

Virtual Cooperative Jigsaw as an Alternative Learning Model for Literacy-Based Learning in Madrasah

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ABSTRACT

Direct learning has migrated into online learning since the education sector is affected by the COVID-19 pandemic. One alternative to the online learning method is by implementing an online cooperative-jigsaw or virtual jigsaw. The study explores students' perceptions of virtual Jigsaw learning as an alternative model during the COVID-19 pandemic. The data were obtained through questionnaires given to the 25 students of science student-teachers at State Islamic University who have implemented the model. The perceptions to be seen are related to interest, effectivity based on the advantages and difficulties they have experienced, and syntax implementation during online learning using the Jigsaw model. The result indicates that most students showed positive perceptions and interest, also gained more advantages rather than difficulties. Moreover, the Jigsaw syntax is well-applicable though it runs online.

Keywords: Learning method, Pandemic, Perceptions, Students, Virtual jigsaw.

1. INTRODUCTION

As the COVID-19 pandemic has spread worldwide, the authorities took various efforts and measures to prevent the disease from spreading. The educational sector includes closing the schools and campuses and migrating learning activities to online platforms. The Indonesian government cancelled all educational institutions' activities, from pre-school level to higher education level, to suppress the spread of COVID-19 [1]. The government has issued a policy to suspend classrooms without stopping learning; hence, schools and campuses currently conduct online learning as an alternative method to deal with the pandemic situation.

Online learning is a learning method that allows students to learn in a virtual environment using the internet and other communication tools. It is a digital knowledge delivery strategy in fulfilling the needs of learning method practically and effectively. This method allows students to access their course materials anywhere and anytime [2]. It can be conducted virtually through

online platforms, such as Google Classroom, WhatsApp, Zoom, and Telegram. Teachers and institutions must fully understand the benefits and limitations [3].

The sudden and *forced* transition from face-to-face to online learning has naturally entailed its benefits and limitations at the same time [4]. It is said that the online learning mode is easily accessible. Flexibility is another exciting aspect. Teachers and students can schedule or plan their time to complete courses available online [5]. Nevertheless, some limitations also exist. As students have been practicing using such technology while learning, various problems have occurred during the process. Internet access support systems must also be taken into account, let alone the costly internet bills. Those who live outside the reach of internet access in rural and remote areas have struggled to join the online classes.

Considering the benefits and limitations, implementing online learning is not necessarily effective and efficient. Schools with limited or no experience with

e-learning encounter hardships, particularly when teachers are not savvy enough to conduct online learning [6], whereas they are expected to bring out innovation to keep the class fun and not monotonous. It is solid to say that online learning has become a new challenge for teachers in this pandemic situation. The previous studies have confirmed that the views of students and teachers are essential on this issue [7-9]. This research aimed to explore student-teachers' perceptions of experiencing online learning. Student-teachers must be adaptive and attractive at the same time since the pandemic uncertainty is real, and the sophisticated IT 5.0 era undoubtedly emerges shortly.

The need to create learning environments for student-teachers doing their teaching preparation demands decisions, choices, and adaptations to meet the expectations of students and the requirements of teacher education [10]. One of the learning strategies used is by using cooperative learning. Cooperative learning as a form of learning method requires students to work collaboratively in small groups by helping each other learn the assigned task [11]. Jigsaw is considered one of the models and can be implemented online. The online Jigsaw model is a breakthrough in utilizing technology to improve student academic performance in various conditions, particularly during the COVID-19 pandemic [12]. Technological tools prepare the student-teachers to deal with the ever-evolving, innovative learning models and pedagogical skills [13].

The study explores the science student-teacher's perceptions of experiencing the virtual jigsaw as an alternative learning model in the aspects of (1) interest; (2) effectiveness from the advantages and difficulties they've experienced; (3) and implementation of the syntax. Findings from the present study will help to understand online learning amid the pandemic situation COVID-19 in science student-teachers.

2. LITERATUR REVIEW

2.1. Student-Teachers Perception

Based on Cambridge Dictionary, perception is (1) a belief or opinion, often held by many people and based on how things seem; (2) thought, belief, or opinion, often held by many people and based on appearances. Meanwhile, according to the Great Dictionary of Bahasa, perception defines as the direct response or acceptance of something. The cognitive dimension of perception is the process where people attach meaning to their experiences. Perception is an individual's response to an object or subject produced when the individual is or has already been in action with the subject or object through its senses.

According to Ou, the perception process consists of three stages: selection, organization, and interpretation.

People perceived only part of the information in the environment to be interested due to the limit of attention [14]. Only the critical information will be paid attention to through the selective processes of perception. The partial perception of something can cause misunderstanding. In an organization, selective information is then structured in a specific pattern or being categorized.

In the Interpretation stage, people assign meaning to the information or stimuli. Travis stated that several psychological factors could affect an individual undoing a perception: needs, belief, emotions, and experience. For perception to occur, the attributes must be present are: 1) sensory awareness or cognition of the experience; 2) personal experience; 3) comprehension that can lead to a response [15]. The student-teachers have to master the essential teaching skills by experiencing the teaching-learning process to make a useful perception to engage their students in learning.

Students' perception in the implementation of learning means their thought, opinion, direct response, and acceptance based on the learning they experienced. It is crucial as they need to perceive the learning process. The emotional or affective aspects of perception are also important since their interest, pleasure, boredom, anxiety, and fear also shape the perception and impression.

2.2. Virtual Jigsaw Learning

During the Covid-19 Pandemic, the use of ICT with electronic systems became a demand for the world of education [16-18]. It should be supported by using electronic devices connected to the internet such as notebooks, tablets, and smartphones [19]. Learning development with new learning options by combining sources makes learning more flexible and adapted to existing conditions [20]. By learning from home, both students and lecturers carry out teaching and learning activities virtually [21] do not need to be face-to-face [22]. It requires an educator to create learning methods that encourage students to play an active and unsaturated role [23].

One learning strategy that can be used to solve problems is forming small groups and discussing together namely Cooperative learning, so there is an interaction between lecturer and students. Students communicate and interact socially with their friends while lecturers act as motivators and facilitators [24].

The jigsaw is a unique type of cooperative learning model. It refers to a teaching and learning system involving teachers, students, and teaching materials [25]. The general steps to implement jigsaw in the classroom are as follows: 1) classes are divided into several groups; 2) each group of students consists of 4-6 heterogeneous people, both in terms of ability, gender, culture, and others; 3) groups are given teaching materials and

learning tasks that must be done; 4) from each group take a member to create a new group (expert group) to discuss the same topic; in this group a discussion was held between expert groups; 5) members of the expert group then returns to the original group to teach members group; 6) during the learning process in groups, the lecturer acts as a facilitator and motivator; 7) the lecturer evaluates individually to determine student learning progress, and 8) groups of students who get the highest score then being rewarded [26].

Studies show that the Jigsaw learning method has improved student learning outcomes, increased motivation to learn and understand learning [27], and improved communication skills. Besides, a jigsaw model can be used for the theoretical education of nursing students to increase self-regulated learning. During the Covid-19 pandemic, teachers can apply this method to improvise the learning process to make students not experience boredom with technological knowledge and implementation technique using software appropriately [28]. According to Yogica et al., the Jigsaw model can improve the teaching ability of pre-service teachers [29]. In line with this opinion, Parmar and Parmar stated that the Jigsaw model has effectively transformed passive learners into active ones and helped them improve their abilities to obtain practical learning and communication skills [30].

Virtual Cooperative-Jigsaw learning means the model which is implemented in the online mode or by using electronic learning. Online learning with the virtual cooperative Jigsaw uses a design as shown in Figure 1.

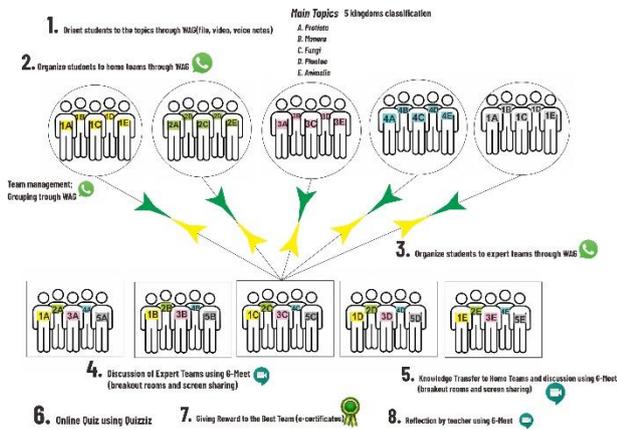


Figure 1 Design of virtual Jigsaw Learning.

Learning with virtual Cooperative Jigsaw uses several online media platforms, including WhatsApp Group (WAG), Google Meet video conference, and Quizziz online quiz. The variety of applications used makes students not feel bored.

The topic was Biology, about 5 Kingdom classification. While the steps based on cooperative jigsaw are as follows 1) orient students to the topic; 2) organize students to home teams for task distribution; 3) organize students to expert teams; 4) facilitating

discussion in the expert team; 5) organize students to return to the home team; 6) facilitating knowledge transfer in-home team; 7) taking evaluation through an individual quiz; 8) Giving reward to the best team and; 9) reflection.

3. METHODS

The data were analyzed through quantitative descriptive approach. Descriptive research was chosen to obtain exploratory data on students' perceptions towards virtual Jigsaw learning as an alternative learning model during the Covid-19 Pandemic.

The respondents are science student-teachers. The survey was conducted online via Google Form. Saturated sampling was used to get feedback about virtual Jigsaw model implementation.

Closed and open questionnaire methods were used; the validity is determined by professional judgment. The data was obtained through a questionnaire consisting of questions related to the interest, effectiveness, and implementation of learning using a virtual jigsaw. The questionnaire consists of 18 questions. Five questions related to the interest of natural science teacher student-s towards virtual jigsaw learning, consisting of three closed questions and two open questions. Five questions related to the effectiveness of the virtual jigsaw and six questions related to the implementation of the virtual jigsaw.

Furthermore, the data were analyzed using descriptive quantitative analysis of percentage techniques. The steps of the research are 1) arranging research instrument; 2) carrying out instrument validation; 3) implementing virtual Jigsaw learning; 4) distributing instrument to the respondent and; 5) analyzing the data obtained.

4. RESULT AND DISCUSSION

Student-teacher's perceptions related to interest shown in Figure 2, Statement (q1) related to students' interest in participating in virtual jigsaw learning, as much as 64% of students showed agreement that learning was fun. It is supported by Orcos that learning with the jigsaw technique in a virtual environment can increase students learning motivation and academic ability [31]. Participating in the jigsaw class also generated their interest in the topic. It motivated them to read further [32] as motivation theory states that motivation is fundamental in learning so that it affects the level of absorption of information. The more students are motivated in learning; the more information is absorbed in the student's minds.

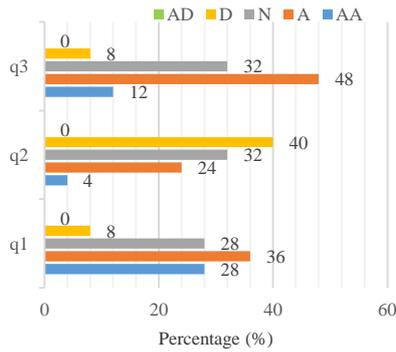


Figure 2 Student’s perception relates to interest in Jigsaw Virtual Learning.

As it is known, learning during the pandemic requires lecturers and students to adapt to a digital learning environment and e-learning. Despite the difficulties, learning in this virtual atmosphere also brings advantages, including borderless space and dynamism. Cooperative-Jigsaw is one model that can be easily adapted in a virtual learning environment [33].

The diversity of student responses can be affected because group members consist of heterogeneous academic abilities ranging from high, medium, to low. The learning environment formed in Jigsaw cooperative learning is democratic and active. Lecturers can provide direction in creating groups and defining overall procedures, but students are left to control interactions in their groups [34]. This atmosphere of independence makes students feel more comfortable and trusted. It activates students’ participation and responsibility from every group member. In line with Vigotsky’s theory that students’ development is related to social interactions and experiences, students intellectually learn through the more experienced people in the social environment. The sociocultural theory looks at the significant contributions that society makes to individual development.

Statement (q2) relates to whether students have difficulty in learning by using the virtual jigsaw. A total of 28% agreed. The Statement (q3) related to whether students experience ease in learning using virtual jigsaw was approved by 80% of students.

The following Statement is an open-ended question relating to the type of difficulties and advantages experienced. Among these conveniences, online learning can activate students and make it more interactive. Online discussions effectively use synchronous online features and social media, such as breakout rooms and screen sharing on the Google Meet video conference platform and messaging and voice notes features on WAG. Students can express opinions comfortably, openly, and confidently in online discussion forums because of discussions among peers, reduce awkwardness in discussions because they do not meet face to face, understand more and better material due to efficient

division of tasks in teams, increase motivation with online quizzes, appreciation, and rewards, increasing interaction with friends and lecturers. Among the difficulties experienced include limited quotas and connections and not time efficiency compared to face-to-face learning.

As stated, the jigsaw can encourage active participation of students in learning, build interpersonal relationships and interactive skills, increase responsibility among colleagues and provide comfortable interaction through peer tutors. In line with this opinion, Purwanty et al. state that implementing this cooperative jigsaw model can improve student learning success, including because their learning resources are teachers, books and tools, and discussions with their peers [35].

According to cognitive apprenticeship theory, the learning process in which a student gradually attains expertise in his interaction with an expert, whether an adult or a peer with higher knowledge [36]. Having group members share the material is a way of structuring interdependence tasks. This model also improves higher-order thinking skills, including creative thinking and student metacognition [37], critical thinking, and learning outcomes [38]. Although in an environment that limits social interaction due to a pandemic, and students are in their homes, learning with virtual cooperative Jigsaw can bring a learning atmosphere that requires interdependence between groups and members to distance themselves from egoism and individualism and form an attitude of tolerance and cooperation considering Team performance determines the average score for the competition.

Data relate to effectivity of Jigsaw syntax through difficulties and advantages shown in Figure 3.

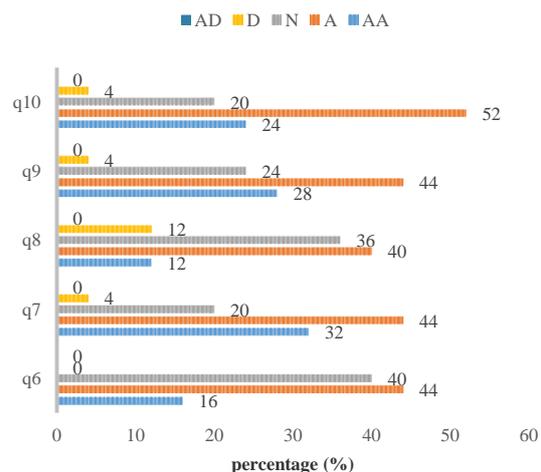


Figure 3 Student’s perception relates to effectiveness of Jigsaw Virtual Learning.

The following statements describe the effectiveness of virtual jigsaw starting from the virtual implementation of jigsaw syntax. In this case, 60% of students stated it

was effective, and 40% said it was neutral. Neutral perception means when an individual feels neither too positive nor negative toward the target being perceived. It doesn't mean they feel nothing or do not have perception at all.

Even though it is done online, each group member can express their opinion well. It is approved by 76% of students. Discussion management in each group took place quite effectively based on the agreement of 52% of respondents.

Online discussion is one of the effective methods in online learning [39]. The more active students discuss in groups is an indicator that there are many thinking processes compared to groups that are passive/do not express any opinions or questions. It is reinforced by cognitive psychologists who argue that learning should be focused on the process carried out by students, not on the results alone.

The survey by respondents showed that 72% agreed that even though it was done online, every individual could carry out their duties well. Likewise, each group member contributes ideas according to their ability to complete the task together for the statement points. The use of social media platforms such as WhatsApp Group (WAG) as one of the most popular social media platforms because it is easy and cheap also determines the effectiveness of the discussion process through voice notes modes. The use of WAG as a discussion media is very effective [40]. Likewise, synchronous platforms such as Google Meeting using breakout rooms and screen sharing features extensively facilitate students conducting group discussions such as when they are in the actual classroom.

As for the virtual implementation of Jigsaw syntax, the data obtained are as shown in Figure 4.

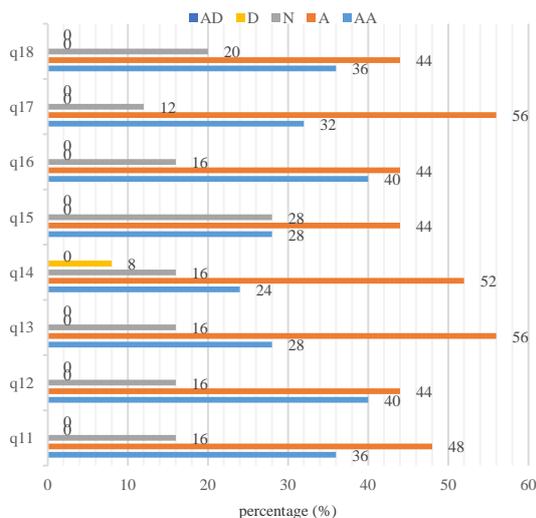


Figure 4 Student's perception relates to implementation of Jigsaw Virtual Learning.

The grouping step and the task distribution are carried out well, and the expert group discussion is going well, stated by 84% of respondents.

The online implementation quiz is carried out well according to the respondents' approval as much as 76%, and the awarding of the group awards was carried out very well based on the agreement of 85% of the respondents. Using an online quiz platform is one of the most popular parts of a series of Jigsaw syntax students are interested in. It is because the online quiz feature contains challenges that raise student interest. Direct score acquisition and inter-group competition also trigger student motivation in taking quizzes. The practicality of online quizzes is also the main attraction and provides convenience for students working compared to manual tests that require more energy. Respondents also found the quiz very useful. In this research, the quiz platform used is quizzes.

Online tests are tools designed to provide valuable experiences to students by providing a learning environment that they can control at their own pace and learn to account for their performance effectively. Online tests are an effective pedagogical tool to evaluate student learning outcomes through teacher guidance.

Lecturers provide good direction during the virtual jigsaw process and reflect well at the lesson's end. It received approval responses of 88% and 80%, respectively. As Purwanti stated, in the implementation of Jigsaw cooperative learning, the teacher acts more as a facilitator and motivator [41]. The freedom of students in a democratic group atmosphere must be re-directed according to the learning objectives, this is the teacher's significant role in guarding Jigsaw cooperative learning, and especially in virtual conditions where there are several students with low internet connection conditions, it is necessary to make efforts to prevent miscommunication and misconceptions for them.

Sociocultural and Constructivist theories state that cognitive and social learning consist of the active construction of knowledge through interactions with others. Teachers facilitate and guide student interaction and help them construct their understanding and ideas [42].

5. CONCLUSION

1. Student-teacher's perception relate to the interest of virtual jigsaw learning are fun, experiencing problems or difficulties in the form of connection and discussion time efficiency, experiencing convenience in terms of more active and interactive learning, reducing awkwardness in discussions, and more efficient in task distribution. Student-teacher's perception relates to learning with a virtual jigsaw can effectively carried out since there are more advantages in the aspect of materials delivery,

opinions exploration in groups, discussion management, and task distribution. Moreover, the student-teacher's perception relate to syntax implementation was carried out very well based on the respondents' answers starting from the grouping, tasks distribution in the home-group, discussion in the expert group, discussion in the home-group, quiz implementation, and giving rewards—likewise the lecturer's direction and reflection at the end of the lesson.

2. Science teachers or students can refer to the results to make learning innovations in the pandemic condition and digital era. It facilitates two-way interaction between students and teacher as well as students and students in long-distance learning. The implementation of the syntax and the goal of cooperative was achieved well.
3. The role of a teacher in assisting learning and discussion should be strengthened to make sure that all the students are engaged in online learning. The results should be refined with further research to obtain more comprehensive data and results.

AUTHORS' CONTRIBUTIONS

All authors have different roles in the accomplishment of the study. For this manuscript, they contributed equally to the process of drafting, revision, and approval of the final revision.

REFERENCES

- [1] V. Lath, T. Lee, K. T. Tan, P. Wibowo, How Indonesia Can Emerge Stronger from The COVID-19 Crisis. URL: <https://www.mckinsey.com/featured-insights/asia-pacific/with-effort-indonesia-can-emerge-from-the-covid-19-crisis-stronger>
- [2] S. Dhawan, Online Learning: A Panacea in the Time of COVID-19 Crisis, *Journal of Educational Technology Systems*, 49(1) (2020). DOI: <https://doi.org/10.1177/0047239520934018>
- [3] S. Hrastinski, Asynchronous and Synchronous E-Learning, 2008. URL: <https://er.educause.edu/articles/2008/11/asynchronous-and-synchronous-elearning>
- [4] C. Carrillo, M. A. Flores, COVID-19 and Teacher Education: A Literature Review of Online Teaching and Learning Practices, *European Journal of Teacher Education*, 43(4) (2020) 466–487. DOI: <https://doi.org/10.1080/02619768.2020.1821184>
- [5] S. Dhawan, Online Learning: A Panacea in the Time of COVID-19 Crisis, *Journal of Educational Technology Systems*, 49(1) (2020) 5–22. DOI: <https://doi.org/10.1177/0047239520934018>
- [6] Z. Zaharah, G. I. Kirilova, A. Windarti, Impact of Corona Virus Outbreak Towards Teaching and Learning Activities in Indonesia, *SALAM: Jurnal Sosial dan Budaya Syar-i*, 7(3) (2020). DOI: <https://doi.org/10.15408/sjsbs.v7i3.15104>
- [7] Mailizar, A. Almanthari, S. Maulina, S. Bruce, Secondary School Mathematics Teachers' Views on E-learning Implementation Barriers during the COVID-19 Pandemic: The Case of Indonesia, *EURASIA Journal of Mathematics, Science and Technology Education*, 16(7) (2020). DOI: <https://doi.org/10.29333/ejmste/8240>
- [8] C. Coman, L. G. Tîru, L. Mesesan-Schmitz, C. Stanciu, M. C. Bularca, Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective, *Sustainability*, 12 (2020) 10367. DOI: <https://doi.org/10.3390/su122410367>
- [9] I. Yuzulia, The Challenges of Online Learning During Pandemic: Students' Voice, *Wanastra: Jurnal Bahasa dan Sastra*, 13(1) (2021). DOI: <https://doi.org/10.31294/w.v12i1>
- [10] M. A. Flores, M. Gago, Teacher Education in Times Of COVID-19 Pandemic in Portugal: National, Institutional and Pedagogical Responses, *Journal of Education for Teaching*, 46(4) (2020) 507–516. DOI: <https://doi.org/10.1080/02607476.2020.1799709>
- [11] A. Sari, Perilaku Pencegahan Covid-19 Ditinjau dari Karakteristik Individu dan Sikap Masyarakat, *Jurnal Penelitian dan Pengembangan Kesehatan Masyarakat Indonesia*, 1(1) (2020).
- [12] Istiqomah, B. B. Wiyono, H. Rahmawati, E. Prastuti, N. Eva, T. A. Ardani, Jigsaw On Line Model as the Improvization of Learning Methods in the Covid-19 Pandemic, *Psychology and Education Journal*, 58(1) (2021). DOI: <https://doi.org/10.17762/pae.v58i1.1798>
- [13] D. Wake, J. Whittingham, Teacher Candidates' Perceptions of Technology Supported Literacy Practices, *Contemporary Issues in Technology and Teacher Education*, 13(3) (2013) 175-206.
- [14] Q. Ou, A Brief Introduction to Perception, *Studies in Literature and Language*, 15(4) (2017) 18-28. DOI: <http://dx.doi.org/10.3968/10055>
- [15] S. Mcdonald, Perception: A Concept Analysis, *International Journal of Nursing Knowledge*, 23 (2012) 2–9. DOI: <https://doi.org/10.1111/j.2047-3095.2011.01198.x>

- [16] N. Islam, M. Beer, F. Slack, E-Learning Challenges Faced by Academics in Higher Education: A Literature Review, *Journal of Education and Training Studies*, 3(5) (2015) 102–112. DOI: <https://doi.org/10.11114/jets.v3i5.947>
- [17] P. E. Sanderson, *E-Learning and Consulting Philips Medical Systems North America*, 2001.
- [18] P. Thomas, K. Setiaji, E-Learning Dengan Pendekatan Kooperatif Tipe Jigsaw Untuk Meningkatkan Aktivitas Dan Hasil Belajar Mahasiswa, *Dinamika Pendidikan*, 9(1) 2014. DOI: <https://doi.org/10.15294/dp.v9i1.3353>
- [19] B. Setiawan, V. Iasha, Covid-19 Pandemic: The Influence of Full-Online Learning For Elementary School In Rural Areas, *JPSd (Jurnal Pendidikan Sekolah Dasar)*, 6(2) (2020). DOI: <https://doi.org/10.30870/jpsd.v6i2.8400>
- [20] J. A. Mondéjar, J. M. Jiménez, M. Vargas, Docencia Virtual En Universidades Presenciales: Experiencia En La Universidad De Castilla-La Mancha, *RIED*, 10(2) (2012). DOI: <https://doi.org/10.5944/ried.2.10.1000>
- [21] N. N. Karmini, Implementasi Model Pembelajaran Kooperatif Tipe Jigsaw Agama Hindu Dimasa Pandemi Covid-19 Pada Siswa Kelas X SMAN 1 Toili Barat, *Cetta: Jurnal Ilmu Pendidikan*, 3(3) (2020).
- [22] L. Stoetzel, S. Shedrow, Coaching Our Coaches: How Online Learning Can Address The Gap In Preparing K-12 Instructional Coaches, 88 (2020). DOI: <https://doi.org/10.1016/j.tate.2019.102959>
- [23] R. N. Fadillah, A. Mardhiah, I. Maisyaroh, Metode Jigsaw Dalam Pembelajaran Materi Tsulatsi Mujarrod Pada Peserta Didik Kelas 4 Madrasah Ibtidaiyah, *semnasbama*, 5(0). URL: <https://prosiding.arab-m.com/index.php/semnasbama/article/view/776/724>
- [24] Isjoni, Cooperative Learning Mengembangkan Kemampuan Belajar Berkelompok. URL: <https://inlisliteperpus.batukota.go.id/opac/detail-opac?id=799>
- [25] R. N. Fadillah, A. Mardhiah, I. Maisyaroh, Metode Jigsaw Dalam Pembelajaran Materi Tsulatsi Mujarrod Pada Peserta Didik Kelas 4 Madrasah Ibtidaiyah, *semnasbama*, 5 (2021). URL: <https://prosiding.arab-m.com/index.php/semnasbama/article/view/776/724>
- [26] M. Wena, Strategi pembelajaran Inovatif Kontemporer : Suatu Tinjauan Konseptual Operasional. URL: http://library.fip.uny.ac.id/opac/index.php?p=show_detail&id=4926
- [27] Y. Nurhayani, Improving Fifth Graders' Motivation and Learning Achievement of Social Science Material on Defending Independence Through Jigsaw Cooperative Learning Model in Punggul 1 Elementary School Gedangan Sidoarjo, *Advances in Social Science, Education and Humanities Research*, 212 (2018) 637–642. DOI: <https://doi.org/10.2991/icei-18.2018.141>
- [28] Istiqomah, B. B. Wiyono, H. Rahmawati, E. Prastuti, N. Eva, T. A. Ardani., Jigsaw On Line Model as the Improvization of Learning Methods in the Covid-19 Pandemic, *Psychology and Education Journal*, 58(1) (2021). DOI: <https://doi.org/10.17762/pae.v58i1.1798>
- [29] R. Yogica, Lufri, R. Fitri, A. Muttaqiin, Improving Teaching Skills of Pre-teacher Students With Modified Jigsaw on Biology Instructional Methodology Course, (2019) 620–623. URL: <https://www.atlantispress.com/proceedings/aisteel-19/125928483>
- [30] R. Dhaval Parmar, D. Jugabhai Parmar, Study of students perceptions for Jigsaw-collaborative learning in Forensic Medicine, *IP International Journal of Forensic Medicine and Toxicological Sciences*, 4(4) (2020) 105–110. DOI: <https://doi.org/10.18231/j.ijfmts.2019.024>
- [31] L. Orcos, R. Arias, N. Aris, Á. A. Magreñán, Collaborative learning: implementation of Jigsaw technique, in Google, in The HEAd'16 - International Conference on Higher Education Advances, 2016. DOI: <https://doi.org/10.4995/HEAD16.2016.2772>
- [32] N. Verma, S. M Rustagi., S. Prakash, V. Dave, R. Dhuria, Perception analysis of students and faculty of a recently implemented Interactive Teaching session in Anatomy using 'Jigsaw Technique' in a north Indian medical college, *Journal of Education Technology in Health Sciences*, 7(1) (2020) 17–22. DOI: <https://doi.org/10.18231/j.jeths.2020.004>
- [33] L. Orcos, R. Arias, N. Aris, Á. A. Magreñán, Collaborative learning: implementation of Jigsaw technique in Google, in The HEAd'16 - International Conference on Higher Education Advances, 2016. DOI: <https://doi.org/10.4995/HEAD16.2016.2772>
- [34] R. Arends, *Learning to teach*, 9th ed, Dubuque, Iowa: McGraw-Hill, 2012.

- [35] R. Purwanty, Fredy, U. Yampap, R. R. Bay, Cooperative Learning Using Jigsaw Type on Thematic Learning, (2020) 467–471. DOI: <https://doi.org/10.2991/assehr.k.201014.102>
- [36] R. Arends, Learning to teach, 9th ed, Dubuque, Iowa: McGraw-Hill, 2012.
- [37] R. N. Perangin-angin, B. Sinaga, E. Syahputra, Qualitative Analysis of Metacognition Ability and Creativity Thinking with Jigsaw Cooperative Learning Model, (2019) 330–335. URL: <https://www.atlantis-press.com/proceedings/aisteel-19/125928372>
- [38] A. R. Subiyantari, S. Muslim, E. Rahmadyanti, Effectiveness of Jigsaw Cooperative Learning Models In Lessons of the Basics of Building Construction on Students Learning' Outcomes Viewed From Critical Thinking Skills, International Journal for Educational and Vocational Studies, 1(7) (2019). DOI: <https://doi.org/10.29103/ijevs.v1i7.1653>
- [39] S. Halimah, et al., Effectiveness of Learning Using Online Discussion Methods Pandemic Period, (2020) 140–142. DOI: <https://doi.org/10.2991/assehr.k.201015.022>
- [40] E. A. Putra, E. Nurlaelah, High School Students' Perceptions Towards Quiz-Based Smartphone Learning Management System (S-LMS) as Learning Evaluation Media, (2021) 123–127. DOI: <https://doi.org/10.2991/assehr.k.210508.053>
- [41] R. Purwanty, Fredy, U. Yampap, R. R. Bay, Cooperative Learning Using Jigsaw Type on Thematic Learning, (2020) 467–471. DOI: <https://doi.org/10.2991/assehr.k.201014.102>
- [42] L. Chen, Using Online Tests to Enhance Teaching and Learning, (2015) 79–83. DOI: <https://doi.org/10.2991/icaicte-15.2015.19>