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The Environment as a Medium of Original Ideas for Young Researchers in Self-Determined Learning

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Abstract

This article aims to explain young researchers' learning activities at age of 13 to 15 years old in formulating original ideas as well as self-determined collaboration and exploration associated with environmental learning activities. This study employs qualitative descriptive research approaches to examine the research learning activities of young researchers in finding self-determined original ideas. This study was carried out in Madrasah Tsanawiyah Negeri (MTsN) Kota Batu, East Java Province, Indonesia. The participants of this study consisted of 22 madrasah students (aged 13-15) who are divided randomly into 12 groups and two research teachers were also involved. The data collection techniques used are observations, interviews, and other documentations. The results of this study indicate that: (1) Students accompanied by teachers are able to think critically about environmental problems in formulating original ideas through teacher's stimulation and habituation to carry out observations both at school and in residence environments that can improve the sensitivity of students in responding to surrounding environmental problems. (2) Students can deliver research ideas to teachers and friends, collaborate, and participate in groups in analyzing, interpreting, designing, implementing as well as reporting activities involved in research projects from the student's point of view. (3) The teacher's habit of stimulating students to obtain original ideas from their surroundings can indirectly lead to an enjoyable research culture for students. The project report is presented as part of this article.

Keywords: Environmental education, Environmental utilization, Original ideas, Self-determined, Student researcher.

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1. Introduction

This study aims to describe the learning activity process of young researchers aged 13-15 years in generating original ideas and self-determined collaboration and exploration through the environment. I found that most young researchers in the early stages had difficulty getting research ideas, what they were interested in, and how they got research ideas through teacher assistance. The 1989 United Nations Convention on the Rights of the Child (UNCRC) recognizes that children have the right to express their views on their rights in everyday life including through research and consultation [1, 2]. In the context of research, the involvement of children as a researcher or partners in the research includes the process of defining research questions [3], collecting data [4], analyzing and reporting [5] as well as disseminating the results of the research [6]. According to Helen Hedges, "Children's work theory, testing and exploring ideas is an activity that builds new knowledge for children" [7].

The learning environment is a component of the learning system that cannot be separated from students, teachers, and teaching materials [8]. Efforts to create a conducive learning environment, both externally and internally, cannot be separated from environmental components [9-11]. An open learning environment involves a process by which each individual's intentions and goals can be uniquely developed and achieved [12-14] and aims to encourage learners to think critically and be inquiry-oriented. It is a heuristic-based learning, which is independent and unstructured [15]. The real environment around students and many complex and unique problems make it easier for young researchers to build independent learning and form critical thinking patterns through a research process [16, 17].

Self-Determined Learning is independent learning [18, 19] in which learners engage in self-directed and self-regulated learning [20]. This learning model applies a holistic approach to independent learning abilities as the main agent in gaining personal experience [14]. Heutagogy design elements include: exploring, creating, collaborating, connecting, reflecting, and sharing [20]. Heutagogy is centered on the philosophy that learners define their own learning path [20]. Heutagogy learning activities have three universal aspects: challenge, autonomy, and support, where teachers are able to design and create "challenging tasks for learners" so that benefits can be achieved in learning [21, 22].

2. Theoretical Background

2.1. Student as a Researcher

Children's Research Centre (CRC) has the main objective of empowering children and adolescents as active researchers in research activities. The CRC recognizes children as experts in their own lives and values a perspective of trust by supporting children's voices by conducting research on topics important to children [23, 24]. In addition, the experts also admit that children are able to find intelligent solutions to solve various problems during the learning process in everyday life activities [25]. These activities are initiatives in establishing young children as researchers, particularly in simple research activities [8, 26-28]. Young Children as Researchers (YCAR) describes four research behaviors: exploring, finding solutions, conceptualizing, and decision-making based on evidence [29]. Furthermore, these four research behaviors combine sensory information to identify the reasons to undertake the research [30].

Every learner has an intuitive way to form and express their views in a variety of different ways [8, 28] such as obtaining information, planning, questioning, analyzing, interpreting, solving problems, and exploring and reporting new ideas that they naturally create [31-33]. Children use this behavior as a basis for evidence to form and support their views, and what they know and understand in making decisions independently [29].

Students can become distinguished researchers that are able to create their own knowledge if facilitated by teachers with relevant curriculums. Therefore, the expected goals to produce creative students can be achieved (8.34). Consequently, to achieve this goal further question arises, how do we (teachers) encourage students to become researchers? This question is essential for every teacher in fostering students to participate in research, particularly in solving empirical-based problems. Critical teachers help student researchers engage with meaning systems using Michel Foucault's concept of genealogy [34].

2.2. Environmental Utilization

The learning environment is all learning resources that support students' learning process both inside and outside the classroom. The learning environment starts from the classroom, the school environment, the student's residence, nature, culture, and the community around the student's residence which are the places that can be used by teachers and students to perform the learning process. The learning process is known as Open Learning Environments (OLEs) that involves the

process of intentions and goals of each individual in achieving the expected results of teachers and students Land [35]. An open learning environment, emphasizes how learners find solutions or other things that are expected from independent learning and are not directed by the teacher. Students are allowed to think differently from the teacher - in an open learning environment where the teacher is referred to as a facilitator [36-38]. In an open learning environment, various models provide students with opportunities to use various contexts, resources, tools, and frameworks in the problem-solving process. According to Jacobson and Spiro [39], open learning environments (OLEs) foster complex problem-solving or higher-order reasoning skills [40]. Hannafin stated that OLEs can encourage critical thinking, inquiry-oriented learning, and heuristic-based learning independently [15].

The principles of implementing OLEs, according to Hannafin, et al. [41], are as follows; 1) increasing different perspectives in thinking and encouraging the application of multiple perspectives. 2) encouraging independent learning and giving students autonomy or power in learning, accompanied by metacognitive encouragement. 3) giving students direct and concrete experiences in real-world problems. 4) bridging personal experiences and personal theories so that students get descriptions and not just theories. 5) providing tools and resources to assist students in learning [15].

The learning and research environment cannot be separated. Students are involved as active members of the research community [42]. The application of OLEs must use these five principles to encourage students to think critically, out of the box, and to recognize problems and find solutions in real life because the problems presented in OLEs are concrete and authentic.

2.3. Self-Determined Learning Model

Self-determined learning model, according to Stewart Hase and Chris Kenyon [20], is a holistic approach to developing learners' capacities and abilities as "primary agents in their learning as a result of personal experiences [22, 43].

Self-determination provides a holistic framework governing the learning and teaching process in formal education and creates a foundation for practicing informal learning throughout one's life. The difference between andragogy and heutagogy is seen in the human agency's broader role in the learning process. Heutagogy is a form of self-determined learning within a coherent framework for application to educational and training practice [20]. The theories that gave birth to heutagogy have gained traction, especially among practitioners and researchers in the world of e-learning [20, 44].

3. Research Methods

This study employs a qualitative method that involves words and behavior data analysis as well as the resulting images [45]. This research was carried out at the Madrasah Tsanawiyah Negeri Batu City, East Java Province, Indonesia. The data collection technique used included observation, interviews, and documentation conducted on 22 madrasah students aged 13-15 years. Students who were participants in the study were then divided into 12 groups which were randomly selected by two research teachers. The data collection process in this study involved participant observation (6 months, 3-4 days per week for 3-6 hours per day). The study was conducted from November 2019 to April 2020. Prior to data collection, we spent two days adapting to familiarize ourselves with the students. After the data is collected, the next step is data analysis by using Miles and Huberman analysed with the following stages data reduction, data presentation, conclusion drawing, and verification [46].

4. Results and Discussion

Collaborative research with students is part of my life as a teacher and facilitator who listens to the chatter of creative ideas of everyday students in school. How can one stimulate students to be sensitive to the environment? How do they come up with unique research ideas? How can a teacher inspire students to become interested in research? Researchers are very interested in describing student research activities with teachers as a form of empowerment and channeling inspiration to care for the environment by channeling creative and innovative ideas.

4.1. Environment as a Medium to Explore Students' Original Ideas

Fundamental Heutagogy is an exploration where learners are given the opportunity and freedom to explore various sources of knowledge in finding information independently [20]. Three dimensions of the realm of scientific knowledge (Nature of Science) in research: (1) Scientific knowledge can be found and changed, (2) scientific knowledge can be linked to other fields of science, and (3) culture influences the development of scientific knowledge [47].

4.1.1. The Teacher Displays Stimulus with Imagination

Nature of Science (NOS) assists students in developing simple research ideas according to their age and is able to provide an in-depth conceptualization of ideas [48]. The ideas formulation by students can be developed through explicit reflective strategies in urban, suburban, and rural environments [49, 50].

In the present study, we are interested in participants aged 13-15 years generating original research ideas from their environments that include school and their residence environments. The location where this research was conducted is MTsN Kota Batu which is one of the schools sited between agricultural fields. During the learning process, the teacher invites students out of the classroom to observe all objects, plants, and activities in unutilized surrounding environments. On that occasion, the teachers carry out activities that can stimulate the students in developing original ideas for example by taking and asking students to observe the fruit scattered in the schoolyards:

Teacher: This fruit is unique, don't you know the name of this fruit? What's in it? You can use it as what?

(The teacher gives 5 minutes for students to find information from sellers around the school environment and use cellphones and laptops).

Clarisa (13 years old): Ma'am, said the merchant in the school area, this fruit is Mojopahit (Javanese), in Indonesian it is called Bintaro fruit with the Latin name *Cerbera manghas*.

Safira (14 years): interrupts, adding some information, Bintaro fruit contains saponins, terpenoids, polyphenols, alkaloids, cerberrin, tannins, flavonoids, steroids, and essential oils.

Teacher: Do you think this content has a function? And used as what?

Aal (13 years): alkaloid content is not preferred by animals. What if we use it as a rat killer? Majapahit fruit rat repellent seems cool (laughing).

Farel (14 years old): That's good too. Herbal rat repellent because it's natural.

Clarisa: I don't like cockroaches, why don't you make a natural and safe cockroach repellent? (laughs).

Teacher: Your ideas are excellent. Next, can you imagine what these things can be used for?



Figure 1.
Environment-based learning.

Through questions, the teacher indirectly asks students to reflect and relate their understanding of science content explicitly and contextually so that they are involved in research through scientific practice [48]. The teacher stimulates students in getting research ideas by utilizing the environment around the school. Indirectly, the teacher provokes students to be sensitive to the surrounding problems they encounter. Teacher stimulus, which is carried out regularly in learning, can create a culture of research in students because with this habituation, they will easily get original research ideas Figure 1.

4.1.2. Students Find Inspiration

It is not easy to develop inspirational ideas for students. Teachers must be creative in stimulating and provoking students to inspire research ideas. Several times the teacher (Umroh, 33 years) played a sociodrama in observing an object in the surrounding environment to provoke students to think critically.

The interviews with Amanda (14 years) and Intan (14 years) in the madrasah areas happened during the observation of the school gardener clearing the weeds in the schoolyard. The students were interested in the activities carried out by the gardener and sought information about the benefits of the grass being pulled by the gardener.

The importance of observing and concluding on hidden items, students are able to conceptualize ideas and relate them to content knowledge [51]. They asked permission from the teacher to search for information in the library and use internet facilities.

4.2. Developing Student Creativity and Collaboration

An important design element of heutagogy is to give students the freedom to be creative [20] making efforts in obtaining knowledge about creativity, leadership, ethics, and achieving creative breakthroughs. Problem-solving combines hidden goals, strategies, and evaluations [52] and often involves deductive thinking [53]. Finding solutions - or solving problems - is engaging in higher-order thinking [54].

Amanda (14 years) started experimenting by gathering grass in the madrasa area and doing the steps she learned from articles and YouTube. In the first trial, Amanda uses grass and banana stalks, "I want to know which fiber is stronger and produces a good texture."

Amanda: Ma'am, my first trial was that this banana leaf paper produced a smooth texture but was easily torn and could not be used for writing because it was very brittle. Meanwhile, the paper from weeds was stronger, but the resulting fibers looked rough.

Diamond: it is possible that the process we do is not optimal. What if we do 2x refinement and boiling to get adequate fiber? We will try it now.

Bring up the tentative aspects, creative and imaginative science, and distinguish between observation and inference [55]. Amanda and Intan develop strategies for processing, testing, guessing/hypotheses, obtaining information, evaluating, and concluding while getting the best and maximum results. Their creative idea developed to add food coloring to the paper, and the result is shown in Figure 2.



Figure 2.
Students are developing creativity.

Collaboration is a key element of heutagogy that aims to provide an environment in which students learn from each other [20]. Working with learners is able to exchange reinforcing information, solve problems and experiences, continue to practice, and experiment with trial and error.

The teacher serves as a companion and coach during the collaborative process, motivating students to move forward and take action when necessary. The application of collaboration in heutagogy recommends and gives full autonomy to the team, allowing them to manage learning activities and the learning process [20, 56]. When students work in teams, they can share and discuss ideas about science [57, 58].

In the next activity in the research room, students work together to plan research and prepare material tools according to their respective research. Students communicate jokingly, then make research action plans, and research schedules, and assign tasks in groups. Each student in each group has different abilities and points of view but produces unique meeting points and points of view Figure 3.



Figure 3.
Students make a research action plan.

Students accompanied by scientists can interpret data differences with subjectivity and can change their ideas. Working in teams helps students see and understand science as creative by creating their scientific investigations in teams - from designing, implementing, interpreting, and reporting on their results, students can see that they are as creative as scientists [51].

Based on the researcher's observations, students have unique research ideas expressed by one of the students and get additional ideas from other friends in their team, developing with teacher assistance. In the picture above, students collaborate with the team to form independence and responsibility and communicate and share with friends.

Students are able to work together and collaborate to understand others in their way, make imaginative leaps, and convey their views. Students are actively and effectively involved in creating school activities in utilizing the environment with satisfactory results.

4.3. Connect and Reflect through Innovation

Networks and connections are important aspects of heutagogy. Connections provide opportunities for learners to get information and connect with people around the world [20]. Virtual connection via the internet allows students to connect with other people in the discipline of using available media [59, 60]. The use of scientific notebooks where students are explicitly reflected in writing about ideas [48].

Naura and Aulia have reviewed several articles, journals, and previous research related to environmental conditions and the body temperature of Ettawa goats. They are curious about the causes of stress in goats that impact unstable milk productivity. They asked the teacher to find information from one of the lecturers at the Faculty of Animal Husbandry Universitas Brawijaya.

Aulia: After we observed the farm's environment and observed the goats during the day, they looked nervous. The possibility of hot air temperature during the day is one of the uncomfortable factors for goats, which causes stress and affects the milk's productivity. We want to make a simple tool, namely "Ettawa blanket," which functions to stabilize ettawa goat milk's productivity and reduce stress in the goats.

Innovation' is the act of doing or creating something in a new way and applied in a useful way that becomes valuable [52]. Students use the school's computer laboratory to find journal information related to what they want to research and discuss with their groups to find solutions and innovations (Figure 4). They also consulted with the teacher when they encountered obstacles or steps they did not know, and shared several times with friends to find solutions to take for the next step. The results of the researcher's observations: the school collaborates with universities in Malang City in terms of being a consultant or laboratory test. Ainun (13 years) with Azzam (13 years) after visiting several studios to collect data, told researchers:

Ainun: I understand why bantengan art exists among Batu City teenagers. After I conducted interviews with teenagers in art studios, they wanted to keep the Indonesian nation's traditional arts from extinction, especially in the millennial era, like teenagers like to hold gadgets. They don't care about the culture of their ancestors. The youth community is a group that can add and preserve art culture as a form of preservation of the culture of the Indonesian State.

Researcher: What positive things did adolescents get from liking the art?

Azzam: An interview with Ki Iswandi, the owner of Padepokan Gunung Wukir, the number of teenagers who like the art of bantengan can add to their experience, practice honesty, discipline, strengthen kinship, politeness and channel positive activities so that they do not depend on the gadget.

Ainun: Interview with the Tourism Office, many bantengan art activities in Batu City, including the Batu festival, cultural tours, the 1000 Banteng festival, and the preservation of Bantengan art by building a cultural center in each district. Results of interviews with teenage artists of the moon. They went to Australia to take part in cultural competitions. Bantengan art has been known to foreign countries.

Take action by gathering evidence.



Figure 4.
Students collect information evidence.

The teacher (Umroh, 33 years old) said that the original research ideas that have emerged from students so far are very diverse and extraordinary. It is regrettable if their ideas are not channeled and are not facilitated.

4.4. Share

The final activity of the students, after collecting data and writing down the results of the research, students are asked to make a PowerPoint for presentation in class Figure 5. The top three best works will take part in an inter-class competition, and then the top 10 are taken. Once students start connecting, they can start sharing [20].

At the end of the semester at State Islamic Junior High School (MTsN) Kota Batu, the researchers' observations of students' research work were held in the school area. When parents come to take report cards, they can enjoy and see the results of the student's ideas and creativity during research at school. Exhibition activities in schools instill a spirit of independence for students, and self-confidence, and mentally train students to communicate with people from outside their environment. Apart from these activities, students participate in competitions at the city, provincial, national, and international levels. Based on information from the student and the teacher at MTsN Kota Batu, they have several research competitions at the regional, national, and international levels.



Figure 5.
Students present study results.

5. Conclusion

This article presents the exploration process of young researchers involved in research learning behavior by generating original ideas through the surrounding environment. This study's results are that the teacher has a vital role in young researchers' learning activities for beginners. Students accompanied by teachers are able to think critically about environmental problems in getting original ideas through teacher stimulus and habituation of observations at school and at home, and able to respond to learners so that they are accustomed to being sensitive to their environmental problems. Students can convey research ideas to teachers and friends, work together, and participate in groups to analyze, interpret, design, implement, and report activities in research projects from the learner's point of view. Student activities follow hutagogy/self-termed design elements include: explore, creating, collaborating, connecting, reflecting, and sharing. In line with the principles of OLEs, it encourages students to think critically, orientate toward inquiry-oriented and heuristic-based learning independently (Hannafin), and four Young Children As Researcher (YCAR) research behaviors: exploration, finding solutions, conceptualizing, and basing decisions on evidence. The findings in this study are, teacher habituation to stimulate students to get original ideas from the environment can indirectly lead to a pleasant research culture for students. It means that with this habituation, students conduct observations of the environment and stimulate sensitivity to environmental problems so that they come up with creative ideas as a solution. Ainun (13 years) Amanda (14 years) got a new research idea after completing one of her research through observation of developing initial research. It cannot be separated from the teacher as a guide and facilitator for students independently in learning for young researchers. Teachers' role cannot be replaced by technological advances so teachers remain the primary key in the learning process in motivating the development of creativity and innovation. Teachers as researchers with students are able to facilitate the curriculum in achieving creative student goals.

References

- [1] L. Lundy, "'Voice' is not enough: Conceptualising article 12 of the United Nations convention on the rights of the child," *British Educational Research Journal*, vol. 33, pp. 927-942, 2007. Available at: <https://doi.org/10.1080/01411920701657033>.
- [2] C. Zurbrugg, M. Gfrerer, H. Ashadi, W. Brenner, and D. Küper, "Determinants of sustainability in solid waste management—the Gianyar waste recovery project in Indonesia," *Waste Management*, vol. 32, pp. 2126-2133, 2012. Available at: <https://doi.org/10.1016/j.wasman.2012.01.011>.
- [3] M. Montreuil, A. Bogossian, E. Laberge-Perrault, and E. Racine, "A review of approaches, strategies and ethical considerations in participatory research with children," *International Journal of Qualitative Methods*, vol. 20, pp. 1-15, 2021. Available at: <https://doi.org/10.1177/1609406920987962>.

- [4] N. O'Brien and T. Moules, "So round the spiral again: A reflective participatory research project with children and young people," *Educational Action Research*, vol. 15, pp. 385-402, 2007. Available at: <https://doi.org/10.1080/09650790701514382>.
- [5] J. Coad and R. Evans, "Reflections on practical approaches to involving children and young people in the data analysis process," *Children & Society*, vol. 22, pp. 41-52, 2008. Available at: <https://doi.org/10.1111/j.1099-0860.2006.00062.x>.
- [6] L. Lundy, L. McEvoy, and B. Byrne, "Working with young children as co-researchers: An approach informed by the United Nations convention on the rights of the child," *Early Education & Development*, vol. 22, pp. 714-736, 2011. Available at: <https://doi.org/10.1080/10409289.2011.596463>.
- [7] H. Hedges, "Young children's 'working theories': Building and connecting understandings," *Journal of Early Childhood Research*, vol. 12, pp. 35-49, 2014. Available at: <https://doi.org/10.1177/1476718x13515417>.
- [8] L. Darling-Hammond, L. Flook, C. Cook-Harvey, B. Barron, and D. Osher, "Implications for educational practice of the science of learning and development," *Applied Developmental Science*, vol. 24, pp. 97-140, 2020. Available at: <https://doi.org/10.1080/10888691.2018.1537791>.
- [9] M. W. Allodi, "The meaning of social climate of learning environments: Some reasons why we do not care enough about it," *Learning Environments Research*, vol. 13, pp. 89-104, 2010. Available at: <https://doi.org/10.1007/s10984-010-9072-9>.
- [10] A. L. Burrow and P. L. Hill, "Purpose by design or disaster: Preserving a sense of purpose amid environmental uncertainty," *Journal of Environmental Psychology*, vol. 69, p. 101436, 2020. Available at: <https://doi.org/10.1016/j.jenvp.2020.101436>.
- [11] M. R. Young, "The motivational effects of the classroom environment in facilitating self-regulated learning," *Journal of Marketing Education*, vol. 27, pp. 25-40, 2005. Available at: <https://doi.org/10.1177/0273475304273346>.
- [12] S. Naidu, "How flexible is flexible learning, who is to decide and what are its implications?," *Distance Education*, vol. 38, pp. 269-272, 2017. Available at: <https://doi.org/10.1080/01587919.2017.1371831>.
- [13] L. Leng, "The role of philosophical inquiry in helping students engage in learning," *Frontiers in Psychology*, vol. 11, p. 449, 2020. Available at: <https://doi.org/10.3389/fpsyg.2020.00449>.
- [14] S. Loeng, "Self-directed learning: A core concept in adult education," *Education Research International*, pp. 1-12, 2020. Available at: <https://doi.org/10.1155/2020/3816132>.
- [15] Q. Wang, "Designing a web-based constructivist learning environment," *Interactive Learning Environments*, vol. 17, pp. 1-13, 2009. Available at: <https://doi.org/10.1080/10494820701424577>.
- [16] P. Kwangmuang, S. Jarutkamolpong, W. Sangboonraung, and S. Daungtod, "The development of learning innovation to enhance higher order thinking skills for students in Thailand junior high schools," *Heliyon*, vol. 7, p. e07309, 2021. Available at: <https://doi.org/10.1016/j.heliyon.2021.e07309>.
- [17] M. A. Al Mamun, G. Lawrie, and T. Wright, "Instructional design of scaffolded online learning modules for self-directed and inquiry-based learning environments," *Computers & Education*, vol. 144, p. 103695, 2020. Available at: <https://doi.org/10.1016/j.compedu.2019.103695>.
- [18] E. Gillaspay and C. Vasilica, "Developing the digital self-determined learner through heutagogical design," *Higher Education Pedagogies*, vol. 6, pp. 135-155, 2021. Available at: <https://doi.org/10.1080/23752696.2021.1916981>.
- [19] M. L. Wehmeyer, K. A. Shogren, S. B. Palmer, and A. Boulton, "Impact of the self-determined learning model of instruction on self-determination: A randomized-trial control group study," *Exceptional Children*, vol. 78, pp. 440-448, 2014. Available at: <https://doi.org/10.1177/001440291207800201>.
- [20] L. M. Blaschke and S. Hase, "Heutagogy, technology, and lifelong learning for professional and part-time learners. In Transformative perspectives and processes in higher education," ed Cham: Springer, 2015, pp. 75-94.
- [21] R. L. Moore, "Developing lifelong learning with heutagogy: Contexts, critiques, and challenges," *Distance Education*, vol. 41, pp. 381-401, 2020. Available at: <https://doi.org/10.1080/01587919.2020.1766949>.
- [22] N. Agonács and J. F. Matos, "Heutagogy and self-determined learning: A review of the published literature on the application and implementation of the theory," *Open Learning: The Journal of Open, Distance and e-Learning*, vol. 34, pp. 223-240, 2019. Available at: <https://doi.org/10.1080/02680513.2018.1562329>.
- [23] C. Wang, J. R. Hipp, C. T. Butts, and C. M. Lakon, "The interdependence of cigarette, alcohol, and marijuana use in the context of school-based social networks," *PloS One*, vol. 13, p. e0200904, 2018. Available at: <https://doi.org/10.1371/journal.pone.0200904>.
- [24] C. Pascal, T. Bertram, C. Pascal, and T. Bertram, "Listening to young citizens: The struggle to make real a participatory paradigm in research with young children," *European Early Childhood Education Research Journal*, vol. 17, pp. 249-262, 2009. Available at: <https://doi.org/10.1080/13502930902951486>.
- [25] P. Christensen and A. Prout, "Working with ethical symmetry in social research with children," *Childhood: A Global Journal of Child Research*, vol. 9, pp. 477-497, 2002. Available at: <https://doi.org/10.1177/0907568202009004007>.
- [26] H. Cahill and B. Dadvand, "Re-conceptualising youth participation: A framework to inform action," *Children and Youth Services Review*, vol. 95, pp. 243-253, 2018. Available at: <https://doi.org/10.1016/j.childyouth.2018.11.001>.
- [27] A. B. Koch, "Children as participants in research. Playful interactions and negotiation of researcher-child relationships," *Early Years: An International Journal of Research and Development*, vol. 41, pp. 381-395, 2021. Available at: <https://doi.org/10.1080/09575146.2019.1581730>.
- [28] P. J. van der Zanden, P. C. Meijer, and R. A. Beghetto, "A review study about creativity in adolescence: Where is the social context?," *Thinking Skills and Creativity*, vol. 38, p. 100702, 2020. Available at: <https://doi.org/10.1016/j.tsc.2020.100702>.
- [29] J. Murray, "Young children are researchers: Children aged four to eight years engage in important research behaviour when they base decisions on evidence," *European Early Childhood Education Research Journal*, vol. 24, pp. 705-720, 2016. Available at: <https://doi.org/10.1080/1350293x.2016.1213565>.
- [30] A. Tversky and D. Kahneman, "Availability: A heuristic for judging frequency and probability," *Cognitive Psychology*, vol. 5, pp. 207-232, 1973. Available at: [https://doi.org/10.1016/0010-0285\(73\)90033-9](https://doi.org/10.1016/0010-0285(73)90033-9).
- [31] I. Fajri, R. Yusuf, and Ruslan, "Project citizen learning model in developing civic disposition of high school students through the subject of Pancasila education citizenship," presented at the International Conference on Early Childhood Education, 2019.
- [32] I. Fajri, R. Yusuf, B. A. Maimun, and Y. Sanusi, "Innovation model of citizenship education learning in the 21st-century skill-learning environment of students in Aceh," *Innovation*, vol. 7, pp. 2334-2343, 2020.
- [33] R. Yusuf, S. Maimun, I. Fajri, and J. Saputra, "A comparison of student environmental literacy: Public and Islamic schools in Banda Aceh, Indonesia," *International Journal of Innovation, Creativity and Change*, vol. 12, pp. 222-239, 2020.

- [34] S. Kemmis, "Foucault, Habermas and evaluation," *Curriculum Studies*, vol. 1, pp. 35-54, 1993. Available at: <https://doi.org/10.1080/0965975930010103>.
- [35] S. M. Land, "Cognitive requirements for learning with open-ended learning environments," *Educational Technology Research and Development*, vol. 48, pp. 61-78, 2000. Available at: <https://doi.org/10.1007/bf02319858>.
- [36] E. Vrieling, A. Van Den Beemt, and M. De Laat, "Facilitating social learning in teacher education: A case study," *Studies in Continuing Education*, vol. 41, pp. 76-93, 2019. Available at: <https://doi.org/10.1080/0158037x.2018.1466779>.
- [37] R. R. Yusuf, M. Sanusi, I. Fajri, and S. A. Gani, "Disaster education in disaster-prone schools: A systematic review," presented at the IOP Conference Series: Earth and Environmental Science, 2022.
- [38] R. Yusuf and I. Fajri, "Differences in behavior, engagement and environmental knowledge on waste management for science and social students through the campus program," *Heliyon*, vol. 8, p. e08912, 2022. Available at: <https://doi.org/10.1016/j.heliyon.2022.e08912>.
- [39] M. J. Jacobson and R. J. Spiro, "Hypertext learning environments, cognitive flexibility, and the transfer of complex knowledge: An empirical investigation," *Journal of Educational Computing Research*, vol. 12, pp. 301-333, 1995. Available at: <https://doi.org/10.2190/4t1b-hbp0-3f7e-j4pn>.
- [40] B. Rittle-Johnson and R. S. Siegler, "The relation between conceptual and procedural knowledge in learning mathematics: A review," *The Development of Mathematical Skills*, pp. 75-110, 1998. Available at: <https://doi.org/10.4324/9781315784755-6>.
- [41] M. Hannafin, S. Land, and K. Oliver, "Open learning environments: Foundations, methods, and models," *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory*, vol. 2, pp. 115-140, 1999.
- [42] A. R. Berkowitz, M. E. Ford, and C. A. Brewer, "A framework for integrating ecological literacy, civics literacy, and environmental citizenship in environmental education," *Environmental Education and Advocacy: Changing Perspectives of Ecology and Education*, vol. 227, p. 66, 2005.
- [43] A. Al Shabibi, A. Al Mantheri, and B. Al Rashdi, "Impact of teacher professional development on student attitudes and experiences in school learning—A case study of Oman," *International Journal of Learning, Teaching and Educational Research*, vol. 18, pp. 48-67, 2019. Available at: <https://doi.org/10.26803/ijlter.18.10.4>.
- [44] T. Cochrane, L. Antonczak, A. Gordon, H. Sissons, and A. Withell, *Heutagogy and mobile social media: Post web 2.0 pedagogy*. In M. Brown, M. Hartnett & T. Stewart (Eds.), *Future challenges, sustainable futures*. In *Proceedings ascilite Wellington 2012*. Wellington, New Zealand: Ascilite, 2012.
- [45] J. W. Creswell, *A concise introduction to mixed methods research*. Thousand Oaks, CA: Sage, 2015.
- [46] M. B. Miles, A. M. Huberman, and J. Saldana, *Qualitative data analysis*, 4th ed. Thousand Oaks, CA: Sage, 2014.
- [47] L. Colucci-Gray, A. Perazzone, M. Dodman, and E. Camino, "Science education for sustainability, epistemological reflections and educational practices: From natural sciences to trans-disciplinarity," *Cultural Studies of Science Education*, vol. 8, pp. 127-183, 2013. Available at: <https://doi.org/10.1007/s11422-012-9405-3>.
- [48] K. E. Fouad, H. Masters, and V. L. Akerson, "Using history of science to teach nature of science to elementary students," *Science & Education*, vol. 24, pp. 1103-1140, 2015. Available at: <https://doi.org/10.1007/s11191-015-9783-5>.
- [49] V. L. Akerson, G. A. Buck, L. A. Donnelly, V. Nargund-Joshi, and I. S. Weiland, "The importance of teaching and learning nature of science in the early childhood years," *Journal of Science Education and Technology*, vol. 20, pp. 537-549, 2011. Available at: <https://doi.org/10.1007/s10956-011-9312-5>.
- [50] M. Z. Mohd Yusoff, S. Safrilsyah, M. K. Haji Othman, I. Fajri, S. M. Yusuf, I. Ibrahim, and W. H. W. Mohd Zain, "The effect of moral reasoning and values as the mediator towards student's prosocial behaviour," *International Journal of Adolescence and Youth*, vol. 27, pp. 32-44, 2022. Available at: <https://doi.org/10.1080/02673843.2021.2021959>.
- [51] V. L. Akerson, I. Carter, K. Pongsanon, and V. Nargund-Joshi, "Teaching and learning nature of science in elementary classrooms," *Science & Education*, vol. 28, pp. 391-411, 2019.
- [52] J. Murray, "Welcome in! How the academy can warrant recognition of young children as researchers," *European Early Childhood Education Research Journal*, vol. 25, pp. 224-242, 2017. Available at: <https://doi.org/10.1080/1350293x.2017.1288016>.
- [53] E. Care, C. Scoular, and P. Griffin, "Assessment of collaborative problem solving in education environments," *Applied Measurement in Education*, vol. 29, pp. 250-264, 2016. Available at: <https://doi.org/10.1080/08957347.2016.1209204>.
- [54] A. K. Ahonen and S.-M. Harding, "Assessing online collaborative problem solving among school children in Finland: A case study using ATC21S TM in a national context," *International Journal of Learning, Teaching and Educational Research*, vol. 17, pp. 138-158, 2018. Available at: <https://doi.org/10.26803/ijlter.17.2.9>.
- [55] V. L. Akerson and F. S. Abd-El-Khalick, "'How should i know what scientists do?—I am just a kid': Fourth-grade students' conceptions of nature of science," *Journal of Elementary Science Education*, vol. 17, pp. 1-11, 2005. Available at: <https://doi.org/10.1007/bf03174669>.
- [56] J. Lock, S. Lakhal, M. Cleveland-Innes, P. Arancibia, D. Dell, and N. De Silva, "Creating technology-enabled lifelong learning: A heutagogical approach," *British Journal of Educational Technology*, vol. 52, pp. 1646-1662, 2021.
- [57] K. Moll, K. Landerl, M. J. Snowling, and G. Schulte-Körne, "Understanding comorbidity of learning disorders: Task-dependent estimates of prevalence," *Journal of Child Psychology and Psychiatry*, vol. 60, pp. 286-294, 2018. Available at: <https://doi.org/10.1111/jcpp.12965>.
- [58] H. Hayee, T. Raana, I. I. Haider, and M. R. Sajid, "Association between predictors of borderline personality disorder and quality of life of undergraduate students of Lahore, Pakistan," *Nurture*, vol. 15, pp. 26-35, 2022. Available at: <https://doi.org/10.55951/nurture.v15i1.4>.
- [59] B. Azhari and I. Fajri, "Distance learning during the COVID-19 pandemic: School closure in Indonesia," *International Journal of Mathematical Education in Science and Technology*, vol. 53, pp. 1934-1954, 2022. Available at: <https://doi.org/10.1080/0020739x.2021.1875072>.
- [60] R. Yusuf, S. Sanusi, R. Razali, M. Maimun, and I. Putra, "The efforts to improve culture literacy and student citizenship through ICT based (LBK) media in pancasila and citizenship education," *Universal Journal of Educational Research*, vol. 8, pp. 1513-1519, 2020. Available at: <https://doi.org/10.13189/ujer.2020.080444>.