," *Inspirasi J. Ilmu-Ilmu Sos.*, vol. 19, no. 2, pp. 659–667, 2022.

[14]   A. Ramadhan, "Student's Response Toward Utilizing Discord Application as an Online Learning Media in Learning Speaking at Senior High School," *ISLLAC J. Intensive Stud. Lang. Lit. Art, Cult.*, vol. 5, no. 1, p. 42, 2021, doi: 10.17977/um006v5i12021p42-47.

[15]   E. Efriani, J. A. Dewantara, and A. Afandi, "Pemanfaatan Aplikasi Discord Sebagai Media Pembelajaran Online," *J. Teknol. Inf. dan Pendidik.*, vol. 13, no. 1, pp. 61–65, 2020, doi: 10.24036/tip.v13i1.283.

[16]   R. Akmar, M. Mawardi, A. Ulianas, and F. Q. Aini, "Effectiveness of Discord Instructional Media Integrated with Flipped Classroom and Guided Inquiry Learning on Reaction Rates on Students Learning Outcomes," *J. Penelit. Pendidik. IPA*, vol. 10, no. 1, pp. 108–115, Jan. 2024, doi: 10.29303/jppipa.v10i1.6385.

[17]   A. P. S. Tuti, M. Mawardi, and O. Suryani, "Flipped Classroom System Based on Guided Inquiry Learning Model Using Discord Application on Reaction Rate," *Prism. Sains J. Pengkaj. Ilmu dan Pembelajaran Mat. dan IPA IKIP Mataram*, vol. 11, no. 3, p. 678, Jul. 2023, doi: 10.33394/j-ps.v11i3.8131.

[18]   L. R. Aiken, "Three Coefficients for Analyzing The Reliability and Validity of Ratings. Educational and Psychological Measurement, 131–142.," 1985.

[19]   Purwanto, "Tingkat ke praktikalitasan," 2010.

[20]   O. Hamalik, *Prose Belajar Mengajar*. jakarta: PT. Bumi Aksara, 2003.

[21]   R. Ananda, M. Mawardi, and O. Suryani, "Development of Flipped Guided Inquiry Learning (FGIL) System Using Discord Application on Chemical Equilibrium," *J. Paedagogy*, vol. 10, no. 3, p. 746, Jul. 2023, doi: 10.33394/jp.v10i3.8105.

[22]   I. Pratiwi, R. E. D, R. Silaban, and R. D. Suyanti, "Pengembangan Modul Berbasis Inkuiri Terbimbing Pada Materi Hukum Dasar Kimia Di Sekolah Menengah Atas," *Talent. Conf. Ser. Sci. Technol.*, vol. 2, no. 1, pp. 187–193, 2019, doi: 10.32734/st.v2i1.340.

[23]   H. M. Muhammad, I. D. Cahyani, and B. Fatwa, "POTENSI DISCORD SEBAGAI MEDIA PEMBELAJARAN," vol. 5, no. 1, 2025.

[24]   I. A. Ismail and M. Mawardi, "Thermochemical Materials For High School Students Class XI," vol. 30, no. December, pp. 280–287, 2021, doi: 10.52155/ijpsat.v30.1.3907.

[25]   E. Delfianza, M. Mawardi, and O. Suryani, "Development of Flipped Classroom Based Guided Inquiry Learning System with Digital Literacy Using Discord Application on Thermochemistry," *J. Penelit. Pendidik. IPA*, vol. 9, no. 7, pp. 5228–5235, Jul. 2023, doi: 10.29303/jppipa.v9i7.4245.