SJME (Supremum Journal of Mathematics Education)
Vol.08, No.02, July 2024, pp. 311-333
ISSN: 2548-8163 (online)| ISSN: 2549-3639 (print)
DOI: 10.35706/sjme.v8i2.10515

Learning Design Using Discord and Jigsaw Strategies to Improve Listening Skills

Iqbal Ramadhan[1], Made Duanda Kartika Degeng[2*], Hendry Praherdhiono[3],Saiful Bahri[4]
[1,2*,3] Pasca Sarjana Teknologi Pembelajaran Universitas Negeri Malang; Jl. Cakrawala No.5, Sumbersari, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145
[4] Universitas Muslim Nusantara Al Wasiah
Email: Iqbal.ramadhan.2201218@students.um.ac.id[1], made.degeng.fip@um.ac.id[2*], henry.praherdhiono.fip@um.ac.id[3],saifulbahri@umnaw.ac.id

Article Information

Received December 09, 2023
Revised January 03, 2024
Accepted July 11, 2024

Diterima 09 Desember 2023
Direvisi 03 Januari 2024
Disetujui 11 Juli 2024

Keywords:
Learning, Design, Listening, Skills

Kata kunci:
Pembelajaran, Desain, Mendengarkan, Keterampilan

ABSTRACT

Expanding the challenges faced by the education system in Indonesia in adapting to changes brought by developments in technology and communication. The emergence of Industry 5.0 presents significant challenges, forcing educational institutions to implement distance learning processes. Terms such as blended learning, hybrid learning, flip-classroom, and others have become a way to integrate online and offline teaching and learning activities. This integration presents new challenges in terms of effectiveness, efficiency, and engagement in designing learning that combines various media and strategies. According to Prof. Punaji (2020) in his book on learning design, learning design is a process that includes planning learning needs and goals, developing teaching media, and implementing a systematic effective and efficient learning system to achieve predetermined learning goals. Various factors such as materials and activities, student characteristics, curriculum, experiments, teaching methods and media, and learning evaluation need to be considered in developing learning designs. It is hoped that combining learning design with technology can make learning more effective and efficient so as to produce optimal results.

ABSTRAK

Memperluas tantangan yang dihadapi sistem pendidikan di Indonesia dalam beradaptasi terhadap perubahan yang dibawa oleh perkembangan teknologi dan komunikasi. Kemunculan Industri 5.0 menghadirkan tantangan yang cukup besar sehingga memaksa institusi pendidikan untuk menerapkan proses pembelajaran jarak jauh. Istilah-istilah seperti blended learning, hybrid learning, flip-classroom, dan lain-lain telah menjadi cara untuk mengintegrasikan kegiatan belajar mengajar online dan offline. Integrasi ini menghadirkan tantangan baru dalam hal efektivitas, efisiensi, dan keterlibatan dalam merancang pembelajaran yang menggabungkan berbagai media dan strategi.

Menurut Prof Punaji (2020) dalam bukunya tentang desain pembelajaran, desain pembelajaran adalah suatu proses yang meliputi perencanaan kebutuhan dan tujuan pembelajaran, pengembangan media pengajaran, dan penerapan sistem pembelajaran yang sistematis, efektif dan efisien untuk mencapai tujuan pembelajaran yang telah ditentukan. Berbagai faktor seperti bahan dan kegiatan, karakteristik siswa, kurikulum, eksperimen, metode dan media pengajaran, serta evaluasi pembelajaran perlu dipertimbangkan

dalam mengembangkan desain pembelajaran. Penggabungan desain pembelajaran dengan teknologi diharapkan dapat menjadikan pembelajaran lebih efektif dan efisien sehingga menghasilkan hasil yang optimal.

INTRODUCTION

This section discusses the challenges faced by the education system in Indonesia in adapting to changes due to developments in technology and communication. The emergence of Industry 5.0 presents significant challenges, forcing educational institutions to implement distance learning processes. Terms such as blended learning, hybrid learning, flip-classroom, and others have become a way to integrate online and offline teaching and learning activities. This integration presents new challenges in terms of effectiveness, efficiency, and engagement in designing learning that combines various media and strategies.

According to Prof. Punaji (2020) in his book on learning design, learning design is a process that includes planning learning needs and goals, developing teaching media, and implementing a systematic effective and efficient learning system to achieve predetermined learning goals. Various factors such as materials and activities, student characteristics, curriculum, experiments, teaching methods and media, and learning evaluation need to be considered in developing learning designs. It is hoped that combining learning design with technology can make learning more effective and efficient so as to produce optimal results (Spector, 2001).

Based on research conducted by Saputra & Pasha (2021), learning media that uses scientific-based comics for students can become a learning media that can increase students' knowledge about the perimeter of rectangles.

In the journal entitled Implementation of the Missouri Mathematics Project Learning Model Assisted by GeoGebra to Improve the Mathematical Communication Skills of Middle School Students, the results showed that there was an increase in the mathematical communication abilities of students who received the Missouri Mathematics Project (MMP) learning model assisted by GeoGebra which was better than the increase in the mathematical communication abilities of students who received the Missouri Mathematics Project (MMP) learning model assisted by GeoGebra. received the Missouri Mathematics Project (MMP) learning model assisted by GeoGebra. get conventional learning. Indirectly, this research shows that the method of combining learning design with technology can produce good results (Rosyid & Umbara 2018).

It is widely known that puzzles are a learning strategy that involves students learning in five learning steps. This includes an introductory step, a first home group discussion working cooperatively (Joyce, Weil , & Calhoun , 2009; Mengduo & Xiaoling , 2010). Student learning achievement is expected to increase if learning uses cooperative learning, especially the Jigsaw strategy.

D. Kuswandi (2020) Teachers have additional needs in the learning process by utilizing ICT because teachers in the "now" era are encouraged to present new learning efficiently in the classroom. This research is motivated by the problems faced by students and lecturers in the online and offline learning process. The use of various platforms in the teaching and learning process, such as WhatsApp for disseminating information, Zoom or

Gmeet for online classes , and Siakad for delivering assignments, requires students to navigate various scenarios and switch between applications during the learning process. Discord was chosen as a learning platform that is integrated with the learning design proposed by Degeng & Degeng (2018) in designing classroom learning. H. Praherdhiono (2019) stated that transforming educational technology for the better and winning the hearts of society in the era of the fourth industrial revolution is not a small but crucial task.

Because of its potential, jigsaw learning and its modified versions are used more frequently in educational settings than other types of cooperative learning strategies (Jansoon , Somsook , & Coll, 2008). Jigsaw learning has been used at elementary, secondary, and university levels (Artut & Tarim , 2007). Jigsaw has been applied to science subjects such as chemistry (Doymus , 2007; Effendi Hasibuan, Bakar, & Harizon , 2020), pharmacy (Persky & Pollack, 2009), mathematics (Leikin & Zaslavsky, 1999), and statistics (Perkins & Saris, 2001). In addition, puzzles have been applied in social science subjects such as English (Li, 2012). This global adoption suggests that jigsaw learning is popular and frequently used in learning activities.

However, to get the most out of this puzzle, successful implementation is required. On the other hand, constraints play an important role in influencing the success of implementing cooperative learning, especially in developing countries because of their educational challenges (Effendi-Hasibuan, Harizon , Ngatijo , & Mukminin, 2019), and this also applies to developing countries. . jigsaw learning. Jansoon et al. (2008) have identified that Jigsaw learning in Thailand is influenced by time, student understanding, and teacher understanding of the Jigsaw process. Li (2012) has identified that puzzle learning in English classes in China is influenced by time, teacher participation to provide guidance, class size, and classroom environment. Likewise, Rika (2017) reported that Jigsaw learning in English classes in Indonesia was hampered by a lack of teacher time and classroom management skills. This description reveals a phenomenon that shows that implementing jigsaw learning in these countries is a challenge. The problem may stem from an inappropriate educational environment creating a situation that makes the puzzle less feasible.

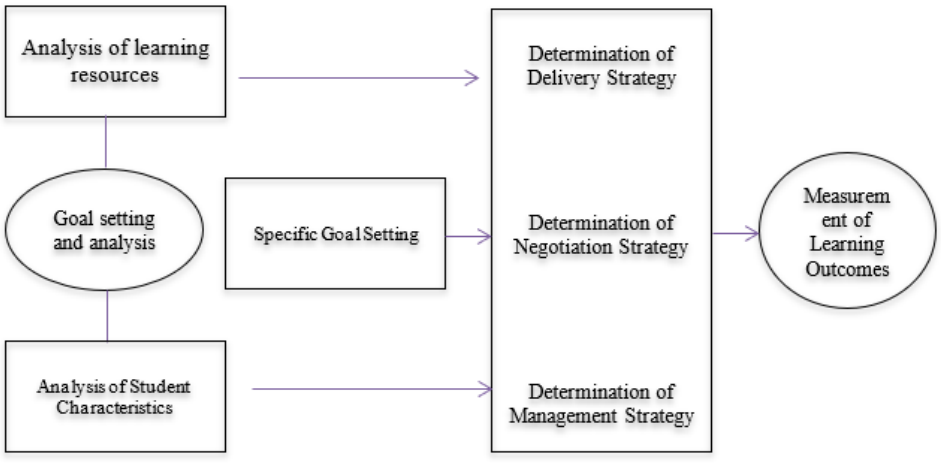

Figure 1. The development of learning design

The learning design in the classroom is adapted to several stages described by Degeng & Degeng (2018) in their book "The Science of Learning". This section does not

provide information regarding the stages mentioned by Degeng & Degeng (2018). The development of learning design in this research is integrated with contemporary online learning media which presents elements of the appeal of the Z and Alpha generations. This learning design has been adapted to the use of Discord in the world of education, utilizing features that support learning. The development of learning design in this research is integrated with contemporary online learning media which presents elements of the appeal of the Z and Alpha generations. This learning design has been adapted to the use of Discord in the world of education, utilizing features that support learning. Based on Figure 1, it can be seen that learning design begins with analyzing learning resources, then setting goals and analysis, then analyzing student characteristics. After going through these 3 stages, the next step is to determine certain goals through 3 stages, namely Delivery Strategy, Determination of Negotiation Strategy, Determination of Management Strategy, so that you can see the measurement of learning outcomes.

The implementation of learning design using Discord is based on the theory put forward by Degeng & Degeng (2018), which is divided into three groups:

Analysis of Learning Conditions

The initial stage of designing learning activities begins with analyzing the objectives and characteristics of learning content, analyzing learning resources, analyzing student characteristics, and determining learning objectives and content. According to the classification, analysis of learning conditions includes assessing learning needs such as media and other supporting factors in the learning process. The learning media analysis in this research utilizes Discord, adapted to learning needs for effectiveness, efficiency and attractiveness so as to produce user retention and become an aspect of interaction in learning activities.

Learning Strategy Development

The second stage includes determining and designing strategies in learning which are also called development steps. Classification in this group begins with determining organizational strategy, negotiation strategy and management strategy. Development strategies in the field of learning technology focus on how to organize and deliver learning content and manage the learning process. Research designs this learning approach based on several factors including effectiveness, efficiency and attractiveness.

Development of Learning Outcome Measurement Procedures

The final step in learning design is developing outcome measurement procedures, covers three aspects, namely effectiveness, efficiency, and attractiveness or attractiveness of learning strategies. Discord as a Learning Management System (LMS): The selection of appropriate learning media in this research is in line with environmental conditions and the current 5.0 technology era. Choosing effective, efficient and interesting learning media is a crucial factor that really supports the learning design process. Ghazali (2021) conducted research on the use of applications as learning media, deploying various online platforms such as Zoom, Webex, Google Meet, WhatsApp, Telegram, Facebook, and Discord based on their calculation features.

Table 1 Comparison of Features of Various Online Platforms

Feature	Zoom in	Webex	Google meets	What's that	Telegram	Facebook	*Dispute*

SJME ISSN: 2548-8163 (online) | ISSN: 2549-3639 (print)

Desktop + Mobile Order	V	V	V	V	V	V	V
Individual text messages	V	V	V	V	V	V	V
Multiplayer Screen	X	X	X	X	X	X	V
Parallel channel	X	X	X	X	X	X	V
Limitation on the number of users	Depends on the package	X	X	256	200k	X	X

Researchers assess that the findings presented in Table 1 above have been adapted to the conditions and needs of students in the current digital era. Researchers also assessed that the use of Discord compared to other applications better meets the needs of students and lecturers in learning mobility in the classroom. Discord's detailed but straightforward supporting features are easy to accept in the learning process. The convenience of Discord can also be accessed via various electronic devices.

The use of Discord in learning is also strengthened by research from several previous studies which discuss the use of Discord in the world of education. For example, research by Ghazali (2021) which compares its use with other learning media, Efriani et al. (2020) explains the use of channels, text channel features, and voice channel features, Anggraini & Yulianawati (2020) explains the use of applications that can be accessed freely anywhere using mobile devices or desktops, and Aulia Ramadhan (2021) explains that the Discord feature is assessed able to create a more interactive classroom environment and help students improve their abilities.

Further support is also strengthened by several previous studies on subjects such as Listening (Wulanjani, 2018), Vocabulary (Odinokaya , 2021), Speaking (Aulia, 2021). Ramadhan, 2021), and research on the use of Discord in learning (Tjahjadi, 2021) (Dewantara et al., 2020) (Huda, 2022), (Rakhmawan et al., 2020).

METHOD

The learning model in this research combines technology-based learning with sequential learning design steps (Degeng & Degeng , 2018). The development of this model is integrated with the use of a Learning Management System (LMS), especially Discord, to increase the effectiveness, efficiency and engagement of the Critical Listening class.

Degeng & Degeng (2018) learning design includes the following stages: 1) Analysis of learning objectives and content characteristics, 2) Analysis of learning resources, 3) Analysis of student characteristics, 4) Determination of learning objectives and content, 5) Determination of learning strategies for organizing learning content , 6) Determine the strategy for delivering learning content, 7) Determine the learning management strategy, 8) Develop procedures for measuring learning outcomes. Testing was carried out on a small, medium and large scale to assess the effectiveness, efficiency and attractiveness of the learning design developed.

This research data was obtained from fourth semester students who took the Critical Listening course at UIN Maulana Malik Ibrahim Malang. Respondents totaled 36 students, consisting of two students for the small-scale trial, five students for the medium-scale trial, ten students for the large-scale trial from the Ak class, and 19 students from the ICP class as research subjects. Data collection includes assessment of learning design, use of Discord as a learning medium using a Likert scale (1-4), student response questionnaires, and student learning outcomes test scores including pre-test and post-test.

Data from field note observations were analyzed using basic qualitative analysis techniques with interpretive methods for learning events. This aims to understand the Jigsaw learning process and look for themes of obstacles. Meanwhile, interview data was analyzed using the descriptive method of teacher answers. This is achieved by looking at the teacher's important statements during learning, the obstacles that arise, and the use of puzzle learning at school in the future. Finally, the data validity analysis process is achieved by involving a member check process, discussion between researchers, and technical triangulation (Creswell, 2009).

Interviews aim to obtain data that supports observation data. In this study, observations were carried out in field note style with the aim of recording all events during Jigsaw learning. This includes data about the practicalities of Jigsaw learning, challenges students face during learning, and critical points in implementation that require adjustments. Observations were carried out once in three different classes, each for 90 minutes.

RESULTS AND DISCUSSION

This research relies on an analysis of the objectives and characteristics related to the dynamics of education that continues to develop, especially in facing the development of the 21st century generation which is dominated by Generation Z and Alpha. The main basis of this research is achieving effective, efficient and interesting learning objectives. The constructivist approach is the main guideline, where students are considered as constructors of knowledge through experience and interaction with learning material. Constructivist theories , particularly those developed by Jean Piaget, a prominent Swiss psychologist, play a central role.

Piaget emphasized that learning is a process of individual knowledge construction through interaction with the environment. The concept of stages of cognitive development that he promotes provides an illustration of how individuals progressively build their understanding over time. Additionally, this research recognizes the role of technological engagement as a key element in ensuring the accessibility of learning anywhere and at any time. In this context, Discord was chosen as a Learning Management System (LMS) to connect students and lecturers in the teaching and learning process. Reference Seymour's work Papert , an influential mathematician and educator, especially in his book "Mindstorms: Children, Computers, and Powerful Ideas," emphasized the importance of a technology-based constructivist approach. The concept of computer-based constructivism introduced by Papert shows that the use of technology can be an effective tool to facilitate deep and creative learning.

This condition was parallel with the result of Jansoon et al. (2008) who had also identified that students' understanding of jigsaw had challenged the jigsaw learning in Thailand. Balfakih (2003) reckoned that a good understanding of the process of a cooperative learning strategy determines the success of its implementation.

SJME ISSN: 2548-8163 (online) | ISSN: 2549-3639 (print)

Analysis of Learning Objectives and Content Characteristics

This research bases its analysis of the aims and characteristics on the needs and conditions of education as it continues to develop, particularly fascinating in its account of the development of the 21st century generation, which is dominated by Generation Z and Alpha. Both grow in line with the rapid growth of information and communications technology. The main aim of research is to achieve effective, efficient and interesting learning. The basis of this concept can be found in the Generation Z and Alpha Theory introduced by Marc Prensky .

Prensky 's theory identifies characteristics of differences between Digital Natives (Generation Z and Alpha), who are accustomed to the digital environment from an earlier age, and Digital Immigrants, who may enter the digital era after their formative years. By understanding these differences, it is a research effort to adapt learning methods that suit the learning styles and technology preferences of Digital Natives . Technology integration, interactive learning, and content that is relevant to their daily lives are the strategies introduced.

The choice to use discussion as a Learning Management System (LMS) and platform to connect students and lecturers in the teaching and learning process is also in line with Prensky 's theoretical concepts . The interesting thing about using technology, as recommended by Prensky , is considering the key to enabling flexible access to learning, from anywhere and at any time. Intercollaboration, which is an important focus in Prensky's theory , is reflected in the choice of Discord as a tool to connect students and faculty, creating an effective and inclusive learning environment. So this research requires inspiration and support from Generation Z and Alpha theories who want to achieve learning goals that are in line with developments from the 20th century 21generation.

Analysis of Learning Resources

This research takes its basis from the views of MDK Degeng (2016) which emphasizes that selecting material that is appropriate to the specified media is a crucial step in planning learning. This initial step is in line with the principles of learning media selection theory, where suitability between the learning material and the media used is considered important. In his explanation, Degeng also highlighted the importance of presenting material in simple, communicative and clear language. Choosing the right language is an application of the principles of learning communication theory, where the quality of information must be easily understood by students.

The next step in this research is to analyze learning sources. This analysis is related to the principles of learning resource theory which emphasizes expanding learning elements to create effective, efficient and interesting classes. In this case, the learning source chosen is a learning video from YouTube with a certain theme. Themes include "Best Places in the World," "Movie Recap," "Technology and the Future," and "Art." The integration of learning resources through the Discord platform as a Learning Management System (LMS) also reflects the application of the fundamental concepts of learning accessibility and testing. Discord allows students to access learning resources from anywhere and at any time, supporting a flexible learning concept in line with the dynamics of the 21st century generation.

Thus, this research not only combines various relevant learning theories but also applies them systematically in material selection, content delivery, learning analysis sources, and learning platform implementation. This approach creates a framework that is robust and suited to contemporary learning needs.

Analysis of Student Characteristics

Analysis of the characteristics of Generation Z and Alpha students highlights the role of technology centers in their educational experiences. The Generation Z and Alpha theory introduced by Marc Prensky can provide a foundation for further understanding of how students from this generation interact with technology. Prensky describes Generation Z and Alpha as "Digital Natives ," who grew up in the digital era and have been accustomed to technology since birth. The integration of technology in education is in accordance with Prensky's thinking , which states that education must match student learning style with it's technology used. So, understanding student characteristics from Prensky's perspective helps the smooth use of technology has become a habit for Generation Z and Alpha.

constructivist theory , particularly the contributions of Jean Piaget , the characteristics of students who tend to choose learning environments according to their needs reflect the concept that students are active constructors in building their own knowledge. Piaget emphasized the importance of the individual's interaction with his environment to understand and build knowledge. In context, it is characteristic of Generation Z and Alpha students who choose learning environments according to their needs that reflect their use of constructive activities in their learning.

When discussing ease of access and integration of technology in education, the theory of the concept of loom taxonomy can be introduced. Benjamin Bloom developed a taxonomy of learning that includes various levels of understanding, from the level of knowledge to the level of evaluation. With the integration of technology and ease of access, students can again easily reach a higher level of understanding in Bloom's Taxonomy through exploration and application of the concepts they learn. By combining these theories and figures in an analysis of student characteristics, educators can better understand how to provide relevant and effective educational experiences for Generations Z and Alpha.

Setting Learning Goals and Content

In determining the learning objectives and content in the Critical Listening course, you can refer to Lev Vygotsky's social constructivist theory. Vygotsky emphasized that learning occurs through social and collaborative interaction, where students can build understanding through discussion and the exchange of ideas. Thus, the goal of improving students' critical listening skills and the ability to transform information into new thoughts can be implemented by building learning situations that facilitate interaction and collaboration between students.

John Dewey's active learning theory is also relevant in the context of setting learning goals and content. Dewey emphasized active, student-centered learning experiences. In developing learning content, strategies that encourage active student participation, such as group discussions, simulations, or collaborative projects, can increase the effectiveness of learning objectives. Apart from that, Howard Gardner and his theory of multiple intelligences can be a guide in determining learning content. Gardner identified different types of intelligence, including verbal-linguistic intelligence related to listening and speaking skills. Therefore, in designing learning content, various activities that utilize various types of intelligence can improve learning efficiency and meet the diverse needs of students.

SJME ISSN: 2548-8163 (online) | ISSN: 2549-3639 (print)

Setting Organizational Strategy

Organizational strategy for delivering managed learning content via Discord as a Learning Management System. The choice of organizational strategy is influenced by the type of learning content and learning design structure. The design implemented in Discord uses the Jigsaw strategy, adopting a blended learning model to maximize the use of technology and adapt to each student's learning preferences. The class organization system is fully registered on Discord LMS for the teaching and learning process.

The paragraph above reflects the final steps in learning design which include procedures for developing learning outcome measurements through testing and conducting research in three stages: small, medium and large scale. In this context, the approach to measuring learning outcomes can be linked to Donald L. Kirkpatrick's Learning Evaluation Theory. Kirkpatrick designed a tiered evaluation model that includes levels of four: reaction, learning, behavior, and results. The research trials in the third stage reflect the application of Kirkpatrick's evaluation principles, starting from student responses to long-term impacts on learning outcomes.

In addition, the concept of testing in three stages can be linked to the principles of measurement theory by Robert L. Thorndike. Thorndike, an educational psychologist, developed a comprehensive measurement concept. Testing on a small, medium and large scale reflects a holistic approach in measuring learning outcomes, ensuring the evaluation process covers various aspects and contexts of learning. To refresh your views, you can refer to research figures in the field of evaluation and measurement such as Michael Scriven. Scriven made important contributions to the development of evaluation theory and the measurement of learning outcomes. These concepts can be used to inform evaluation and measurement steps carried out in the testing phase of research. Thus, through a tiered evaluation approach, Thorndike's measurement concept, and the contribution of figures such as Michael Scriven, this final step in learning design integrates various theories and evaluative approaches to ensure the quality and effectiveness of learning using Discord and Jigsaw strategies.

Establishing a Delivery Strategy

Determination of delivery strategies is based on learning analysis sources. Taking inspiration from previous critical listening lessons, the activity of watching and reviewing films has proven to be effective in improving students' listening skills. Therefore, new and more effective, efficient and engaging delivery strategies are designed to improve listening skills in line with technological advances. The interaction strategy includes a blended learning approach, combining online and offline learning. This is in line with the journal written by Harjanti and Faradillah (2020) entitled *An Exploration of Secondary Students' Perception of Blended Learning in Mathematics Learning* . The results of the research show that many students prefer blended learning . The bold learning components are explained further as follows;

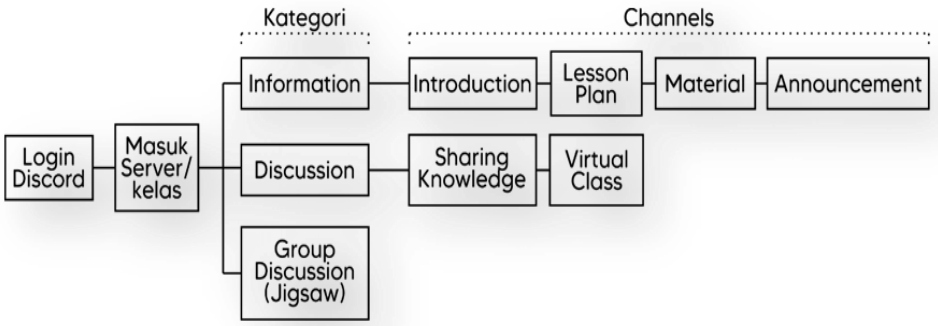

Figure 2. Online Learning Flow

Learning flow using Discord explained in Figure 2, the emphasis is on ease of access to classes. This dare learning process is the first stage of the Jigsaw strategy. Students can access classes from anywhere at any specified time. Dare learning takes place on odd weeks according to the learning process schedule. Ease of accessing information is also a crucial aspect in the learning process. Online activities are conducted for group discussions, each focusing on specific instructional video content.

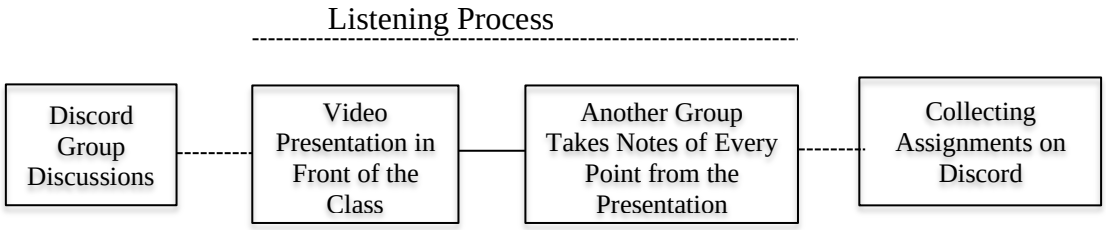

Figure 3. Offline learning flow

In the face-to-face learning flow, students continue listening activities as in figure 3, each student has a group and discusses material based on the topic that will be discussed. Then they prepare a presentation via video that has been previously made in front of the class, then another group notes each point from the presentation, after that students can submit assignments in their discord based on their group.

The flow of learning in class occurs at scheduled times, following the class schedule. In face-to-face sessions, students continue the activities they started in the brave phase. Each group had discussed, watched, and recorded their instructional video, which they then presented to the class. The critical listening process extends to the second stage of the Jigsaw strategy. This stage emphasizes the points conveyed by other groups, requiring students to record the information conveyed during the listening process. The face-to-face teaching and learning process last seven weeks according to the lecture schedule.

Setting Management Strategy

In building is studying management strategies, the technology approaches that utilize Disputes reflect the principles of Social Constructivism _ Theory by Lev Vygotsky . Vygotsky emphasized the importance of social interaction in the learning process. Discord as a technology-based communication platform allows students to interact, collaborate, and

share knowledge, in accordance with Vygotsky 's concept of the zone of proximal development. Correspondingly, the numbers related to this management strategy can refer to research and concepts from James Paul Gee . Wah is a linguist and educator who introduced the theory of Social Literacy which involves a deep understanding of the use of technology and media in the learning process. His approach through Discord , as a form of digital social literacy, supports Gosh's ideas about how technology can shape students' identities and literacy skills . In addition, learning theory based on the concept of Communities of Practice by Etienne Wenger can provide a foundation for this management strategy. Discord as a communication platform allows the formation of a community of practice among students, where they can share their knowledge, experience and practice their critical listening skills.

Development of Learning Outcome Measurement Procedures

After designing the learning process, the final step includes measuring results through testing and conducting research. Research testing occurs in three stages: small, medium, and large scale. This test assesses the feasibility of the learning design developed, which leads to further research activities. The final step in learning design includes developing procedures for measuring learning outcomes through testing and research in three stages: small, medium and large scale. In this context we can refer to the Learning Evaluation Theory proposed by Donald L. Kirkpatrick. Kirkpatrick designed a tiered evaluation model that includes levels of four: reaction, learning, behavior, and results. The research trials in the third stage reflect the application of Kirkpatrick's evaluation principles, starting from student responses to long-term impacts on learning outcomes. This evaluative approach is in line with the need to measure the effectiveness of learning designs that use Discord and Jigsaw strategies. In the context of developing listening skills, learning evaluations can include tests that cover aspects of critical listening that are emphasized in learning design.

In addition, small, medium and large scale testing can refer to the principle of measuring learning outcomes . The supporting theory or which is in line with this discussion is the measurement theory by Robert L. Thorndike. Thorndike, an educational psychologist, contributed the holistic and comprehensive concept of measurement. This three-stage approach reflects a comprehensive approach in assessing learning outcomes according to learning designs involving Discord and Jigsaw strategies. By integrating Kirkpatrick and Thorndike's Learning Evaluation Theory and Measurement Theory, this final step of learning design can produce relevant data to measure the effectiveness and feasibility of learning designs that have been designed using the Discord and Jigsaw strategies.

Content Expert Validation

Content validity theory is a subset of construct validity . Content validity is related to the extent to which the instrument evaluation covers all the domains it is intended to measure. In a learning context, content validation ensures that the learning design includes good material that is desired from the course or curriculum being implemented. This is in line with the content validity theory introduced by experts such as Samuel Messick and Lee Cronbach, who are figures who have made major contributions to the development of the concept of validity, which includes content validity. Validation of class learning content experts was carried out in collaboration with Mr. Harir Mubarok, M.Pd , supervisor of the Critical Listening course at UIN Maulana Malik Ibrahim Malang. The

content of this learning design is aligned with the learning outcomes and objectives of the course. Various presentation methods are used in this validation to achieve the learning objectives, which are explained in the following table 2:

Tabe 2. Content Expert Validation

No	Indicator	Scale			
		1	2	3	4
1	Conformity of Content to Learning Outcomes				V
2	Conformity of Content to Learning Objectives				V
3	Clarity of Material Delivery				V
4	Material Analysis Opportunities				V
5	Video Alignment with Meeting Theme				V
6	Inclusion of Differentiated Learning				V
7	Appropriateness of the Questions Given				V
8	Practice Includes Questions				V
9	Sequential Individual or Group Assignments				V
10	Ease of Access to Provided Content				V

Content expert validation was carried out using a rating scale, with a value of 1 for "strongly disagree", 2 points for "disagree", 3 points for "agree", and 4 points for "strongly agree". This validation process has been adapted to student characteristics, media use, and current conditions. The main goal of content expert validation is to ensure that the content of the course learning design is aligned with the learning objectives, so that it is effective, efficient, and interesting in achieving each student's goals.

Based on the results of the table 2 above, Content Expert Validation shows that all the indicators are on a scale of 4. Where the first indicator of Conformity of Content to Learning Outcomes is on a scale of 4. Next, the indicator of Conformity of Content to Learning Objectives is also on a scale of 4, Clarity of Material Delivery also has a scale of 4, then Material Analysis Opportunities is a scale of 4, Video Alignment with Meeting Theme is on a scale of 4, then Inclusion of Differentiated Learning also has a scale of 4 in this research, Appropriateness of the Questions Given is on a scale of 4, Practice Includes Questions is on scale 4, Sequential Individual or Group Assignments is on scale 4, Ease of Access to Provided Content has scale 4. Thus, it can be said that all indicators in this research fall into the highly approved category

Validation by Design Experts

Validation by design experts is carried out to enable retention of learning designs using Discord. Interest is considered a key factor in achieving Critical Listening learning and attracting students' attention during the learning process. Validation by a design expert is a process in which an expert in the field of design reviews and contains learning design elements to ensure that they meet effective and adequate design standards. In the context of learning to use Discord, this validation involves reviewing the interface design, information structure, and visual elements to ensure readability, engagement, and overall effectiveness. This theory is in line with the thoughts of William D. Ross, he is a figure who contributed to the field of process design evaluation. His theory, " Media Frame , " emphasizes the importance of understanding media elements in designing effective

SJME ISSN: 2548-8163 (online) | ISSN: 2549-3639 (print) ❒

learning. While not focused specifically on Discord, these concepts can be applied in learning design evaluation. Validation of design experts was assessed by Prof. Dedi Kuswandi, M.Pd , design expert and lecturer in Educational Technology. The following validation sheet is used by design experts:

Table 3 Validation of Design Experts

No.	Indicator	Scale			
		1	2	3	4
1	Alignment with Instructional Design Principles				V
2	Effectiveness of Attracting Students' Attention				V
3	Relevance of Content to Learning Objectives				V
4	Alignment with Student Needs and Characteristics				V
5	Integration Between Online and Offline Learning				V
6	Ease of Access and Navigation on Discord Platforms				V
7	Alignment with Instructional Design Principles				V
8	Effectiveness of Attracting Students' Attention				V
9	Relevance of Content to Learning Objectives				V
10	Alignment with Student Needs and Characteristics				V

Design expert validation is explained with the following description, where 1 point indicates "strongly disagree", 2 points indicate "disagree", 3 points indicate "agree", and 4 points indicate "strongly agree". Design expert validation confirmed the feasibility of using Discord learning design that uses the Jigsaw strategy in the teaching and learning process, especially in Critical Listening courses.

Furthermore, in table 3 regarding Validation of Design Experts, the first indicator related to Alignment with Instructional Design Principles is on scale 4, on the second indicator Effectiveness of Attracting Students' Attention is on scale 4, on the third indicator regarding Relevance of Content to Learning Objectives is also on on scale 4, then indicator 4 related to Alignment with Student Needs and Characteristics is on scale 4, then indicator 5 Integration Between Online and Offline Learning has scale 4, then indicator 6 has scale 4, then indicator 7 Alignment with Instructional Design Principles has a scale of 4, indicator 8 Effectiveness of Attracting Students' Attention has a scale of 4, indicator 9 Relevance of Content to Learning Objectives has a scale of 4, and the last indicator has a scale of 4. Thus it can be concluded that in this research all indicators is on a scale of 4 which means strongly approved.

Small Scale Product Testing

Small-scale product testing involves applying the same teaching methods and learning designs that would be tested with classroom research. Teaching methods include the approaches used to teach material, while instructional design involves designing the entire learning experience. In small-scale product testing, these methods and designs are applied to small groups or controlled environments to observe their impact, effectiveness, and learner responses. This theory is supported by Lev Vygotsky, who put forward the theory of cognitive development and the concept of the zone of proximal development, which can guide learning design that is appropriate to students' level of understanding and abilities. This small-scale product trial was carried out on two English Language Education

students majoring in *Critical Listening* . Special Jigsaw methods and strategies are used to improve their critical listening skills.

Table 4 Results of Small Scale Product Testing

No	Name	Presentation	Notes
1	M. Asyam Albana	93.75%	Learning Design is Very Feasible
2	Tiara Nadiya Itabi W.	100%	Learning Design is Very Feasible

In the table 4, the results of small-scale product testing obtained responses with an average percentage above >80%, which shows that the learning design is effective, efficient and interesting. Therefore, it can be continued to medium-scale product testing.

Medium Scale Product Testing

Medium-scale product trials involve applying learning methods and strategies to a larger group than small-scale trials. In this context, the products tested are learning methods and strategies designed for the *Critical Listening course* . In this study, five English Language Education students were used as testing subjects. The results of this test provide an initial picture of the method's effectiveness before it is applied more widely. Constructivist learning theory can support this test. This theory emphasizes that learning occurs through the construction of knowledge by students. In medium-scale trials, students can be active in constructing their own understanding of Critical Listening material. This concept can be applied to assess the extent to which learning methods provide opportunities for students to construct their knowledge. A medium-scale product trial was carried out on five students majoring in English Education in the Critical Listening course, using the same methods and strategies as those to be tested, with the following results:

Table 5 Results of Medium Scale Product Trials

No	**Name**	**Presentation**	**Notes**
1	Achmad Dhoni Septian	87.5%	Learning Design is Very Feasible
2	Falih Syafiu Rozaq	81.25%	Learning Design is Very Feasible
3	Maulidya Rofadinda	100%	Learning Design is Very Feasible
4	Muhammad Yunus	93.75%	Learning Design is Very Feasible
5	Rahma Lia Indah	93.75%	Learning Design is Very Feasible

In the table 5, the results of medium-scale product testing produced responses with an average percentage above >80%, which shows that the learning design is effective, efficient and interesting. As a result, large-scale product testing can continue.

Large Scale Product Testing

Large-scale product trials are the final stage before conducting field research. Large-scale testing was carried out on five students majoring in English Education in the Critical Listening course, using the same methods and strategies as those to be tested, with the following results:

Table 6 Results of Large-Scale Product Testing

NO.	Name	Presentation	Information
1	Inda Permatasari	81.25%	Learning Design is Very Feasible
2	Muh. Iqbal Amrullah	93.75%	Learning Design is Very Feasible
3	Nadia Khoirun Nisa'	75%	Viable Learning Design
4	Nabela Ardama Cherya K.	87.5%	Learning Design is Very Feasible
5	Farisma Nadhrotun N,	93.75%	Learning Design is Very Feasible
6	Chintya Ainun Nabilla	87.5%	Learning Design is Very Feasible
7	Nayla Amalia Latifah	100%	Learning Design is Very Feasible
8	Khumairo Qurrotu'ain	100%	Learning Design is Very Feasible
9	Rusydiana An Nahar	68.75%	Viable Learning Design
10	Rahmat Hidayat R.	75%	Viable Learning Design

In the table 6, the results of large-scale product testing obtained a response with an average percentage above >80%, which shows the success of large-scale testing and allows field research to continue. Some respondents expressed different opinions regarding the use of Jigsaw learning strategies because they were familiar with it and estimated its effectiveness in improving critical listening skills among students in this study.

The learning process in the Critical Listening class is divided into two activities, namely online and offline. The learning process is structured according to the syllabus (RPS) which is designed using a blended learning model. The learning process also takes place alternately, following the online and offline learning schedule. The first and third meetings were held online to coordinate material and group discussions held on Discord to capture important points in the learning material provided.

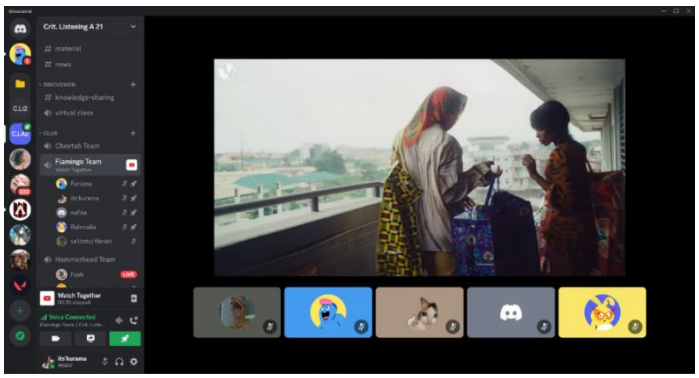

Figure 4 Display of the Jigsaw Learning Strategy on Discord

In figure 4 students do Jigsaw Learning on Discord. Each group member is assigned to study a certain part of the material. Then through a discussion, each member discusses the important points of the material they are studying, helps each other answer questions, and ensures that all expert members understand the material well.

Figure 5 Display of the Jigsaw Learning Channel on Discord

In figure 5, is a display of the Jigsaw Learning Channel on Discord, where in the channel you can see there is a Discussion Group Channel where there is the Orca team, Phoenix team, Tortoise Team and Mamba Team. Each group channel is used by group members for discussions and presentations of their material to other group members.

Figure 6 Learning Activities in Class

In the figure 6, show that the Offline (face-to-face) learning takes place in the classroom with the Jigsaw strategy, a continuation of the offline activities in the second and fourth weeks. Offline activities involve group presentations where each group shares a summary of the previous online learning session.

SJME ISSN: 2548-8163 (online) | ISSN: 2549-3639 (print)

Figure 7 Presentation Activities Using Jigsaw Strategy

In the figure 7, show the listening process in this activity is a crucial aspect in the teaching and learning process of critical listening. The findings from this activity contribute to improving listening skills. Apart from that, Jigsaw learning strategies can also improve students' writing and speaking skills in class.

Research Questionnaire Analysis

Measurement and Scaling Theory: This theory is concerned with measurement principles, including the development and validation of measurement instruments such as questionnaires. Involves concepts such as reliability and validity to ensure that the questionnaire provides consistent and accurate results. Louis Thurstone is one of the figures in the development of measurement and scale theory. His contributions included the interval scale method and psychological measurement techniques which later became the basis for the development of questionnaires and measurement instruments.

This learning design research was conducted over four meetings over four weeks with 19 students majoring in English Education. The learning design questionnaire using Discord and Jigsaw strategies is divided into three aspects: 1) Emotional Engagement, 2) Behavioral Engagement, 3) Cognitive Engagement. The rating scale ranges from one (strongly disagree) to four (strongly agree). The theory of research questionnaire analysis involves evaluating data obtained from questionnaires distributed to respondents as part of a study. The data may include responses, opinions, or information from participants that can be used to support research findings or draw conclusions. Questionnaire analysis includes steps such as coding , data translation, and interpretation of results.

The Emotional Engagement aspect is used to attract the use of learning design with Discord in both online and offline classes. The questionnaire includes the following questions;

Table 7 Results of the Emotional Engagement Questionnaire

No	Indicator	1	2	3	4
1	I feel this learning design adapts to modern educational needs.			2	17
2	I feel comfortable participating in class discussions and activities.			10	9
3	I feel this learning design provides a more enjoyable learning experience.				19
4	I feel that the use of technology in learning (e.g. videos and the Discord learning platform) helps me learn better.			1	18
5	I feel enthusiastic and motivated to take classes with this learning design.			7	12
	Total	19 Participants			

Attraction is a crucial point in learning design to attract student retention or create a special attraction in the teaching and learning process. Based on the results from table 7 the average student response shows strong agreement regarding the learning design used. The

survey results show that the learning design used is in accordance with students' current needs and conditions.

The behavioral engagement aspect is used to assess the efficiency of the learning process using Discord as an LMS in both online and offline classes. Questions on this aspect include:

Table 8 Results of the Behavioral Engagement Questionnaire

No	Indicator	1	2	3	4
1	I felt helped by the clarity and consistency of the instructions and assignments given.			9	10
2	I make good use of the time given and work effectively during the learning process.			8	11
3	The ease of accessing Discord helps me study anywhere.			11	8
4	I utilize environmental factors, without limitation, for my comfort in studying.			5	14
5	I can easily access classes on Discord (such as viewing open materials, information, and submitting assignments) from various devices			6	13
	Total	19 Participants			

Explanation of the contents of the second survey regarding the efficiency of using Discord learning design with the Jigsaw strategy in the teaching and learning process. Based on table 8 the findings indicated that participants agreed with the use of this learning design. Efficiency is the main goal of this learning design, ensuring easy access to learning that allows students to learn anywhere, adapting to needs and environmental factors.

Cognitive engagement content was conducted to assess the effectiveness of the learning process using Discord learning design and Jigsaw strategies in improving critical listening skills. The questions in this content are as follows:

Table 9 Results of the Cognitive Engagement Questionnaire

No	Indicator	1	2	3	4
1	I feel I understand the learning material better after taking this class.			11	8
2	I feel that the learning material is presented in such a way that it makes it easier for me to understand it.			10	9
3	I feel ready to face exams or assignments related to this learning material after taking this class.			12	7
4	I feel that the critical listening course helped me improve my writing skills.			5	14
5	I feel that the critical listening course helped me improve my speaking skills.			3	16
	Total	19 Participants			

The effectiveness of using this learning design has findings as seen in the table 9. Students on average believe that the use of Discord in critical listening education can help students in learning with technology in various academic areas. Additional findings also state that the Jigsaw strategy in this learning can improve students' English writing and speaking skills.

Analysis of Learning Results Using Discord

The supporting theory in analyzing learning outcomes using Discord is system effectiveness theory. System Effectiveness Theory : This theory extends to the extent to which the system, in this case the use of Discord, achieves the goals and needs of the user. Evaluation is carried out on aspects of effectiveness, efficiency and user satisfaction. Theory Originators: James Q. Wilson and Robert H. Salisbury were figures who participated in developing the system effectiveness theory. They highlight the importance of evaluation systems in achieving desired goals.

Test your suitability using Discord Jigsaw learning designs and strategies are assessed from two different situations on the same subject or group in one ICP class consisting of 19 students. Testing the feasibility of learning outcomes is carried out using the paired sample t-test method for pre-test and post-test, with the following hypothesis:

- H0 = with a significance level (<0.05) which states that there is a significant difference between the initial variable and the final variable. There is a significant influence on the differences in treatment given to each variable.
- H1 = with a significance level (>0.05) which states that there is no significant difference between the initial variable and the final variable. There is no significant influence on the differences in treatment given to each variable.

The learning outcomes test was compared between the first variable and the treatment not using Discord learning design and Jigsaw strategy and the second variable with treatment using Discord learning design and Jigsaw strategy.

The demand to find a customized structure for cooperative learning strategies is like a puzzle Basically not a new idea. Previous authors (Anderson, 2002; Furtak , 2006; HmeloSilver , Duncan, & Chinn, 2007) have recommended this need with the aim of increasing the maximum implementation of these strategies in science learning in developing countries, including Indonesia. This need was also answered by Farah in her interview when asked to provide input and reflection regarding Jigsaw learning (R8). He said that the puzzle game was not suitable for the learning situation at his school. The structure is complicated for students. Therefore, according to him, the structure of the puzzle should be simpler so that it can be more applied in his class.

Table 10 Correlation Test

Paired Sample Test

	Couple Differences							
				95% Confidence Interval of the Difference				
	Method	Std. Deviation	Std. Meaning of Error	Lower	On	Q	df	signature. (2 tails)

Pair 1	PRE & POST TEST	-17.21053	10.25009	2.35153	-22.15091	-12.27014	-7,319	18	,000

Based on the table 10, the Paired Sample T-test also shows the significance and correlation between the pre-test and post-test scores in this study. The significance value of the calculated significance test is less than 0.05, namely 0.000, so H0 is accepted. This means that there are significant differences regarding the use of learning designs with Discord and without Discord.

The five obstacles that cause the failure of implementing Jigsaw state that this learning strategy cannot be applied in the Indonesian educational environment. However, this obstacle is actually not surprising because this is a common occurrence in Indonesia. Previous research has identified similar barriers that influence the low desire for inquiry-based learning (IbL), a type of cooperative learning strategy, in several regions of the country. These include limited time, learning facilities such as classrooms and laboratories, large numbers of students, teacher competence in using IbL (Effendi-Hasibuan et al., 2019), and teachers' beliefs in the importance of IbL (Effendi-Hasibuan, Ngatijo , & Sulistiyo, 2019)

CONCLUSION

The conclusion of the research, after validating the appropriate learning design and then testing on various scales, was the result that the learning design using the Discord and Jigsaw strategies was considered appropriate. This is because it helps students in the learning process effectively, efficiently and interestingly.

The experimental results show that there is a shift in learning utilization when using learning designs with Discord and Jigsaw strategies. The impact of this learning design also influences student grades both in the online and offline learning process. Aspects of emotional, behavioral and cognitive involvement from an assessment perspective also show positive results in its application.

Recommendations for future research include realizing that contemporary learning cannot be excluded from the rapid development of technology. The introduction of blended learning media and strategies can encourage innovation in education. The use of Discord can still cover a wide range of abilities and strategies. A wide selection of strategies can be combined with Discord, presenting the potential to make learning more effective, efficient, and engaging.

REFERENCE

Degeng, MDK., Setyosari, P., & Kuswandi, D. (2016). The Effect of Learning Control in Learning Using Web Media on Procedural Knowledge Learning Outcomes. Journal of Education and Learning, Vol. 23, No. 23.

Degeng & Degeng. (2018). Science Learning. Kalam Alive.

Efriani, E.; Dewantara, JA; Afandi, A. Utilization of the Discord Application as an Online Learning Media. J. Techno. _Inf. And Educator. 2020, 13, 61–65.

Ghazali, Nurzal E., 2021, Online Class Design Using Discord Based on the Community of Inquiry Framework. ASEAN Engineering Education Journal.

Harjanti, Intania Ayu, and Ayu Faradillah. “An Exploration of Secondary Student Perceptions _ of Blended Mathematics _ Learning .” SJME (Supremum Journal of Mathematics Education) 4, no. 2 (2020): 197–204. https://doi.org/10.35706/sjme.v4i2.3650.

Hendra Saputra, Sangat, and Donaya Pasha. Scientifically Based Comics as Learning Media During the Covid -19 Pandemic." SJME (Supremum Journal of Mathematics Education) 5, no. 1 (19 March 2021). https://doi.org/10.35706/sjme.v5i1.4514

Kuswandi, D., et al. Al. (2020). Educational Technology Competency in Teacher Training at Wahid Hasyim Middle School Malang, Indonesia. Atlantis Press, Vol. 508.

Odinokaya , MA; Krylova , EA; Rubtsova , AV; Almazova , NI Using the Discord Application to Facilitate EFL Vocabulary Acquisition. Educate. Science. 2021, 11, 470. https://doi.org/10.3390/educsci11090470

Praherdhiono , H., Setyosari , P., & Degeng , INS. (2019). Theory and Implementation of Educational Technology: The 21st Century Learning Era and Industrial Revolution 4.0. Thousand Stars.

Raihan Putra, J., & Putri Rahma, Y. (2018). DISCORD PUBG.INDO.FUN Group Communication Pattern via the DISCORD application. Director, 15(29), 7577–7588.

Ramadhan, A. Student Responses to the Use of the Discord Application as an Online Learning Media in Learning Speaking in High School. ISLLAC J. Intense. St. Lang. turn on. Art Kul. 2021, 5, 42–47

Rosyid, Abdul, and Uba Umbara. "Application of the Missouri Model Learning Mathematics Project with the Assistance of GeoGebra to Enhance the Mathematical Communication Skills of Middle School Students." SJME (Supremum Journal of Mathematics Education) 2, no.2 (2018): 84–89. https://doi.org/10.35706/sjme.v2i2.1326.

Setyosari, P., Learning Design. Earth of Literature. East Jakarta.

Smaldino, Sharon L., Lowther, Deborah L., and Russel, James D. (Rahman translation). (2011). Learning Technology & Learning Media: Learning Technology and Learning Media. Jakarta: Prenada Kencana Media Group.

Spector, J.M., Merrill, M.D., Elen, J., & Bishop, M.J. (2001). Handbook of Educational Communication and Technology Research. Routledge.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Per Harvard University.

Wulanjani, AN (2018). Discord App: Turning a Voice Chat App for Gamers Into a Virtual Listening Class. Proceedings of the International Conference on English Language and Literature (ELLiC), 115-119.

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.). California, CA: Sage Publications.

Joyce, B., Weil, M., & Calhoun, E. (2009). Teaching models (8th ed.). Boston, MA: Pearson.

Jansoon , N., Somsook , E., & Coll, R. K. (2008). Thai undergraduate chemistry practical learning experience using the Jigsaw IV method. Journal of Science and Mathematics Education in Southeast Asia, 31(2), 178-200.

Artut , PD, & Tarim, K. (2007). The Effectiveness of Jigsaw II on Prospective Elementary School Teachers. Asia-Pacific Journal of Teacher Education, 35(2), 129-141. https://doi.org/10.1080/13598660701268551.

Doymus , K. (2007). The influence of cooperative learning strategies on the teaching and learning stage of material and one-component phase diagrams. Journal of Chemical Education, 84(11), 1857-1860. https://doi.org/10.1021/ed084p1857.

Persky, A. M., & Pollack, G. M. (2009). A hybrid puzzle approach to teaching kidney cleansing concepts. American Journal of Pharmacy Education, 73(3), 1-6. https://doi.org/10.5688/aj730349.

Leikin, R., & Zaslavsky, O. (1999). Cooperative learning in mathematics. Mathematics Teacher, 92(3), 240-246. http://www.jstor. org/stable/27970923 .

Perkins, D. V., & Saris, R. N. (2001). The "jigsaw classroom" technique for undergraduate statistics courses. Teaching Psychology, 28(2), 111-113. https://doi.org/10.1207/S15328023TOP2802_09.

Li, W. (2012). A critical analysis of cooperative learning in the Chinese ELT context. Journal of Language Teaching and Research, 3(5), 961-966. https://doi.org/10.4304/jltr.3.5.961-966.

Anderson, R.D. (2002). Reforming science teaching: What research tells us about inquiry. Journal of Science Teacher Education, 13(1), 1-12. https://doi. org/10.1023/A:1015171124982.

Effendi-Hasibuan, M.H., Bakar, A., & Harizon , H. (2020). Argumentation skills: Using argumentation-based learning (AbL) and socio-scientific issues to improve students' argumentation skills in chemistry. Journal of Physics: Conference Series, 1567(2), 1-7. https://doi.org/10.1088/1742-6596/1567/2/022042.

Effendi-Hasibuan, MH, Harizon , H., Ngatijo , N., & Mukminin, A. (2019). Inquiry-Based Teaching (IbTI) in Indonesian Secondary Education: What Makes Science Teachers Successful in Curriculum Implementation? Turkish Journal of Science Education, 16(1), 18-33. https://doi.org/10.12973/tused.10263a.

Effendi-Hasibuan, MH, Ngatijo , N., & Sulistiyo, U. (2019). Inquiry-based learning in Indonesia: Describing chemistry teacher fundamentals, situational beliefs, and adoption. Turkish Journal of Science Education, 16(4), 538-553. https://doi. org/10.36681/tused.2020.6.

Effendi-Hsb, MH, Harizon , H., Ngatijo , N., Fuldiaratman , F., & Sulistyo, U. (2019). Encouraging Indonesian Middle School Students' Argumentation Skills on the Concept of Chemical Reaction Rates: Comparative Effects of Three Cooperative Learning Strategies. Journal of Physics: Conference Series, 1317(1), 1-13. https://doi.org/10.1088/1742-6596/1317/1/012143.

Effendi-Hsb, MH, Harizon , H., Ngatijo , N., Fuldiaratman , F., & Sulistyo, U. (2019). Encouraging Indonesian Middle School Students' Argumentation Skills on the Concept of Chemical Reaction Rates: Comparative Effects of Three Cooperative Learning Strategies. Journal of Physics: Conference Series, 1317(1), 1-13. https://doi.org/10.1088/1742-6596/1317/1/012143.

Fernandez-Rio, J., Sanz, N., Fernandez Cando, J., & Santos, L. (2017). The impact of sustainable cooperative learning interventions on student motivation. Pedagogy of Physical Education and Sports,

Stahl, R. (1994). Cooperative learning in social studies: A handbook for teachers. Menlo Park, CA: Addison-Wesley

Jansoon, N., Somsook, E., & Coll, R. K. (2008). Thai undergraduate chemistry practical learning experiences using the jigsaw IV method. *Journal of Science and Mathematics Education in Southeast Asia, 31*(2), 178-200.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed). California, CA: Sage Publication.

SJME ISSN: 2548-8163 (online) | ISSN: 2549-3639 (print) ❒