

The Framework of Multicultural Education Value in Indonesia Schools to Face Challenge of 21-Century Learning Using Literary Study

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ABSTRACT

This study uses literary analysis to provide a model for how multicultural education might help Indonesian schools meet the challenges of the twenty-first century. This study fills a knowledge vacuum by employing works of fiction to investigate the importance of intercultural education. The novel Negeri 5 Menara also depicts a multicultural lifestyle and educational system. In this investigation, we employ a qualitative strategy based on content analysis. The study's data comes from a search for examples of intercultural education's core values in literature. This study used a selected data gathering method that Huberman and Miles refer to as "data reduction," consisting of five steps: selecting, focusing, simplifying, summarising, and modifying the raw data. Credibility, transferability, dependability, and confirmability are all aspects of data validity that should be examined. According to the study's findings, 1) multicultural education is beneficial because it teaches students to respect and tolerate diverse points of view during the decision-making process; 2) students can benefit from multicultural education both inside and outside the classroom; and 3) the value of multicultural education can be broken down into three main value components: democracy, pluralism, and humanism. The similarities in the concept of pluralism values, cultural empowerment as a basis for freedom of cross-cultural understanding, and the combination of content and knowledge construction in the education system are all examples of the framework of the multicultural education model that emerges from the analysis results. The findings of this study have relevance for the advancement of science, particularly for the study of literature across disciplines.

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1. INTRODUCTION

In Indonesia, literature has become one of the critical media to respond to political, social and educational issues (Yazell, Petersen, Marx, & Fessenbecker, 2021). Many elements and values are explored to be used as examples of literary works, both for children, adolescents and adults, as a medium or input for designing the value of multicultural education in the curriculum so that the educational framework held in schools in Indonesia has relevance, according to the needs of 21st-century learning (Abdurahman, Hayati, & Zulfadhli, 2018). Many Indonesian literary works were written to represent the real reality of the life of Indonesian people who are diverse in ethnicity, ethnicity, language and religion. In one study, Indonesian novels in the 2000s revealed that Indonesian people, in the context of a multicultural nation and world citizens, have an appreciation for cultural pluralism, uphold humanism and carry out the responsibility to maintain the integrity of the world (Sayuti & Wiyatmi, 2017). Thus, the implementation of education in each region of Indonesia cannot be equal because of school members' diverse backgrounds and contexts. This means that regions in Indonesia have a variety of different cultures, so each school has the characteristics of cultural diversity and can include learning that characterises each region, for example learning regional languages as local content. Each school can create a framework for providing education with the value of multicultural education so that the personal character formation of students can be realised with differences and remain united as Indonesia.

Therefore, cultural diversity in Indonesia can be one of the important of building a multicultural-based education system. It means that the value paradigm needed in multicultural education is that culture, language, and the social context of society cannot be separated, resulting in acceptance, or at least tolerance, of different cultures (Sleeter, 2018). The paradigms of multicultural education in Indonesia include the paradigm of cultural preservation, the paradigm of social justice, the paradigm of equality, the paradigm of Unity in Diversity, and the paradigm of social interaction. The more Indonesians promote and apply these values in the lives of their people, the better and faster that society can achieve a peaceful and harmonious life (Jayadi, Abduh, & Basri, 2022a).

Many previous studies have used the study or appreciation of novels to build educational values used in the classroom (Pusvita, 2017; Ningsih, 2018); even literary works are also often used to improve students' reading comprehension skills (Chen, Chen, & Sun, 2010) or describe the broader concept of education derived from fantastic cultural and moral values (Wati, Pulau Flores No, & Timur, 2017; Indriati et al., 2013; Wandira et al., 2013; Nurpaisah, Martono, & Seli, 2014; Wati et al., 2017) Suroso, 2017; Rismawati, Rapi, Bahasa dan Sastra, & Negeri Makassar, 2021). In addition, literary texts can also be used and combined with multicultural subject matter so that literary texts can become a means of multicultural education (Kusá, Sladová, Kopecký, & Mlčoch, 2014). Even understanding multicultural concepts can be started at home through parental involvement (Pattnaik, 2003). While in schools can be played by teachers or educators. The role of teachers in realising positive interethnic attitudes among their students largely focuses on the norms that teachers express about cultural diversity (Tonbuloglu, Aslan, & Aydin, 2016; Geerlings, Thijs, & Verkuyten, 2019). Schools create a conducive climate for learning activities in transforming multicultural values for students (Suryaman, 2019). There are many ways that schools can do in inserting the values of multicultural education, such as responsive curriculum or learning activities by prioritising respect for differences (Abdurahman et al., 2018; Jayadi, Abduh, & Basri, 2022b; Slamet, Masrukhi, Haryono, & Wasino, 2017; Suri & Chandra, 2021). The values of cultural diversity describe the reality within the framework of the implementation

of education in schools in Indonesia, which have ethnic diversity and are relevant to the conditions of the demands for competence in the quality of education in the 21st century.

Moreover, the current development of science and technology has had an impact on various changes in people's lives in Indonesia, including the concept of providing education. It means that the internet network makes it easy to access information that is happening in the world, and students can know various cultural diversity not only in Indonesia but also abroad. Thus, education becomes one of the tools to provide a filter for students in filtering out the entry of western culture that is not in accordance with the character of the Indonesian nation. Therefore, studies related to cultural diversity can continue to be carried out, especially those related to multicultural education (Silva, 2022).

Therefore, from the exposure of previous research, it is known that there are many ways to build the value of multicultural education in the process of providing education. So, the gap in this study was raised through different research bases, namely through literary works. The gap in this research is to examine the value of multicultural education using novel literary works. Moreover, the novel *Negeri 5 Menara* describes the life and educational process that has cultural diversity. So, the problem of studying the value of multicultural education through the perspective of literary works is not only oriented to the issue of inter-ethnic relations, diversity, and similarities but can also be understood through intercultural relations. Therefore, research through the perspective of this literary work is one way to provide an understanding of the formation of multicultural educational values for students in educational institutions. Thus, students can have moral character. This means that if a person has good morals, he will have a good character which is manifested in the attitudes and behaviour of everyday life.

The reasons for choosing literary works as a medium for analysing the formation of multicultural education values are 1) literary works contain multicultural educational values that are easy to study as a form of observation of the real-life reality of Indonesian people, 2) literary works are often used as teaching materials in learning in schools. Elementary to tertiary institutions in shaping the personality of students, and 3) literary works provide inspiration and examples of multicultural educational values that are easily understood and applied by everyone, educational institutions or community groups.

Thus, this study aims to obtain a framework for the value of multicultural education needed by schools in Indonesia through the perspective of literary works, especially to face the demands of 21st-century learning needs. This research is expected to contribute to the development of knowledge and practice of multicultural education. In addition, educators can also take advantage of this research so that they can direct students to the main concepts of cultural diversity in schools or educational institutions so that they can reflect students who have good character and still uphold the value of local wisdom

2. METHODS

This research is a qualitative approach using the method of content analysis (content analysis). The content analysis method is used to systematically analyse data or content/text messages in a propositional manner (Klaus, 2013). The content analysis method is used to reveal the values of multicultural education in the novel "*Negeri 5 Menara*" related to the structure, symbols, meanings, and messages contained therein and their influence on the reader. So, this research examines words or sentences in novels that have multicultural educational values. Data collection techniques using documentation. The main data is taken from words or sentences of literary texts in the form of novels,

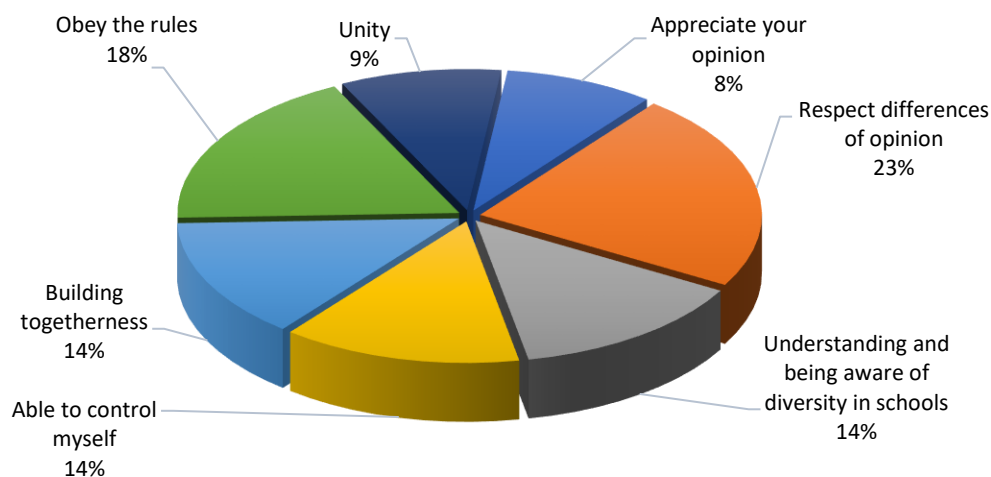
namely the novel entitled *Negeri 5 Menara*, which contains stories about cultural diversity. Secondary data is taken from various theories or previous research as a reinforcement of the main data analysis. The research procedures carried out are as follows (Emzir, 2010):

1. Determine the data source and the data to be studied.
2. Define research problems and objectives.
3. Identify data that contains the meaning of multicultural education values from conversational texts in literary works.
4. Examining more in-depth data on the values of multicultural education
5. Conclude and submit research suggestions

The data analysis procedure consists of several stages that refer to Huberman and Miles' data reduction theory, namely selecting, focusing, simplifying, summarising, and converting raw data (Miles & Huberman, 1994). To obtain the validity of research data, an examination technique is needed based on certain requirements or criteria, which include credibility, transferability, dependability, and confirmability (Moleong, 2019).

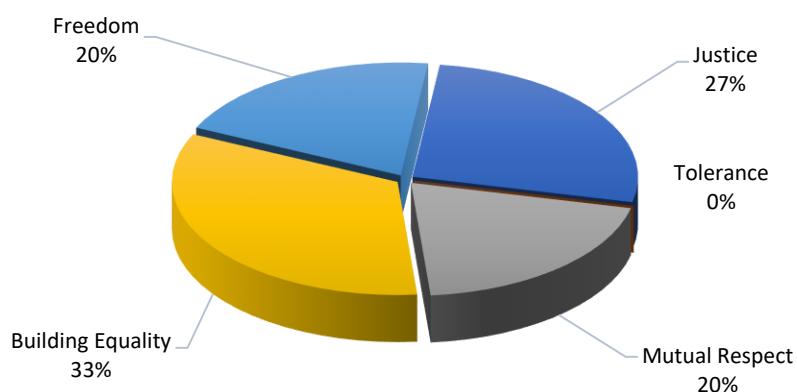
3. FINDINGS AND DISCUSSION

The results of data analysis show that the differences that arise in the concept of multicultural education values are not only tied to the diversity of culture, ethnicity, language and religion, but the values developed in the implementation of multicultural education lead to values that support the formation of students' character and personality. The following are the findings of the values of multicultural education which have been studied in depth as a component of the framework for multicultural education in schools.



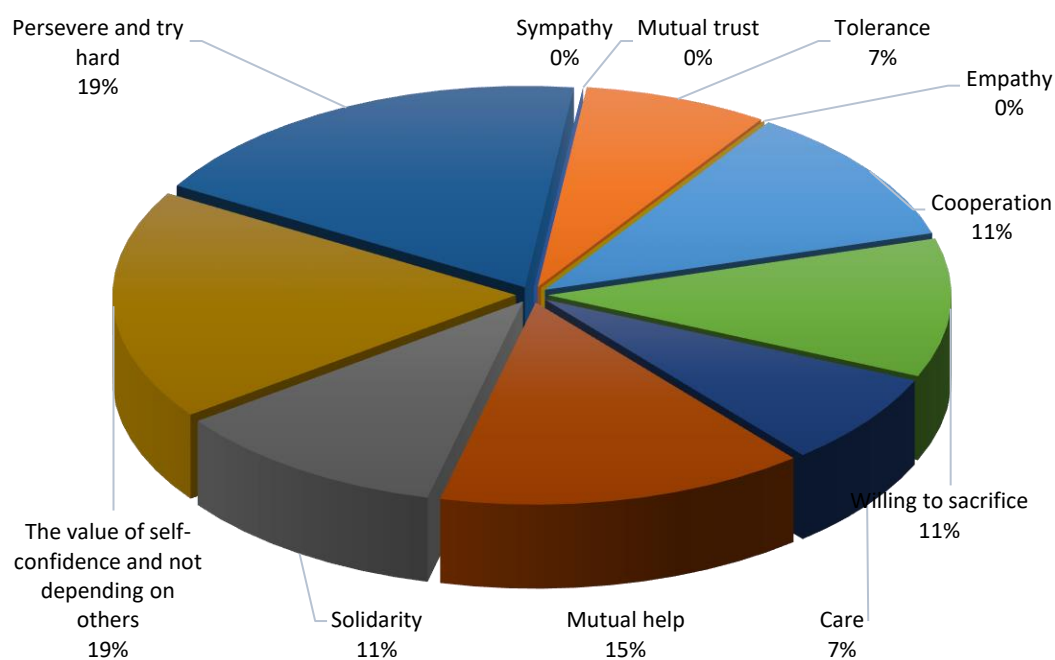
Graph 1. Finding the Value of Multicultural Education on Democratic Values

The data analysis results show that the value of multicultural education in the aspect of democratic values is dominated by the value of respecting differences of opinion 71%. While the findings of the value of pluralism are shown in the following graph;



Graph 2. Finding the Value of Multicultural Education on Pluralism Values

The value of multicultural education that dominates the value of pluralism is the value of equality. This means that schools must create a learning atmosphere and environment that upholds every school member's equality. While the values that appear in the framework of humanism values are as follows:



Graph 3. Finding the Value of Multicultural Education on Humanism Values

These values appear in each component in the implementation of education, which is illustrated below;

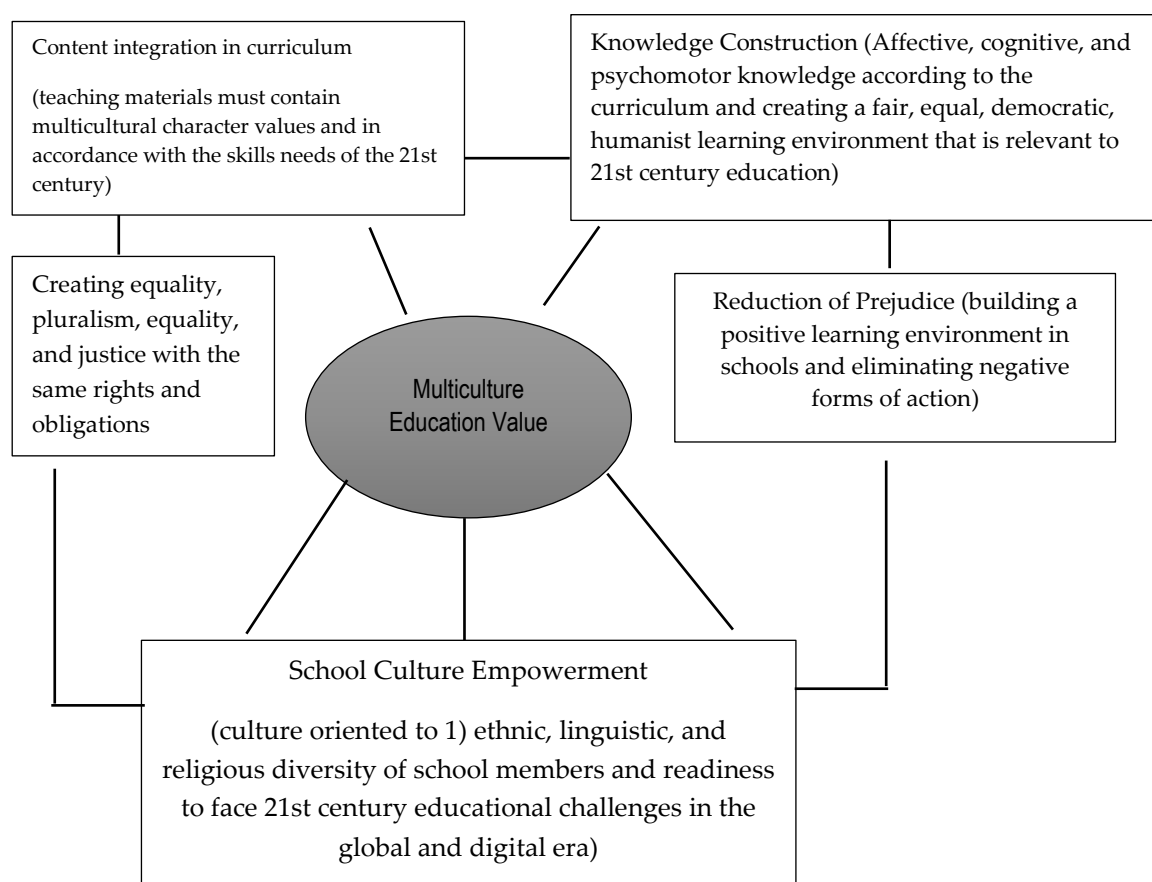


Figure 1. The framework of Multicultural Education Value in Indonesia Schools in Challenge of 21-Century Learning: Literary Perspective

The results of the analysis of text data in literary works containing stories of the reality of multicultural community life found that the value of multicultural education that could be formed in schools had three components, namely the value of democracy, the value of pluralism and the value of humanism. These three values describe value indicators that are relevant to the formation of character education that has been mandated in the curriculum framework in Indonesia. Currently, the Indonesian government has issued an independent learning curriculum policy for educational institutions.

The Independent Curriculum provides students with greater time to explore concepts and build competencies by including a wide range of extracurricular learning opportunities. A teacher's ability to select from a variety of instructional methods allows for differentiation of instruction based on students' individual needs and areas of interest. The Pancasila student profile is a goal of this curriculum, and various projects were designed to help students reach that goal (Kemendikbud, 2022). Consequently, the value framework of multicultural education discovered via this research is consistent with the autonomous curriculum currently in use in Indonesia. Because the concept of the Indonesian nation, known as Pancasila, is best described by the three pillars of multicultural education. Multicultural education, as embodied in the principles of Pancasila, so serves as a symbol of the richness of Indonesian culture. This research provides a theoretical framework for the implementation of

multicultural education in Indonesia, describing the ideological basis of the Indonesian nation so that *Bhinneka Tunggal Ika* graduates continue to be produced.

Multicultural-based education is predicated on the principle that there is value in educating about different cultures. This innovative idea perfectly captures the rich cultural diversity that characterises Indonesia. The advancement of science and technology has also facilitated the dissemination of information to the people of Indonesia. This indicates that exposure to such materials facilitates cross-cultural learning and understanding. Indonesian schools still need to instil the principles of local wisdom within the framework of multicultural education in order to counteract the moral decay that may result from increased access to information. Thus, this research presents the idea of the importance of multicultural education for societies that are highly heterogeneous in terms of ethnic, cultural, and racial groupings in order to learn to appreciate and respect those differences. Recognising and respecting diversity between cultures in an educational setting promotes mutual appreciation and understanding. Teaching a sense of patriotism towards one's country and fellow citizens of all backgrounds is integral to fostering positive diversity relations. Equality is a multifaceted concept that includes teachers treating pupils of all groups equally and students from diverse groups achieving similar levels of success in school (Blum, 2014).

The modern event society is experiencing represents a profound shift in the very fabric of society and culture. Both the exterior structure (patterns of behaviour and attitudes) and the inner structure of society are profoundly affected by the speed with which information travels in the globalisation wave (value systems, views of life, philosophies and beliefs). Cultural exchange between nations can be seen as a dialectic between new and old values, with the latter eventually winning out and paving the way for the standardisation and neo-liberalisation of all parts of life, including local cultural norms that have become community guidelines. As a result of this situation, society's values have shifted to prioritise contemporary ones at the expense of more universal ones. This results in a wide range of moral breakdowns in people's day-to-day actions. Thus, there needs to be a strong emphasis on passing on local cultural values to the next generation (Suradi, 2018).

So this finding allows all educational institutions to apply a multicultural approach to learning activities. Because learning through a multicultural approach is carried out by prioritising the cultivation of a way of life that is respectful, sincere, and tolerant of cultural diversity that lives in a pluralistic society (Amanda & Rochmat, 2020). Thus, educators must be able to continue to develop along with changing times and the demands of the quality of human resources. Educators must become global figures who can harmonise and adapt and adopt changes in learning activities in the classroom according to the current situation. Globally-minded teachers often give birth to globally-minded students. The same relationship seems to apply to multiculturalism; teachers who are committed to multiculturalism often push students toward the same commitment. Global citizenship and multicultural education have strong ties (Umar & Tumiwa, 2020)(Said Dođru & Demirbař, 2021)(Karacsony, Pásztoová, Vinichenko, & Huszka, 2022).

The diverse cultural wealth is also seen as a vehicle for learning to appreciate differences in values, views, and behaviour in the association. Thus, it will form the character of students sensitive to differences, care, empathy, and participation in common interests. These values become the basis for mutual understanding in living together in diversity. Thus, students are equipped with the values of living together in peace, a form of coexistence and pro-existence. Education must be able to stop the increase in the values of silence, ignorance, inequality, prejudice, injustice and ignorance, shifting to

the values of inclusiveness, caring and sharing, equality, justice, and sympathy (Bennett, Gunn, van Beynen, & Morton, 2022)(Satianingsih, Sunu, Budiyono, & Subandowo, 2020).

4. CONCLUSION

The findings of the values of multicultural education are closely related to the concept of character education values which have been proclaimed by the government to be included in the curriculum. From the findings that have been presented to answer the focus of the problem, the concept has also been applied as a comprehensive system and not only in the curriculum. So multicultural values and character education become a complementary and related unit to be applied in learning activities. Character education in Indonesia with diverse cultural and religious backgrounds is very important and urgent. In this case, education does not only function to instil values based on certain cultures but also universal human values.

The results of this study have implications for scientific development, especially for the analysis of literary works from literary research. In addition, these findings can be a valuable contribution to developing character education values based on cultural diversity so that the education system that has been built in Indonesian society can provide equitable education for everyone. The research results can be used to develop a multicultural-based educational system theory related to the development of character education values. In addition, the results of this study have described values such as democracy, pluralism and humanism which are closely related to the social life of the Indonesian people. Therefore, further researchers can study more literary works with multicultural values to obtain the concept of multicultural values, character values and human values that can be used to form multicultural education in Indonesia with a combination of these values.

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REFERENCES

- Abdurahman, Hayati, Y., & Zulfadhli. (2018). Multicultural Values in Indonesian Children Story. *International Conference on Language, Literature, and Education (ICLLE 2018)*. Advances in Social Science, Education and Humanities Research.
- Amanda, A., & Rochmat, S. (2020). Instilling Values of Nation Character Education through Multicultural History Learning. *ICSSSED*. European Alliance for Innovation n.o. <https://doi.org/10.4108/EAI.4-8-2020.2302536>
- Bennett, S. V., Gunn, A. M. A., van Beynen, K., & Morton, M. Lou. (2022). Religiously Diverse Multicultural Literature for Early Childhood. *Early Childhood Education Journal*, 50(4), 1. <https://doi.org/10.1007/S10643-021-01180-7>
- Blum, L. (2014). Three educational values for a multicultural society: Difference recognition, national cohesion and equality. *Journal of Moral Education*, 43(3), 332–344. <https://doi.org/10.1080/03057240.2014.922057>
- Chen, J.-M., Chen, M.-C., & Sun, Y. S. (2010). A novel approach for enhancing student reading comprehension and assisting teacher assessment of literacy. *Computers & Education*, 55(3), 1367–1382. <https://doi.org/10.1016/J.COMPEDU.2010.06.011>
- Emzir. (2010). *Metodologi Penelitian Pendidikan, Kuantitatif & Kualitatif*. Jakarta: Rajawali Pers.

- Geerlings, J., Thijs, J., & Verkuyten, M. (2019). Preaching and practicing multicultural education: Predicting students' outgroup attitudes from perceived teacher norms and perceived teacher-classmate relations. *Journal of School Psychology, 75*, 89–103. <https://doi.org/10.1016/J.JSP.2019.07.003>
- Indriati, E., Martono, H., Prodi, S. S., Bahasa, P., Sastra, D., & Untan, F. (2013). NILAI-NILAI BUDAYA DALAM NOVEL PARA PRIYAYI KARYA UMAR KAYAM DAN IMPLEMENTASI DI SEKOLAH. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK), 2*(9). <https://doi.org/10.26418/JPPK.V2I9.3255>
- Jayadi, K., Abduh, A., & Basri, M. (2022a). A meta-analysis of multicultural education paradigm in Indonesia. *Heliyon, 8*(1), e08828. <https://doi.org/10.1016/J.HELIYON.2022.E08828>
- Jayadi, K., Abduh, A., & Basri, M. (2022b). A meta-analysis of multicultural education paradigm in Indonesia. *Heliyon, 8*(1), e08828–e08828. <https://doi.org/10.1016/J.HELIYON.2022.E08828>
- Karacsony, P., Pásztoóvá, V., Vinichenko, M., & Huszka, P. (2022). The Impact of the Multicultural Education on Students' Attitudes in Business Higher Education Institutions. *Education Sciences 2022, Vol. 12, Page 173, 12*(3), 173. <https://doi.org/10.3390/EDUCSCI12030173>
- Kemendikbud. (2022). Kurikulum Merdeka. Retrieved July 29, 2022, from Website Kemendikbud website: <https://s.id/kurikulum-merdeka>
- Klaus, K. (2013). *Content Analysis: An Introduction to its Methodology*. United Kingdom: Sage Publication.
- Kusá, J., Sladová, J., Kopecký, K., & Mlčoch, M. (2014). Multicultural Literary Education and its Didactic Aspects. *Procedia - Social and Behavioral Sciences, 112*, 300–308. <https://doi.org/10.1016/J.SBSPRO.2014.01.1168>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis; An Expanded Sourcebook*. New Delhi: Sage Publication.
- Moleong, L. J. (2019). *Metodologi Penelitian Kualitatif (Edisi Revisi)*. Jakarta: Rosdakarya.
- Ningsih, W. (2018). NILAI-NILAI EDUKASI ISLAM DALAM NOVEL "PUDARNYA PESONA CLEOPATRA" (Analisis Wacana Kritis Model Sara Mills). *Lingua Franca: Jurnal Bahasa, Sastra, Dan Pengajarannya, 6*(2).
- Nurpaisah, Martono, M., & Seli, S. (2014). NILAI BUDAYA JAWA DALAM NOVEL TRILOGI RONGGENG DUKUH PARUK KARYA AHMAD TOHARI. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK), 3*(2). <https://doi.org/10.26418/JPPK.V3I2.4486>
- Pattnaik, J. (2003). Multicultural Literacy Starts at Home: Supporting Parental Involvement in Multicultural Education. *Childhood Education, 80*(1), 18–24. <https://doi.org/10.1080/00094056.2003.10521245>
- Pusvita, W. D. (2017). Nilai-nilai pendidikan karakter pada novel ayah karya Andrea Hirata. *LEKSEMA: Jurnal Bahasa Dan Sastra, 2*(1), 51. <https://doi.org/10.22515/ljbs.v2i1.652>
- Rismawati, O., Rapi, M., Bahasa dan Sastra, F., & Negeri Makassar, U. (2021). Ikonis Budaya dalam Novel Tiba Sebelum Berangkat Karya Faisal Oddang (Tinjauan Semiotika Charles Sanders Pierce). *Indonesian Journal of Social and Educational Studies, 2*(2), 2021. <https://doi.org/10.35580/IJSES.V2I2.23339>
- Said Doğru, M., & Demirbaş, İ. (2021). The Relationship Between Perceptions of Multicultural Competence and Democratic Values. *Journal of International Students, 11*(1), 24–40. <https://doi.org/10.32674/JIS.V11I1.1356>
- Satianingsih, R., Sunu, ;, Budiyo, C., & Subandowo, M. (2020). Character Education in Multicultural Society: Case in Indonesia. *International Journal of Multicultural and Multireligious Understanding, 7*(4), 337–344. <https://doi.org/10.18415/IJMMU.V7I4.1407>

- Sayuti, S. A., & Wiyatmi, wiyatmi. (2017). MULTICULTURAL VALUES IN INDONESIAN NOVELS OF THE 2000s. *LITERA*, 16(1). <https://doi.org/10.21831/LTR.V16I1.14248>
- Silva, D. (2022). Pre-service teachers' understanding of culture in multicultural education: A qualitative content analysis. *Teaching and Teacher Education*, 110, 103580. <https://doi.org/10.1016/J.TATE.2021.103580>
- Slamet, S., Masrukhi, M., Haryono, H., & Wasino, W. (2017). THE IMPLEMENTATION OF MULTICULTURAL VALUES IN THE EDUCATIONAL INSTITUTION. *The Journal of Educational Development*, 5(1), 118–127. <https://doi.org/10.15294/JED.V5I1.14304>
- Sleeter, C. (2018). Multicultural education past, present, and future: Struggles for dialog and power-sharing. *International Journal of Multicultural Education*, 20(1), 5–20. <https://doi.org/10.18251/IJME.V20I1.1663>
- Suradi, A. (2018). The Challenges of Education Based on Multicultural in National Local Culture Conservation in Globalization Era. *Cendekia: Jurnal Kependidikan Dan Kemasyarakatan*, 16(1), 103. <https://doi.org/10.21154/CENDEKIA.V16I1.1156>
- Suri, D., & Chandra, D. (2021). Teacher's Strategy for Implementing Multiculturalism Education Based on Local Cultural Values and Character Building for Early Childhood Education. *Journal of Ethnic and Cultural Studies*, 8(4), 271–285. <https://doi.org/10.29333/EJECS/937>
- Suryaman, S. (2019). VALUE TRANSFORMATION IN THE MULTICULTURAL ORGANIZATION. *Jurnal Aplikasi Manajemen*, 17(3), 545–554. <https://doi.org/10.21776/UB.JAM.2019.017.03.19>
- Tonbuloglu, B., Aslan, D., & Aydin, H. (2016). Teachers' awareness of multicultural education and diversity in school settings. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, (64), 1–28. <https://doi.org/10.14689/EJER.64.1>
- Umar, M., & Tumiwa, J. F. (2020). Internalisation of Multicultural Values through the Education Process in Manado State University. *International Journal for Educational and Vocational Studies*, 2(8). [https://doi.org/DOI: https://doi.org/10.29103/ijevs.v2i8.2688](https://doi.org/DOI:https://doi.org/10.29103/ijevs.v2i8.2688)
- Wandira, A., Parlindungan, D., Prodi, N., Bahasa, P., Indonesia, S., & Untan, F. (2013). NILAI-NILAI YANG TERCERMIN DALAM NOVEL HAFALAN SHALAT DELISA KARYA TERE LIYE. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK)*, 2(9). <https://doi.org/10.26418/JPPK.V2I9.3254>
- Wati, E., Pulau Flores No, J., & Timur, K. (2017). THE ROLE OF LITERATURE IN INDONESIAN DEVELOPMENT PROCESS. *CaLLs (Journal of Culture, Arts, Literature, and Linguistics)*, 2(1), 53–64. <https://doi.org/10.30872/calls.v2i1.704>
- Yazell, B., Petersen, K., Marx, P., & Fessenbecker, P. (2021). The role of literary fiction in facilitating social science research. *Humanities and Social Sciences Communications* 2021 8:1, 8(1), 1–8. <https://doi.org/10.1057/s41599-021-00939-y>