



Character, Resilience, and Critical Thinking of Biology Students after the Covid-19 Pandemic: How They are Correlated

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Abstract: This research is a correlational study which aims to determine the relationship between character and resilience; character and critical thinking; resilience and critical thinking; and the character, resilience, and critical thinking of undergraduate biology students after the Covid-19 pandemic. The research population is all undergraduate students majoring in Biology and Science Education at Makassar State University, Makassar Muhammadiyah University and Bosowa University who are enrolled in the 2nd semester of the 2021-2022 academic year. The research sample consisted of 3 classes with a total of 120 students who were selected through cluster random sampling technique. The data of students' character and resilience were obtained using questionnaire techniques, while data on students' critical thinking skills were obtained by using an essay test on General Biology subject. The results of data analysis showed a correlation between character and resilience ($p=0.000$); character and critical thinking ($p=0.000$); character and critical thinking ($p=0.000$); student character, resilience and critical thinking ($p=0.000$). The finding of this study suggest that the correlation appears due to the potential of character and resilience to influence, empower, and enhance students' critical thinking skills.

Keywords: Character; Covid-19 Pandemic; Critical Thinking; Resilience

Introduction

Coronavirus Disease of 2019 (Covid-19) has become a global pandemic that wreak negative impact on the realm of education (Serrano-Sarmiento et al., 2021). Several studies have reported that the pandemic can lead to the decrease of skills and knowledge amongst students in higher education, secondary education and also primary education (Adhawiyah et al., 2021; Eva et al., 2021). Abrupt change in educational learning system and environment has been found as the main factor in the decline in students' skills and knowledge (Rodríguez et al., 2019). However, the most feared impact in the realm of education is the decline of students' character.

Character is the main foundation for one's social life and of paramount importance for the realm of education (Counts, 2013). Character is also said to be the main capital for students to live a better future. In addition, several studies has asserted that character can affect students' academic abilities (skills and knowledge)

(Jamaluddin et al., 2021b; Suyitno et al., 2019). The damage to students' character can give a bad influence for the future of Indonesia. Unfortunately, the current flow of modernization and the pandemic period has been one of the factors causing the crisis of students' character (Akib, 2016).

The presence of character crisis can be observed through various problems committed by students, such as frequent acts of bullying, brawling, pornography, etc. (Hidayati et al., 2014; Jamaluddin et al., 2021a). In addition, the most severe character crisis in students is the lack of respect for educators or for elderly. The students' character crisis is caused by a narrow world view. Thus, they can easily be influenced by negative things (Hidayati et al., 2020). This causes the lack of student character, thus can lead to a poor resilience.

Resilience is the ability to bounce back from a deteriorating comfort, bleak, or bad situations. This statement is in line with a study (Sumardani & Matulesy, 2021) which asserted that resilience is the

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ability to cope and to adapt with harsh events or problems that occur in one's life. According to Newman & Dantzler (2015) resilience has a positive correlation with self-confidence. Sufficient self-confidence can provide a positive value in the formation of student's resilience, vice versa.

Studies has found that students in Indonesia showed a decline in learning enthusiasm after the occurrence of the Covid-19 pandemic. The decline in students' enthusiasm has caused many problems, such as being lazy, delaying work, underestimating assignments, and many others (Adhawiyah et al., 2021). According to Warnecke & Lewine (2019), neglecting the low level of students' resilience can affect students' knowledge and thinking skills, one of which is critical thinking skills.

Critical thinking skills are reflective thinking skills centered on the ability to make decisions that are believed or carried out (Yusuf & Adeoye, 2012), and skills in assessing assumptions as well as evaluating and reviewing conclusions (Fatmawati et al., 2019). It is a higher-order thinking skills that leads to problem solving and decision making (Tiruneh et al., 2014). Furthermore, it is a very important and beneficial skills for every individual, especially in the field of education.

Several research findings in Indonesia reported that students' critical thinking skills were still low (Hidayati, 2016; Sa'diyyah et al., 2021). The low level of students' critical thinking skills can be seen from their inadequate concepts explanation as well as ill-structured flow of thinking (Antika et al., 2017), it is suspected that the learning process is still not optimal in supporting the development of students thinking skills since the instruction rely merely on rote learning.

The learning process aspects which include analyzing, synthesizing and evaluating are part of the critical thinking skills which is less trained in the learning process (Tiruneh et al., 2014). This may occur due to the absence of appropriate pedagogical strategies from educators to develop critical thinking skills. Based on these facts, it is of paramount importance to make changes in the learning process. Therefore, solutions must be offered to overcome these obstacles. The implementation of the Flipped Classroom learning model based on Cultural values is deemed as one of the right solutions.

It has been proven that Flipped Classroom based on Cultural values can improve students' higher order thinking skills (Jamaluddin et al., 2021a). The model can facilitate the development of thinking skills as well the formation of positive character. Another study also confirmed that students who were taught using the Flipped Classroom learning model based on Cultural values were able to achieve better learning outcomes and higher order thinking skills compared to students who were taught using conventional learning models

(Hidayati et al., 2020; Jamaluddin et al., 2021a). However, the relationship between character, resilience, and critical thinking using the Flipped Classroom learning model based on cultural values is not yet known.

Based on the above-mentioned facts, character, resilience and critical thinking need to be addressed through in-depth study, considering that these variables are indispensable for one to face the global competition in the future. In addition, in-depth studies on the relationship between the three variables are still scarce, even after the occurrence of Covid-19 pandemic. Therefore, this study aims to determine the relationship between (a) character and resilience; (b) character and critical thinking; (c) resilience and critical thinking; and (d) character, resilience, and critical thinking of undergraduate biology students after the Covid-19 pandemic.

Method

The research design used in this study is a correlational research design, which aims to determine the extent to which one variable is related to other variables. The research population is all undergraduate Biology and Science Education students at Universitas Negeri Makassar, Universitas Muhammadiyah Makassar, and Universitas Bosowa who are registered in Semester 2 of the 2021-2022 academic year. The research sample consisted of 3 classes with a total of 120 students who were selected using cluster random sampling technique.

The data collection instrument for character and resilience is a questionnaire adapted from Bulach (2002), the Ministry of National Education Nasional ,(2011) and Bachtiar et al. (2018), which assess five components of character, namely religious, honest, discipline, responsible, and hardworking; as well as two components of resilience, namely emotion regulation, impulse control, and optimism. Meanwhile, the instrument for critical thinking skills is an essay test. The indicators for critical thinking are focus, reason, inference, situation, clarity and overview (FRISCO) which have been modified and developed (Zubaidah et al., 2018). All instruments have been previously validated and declared as valid and reliable.

The data collected were quantitative data which will be analyzed statistically through multiple regression analysis to reveal the correlation between students' character, resilience and critical thinking skills. The process of data analysis is assisted by SPSS for windows at a significance level of 5%. The learning model used in the instructional process is the Cultural Values-Based Flipped Classroom Model that has been previously developed (Jamaluddin et al., 2021a). The syntax of the learning model can be seen in Table 1.

Table 1. The Syntax of Cultural Values-Based Flipped Classroom Model

Stage	FC
Before Class	Independent learning by using Video, PPT, module, and article on Edmodo.** Understanding the educational values of Bugis Makassar on the timeline and worksheet at Edmodo to be applied during the learning process in the classroom. */**
During Class	Educators provide stimulus to students about the educational values of Bugis Makassar to be implemented in the learning process. */** Clarification of misconception during online learning. */** Collaborative process of problem solving and development of presentation materials. */** Presentation and Q&A */**
After Class	Reflection and evaluation of concepts understanding. */** Self evaluation through material review. ** Complete the assigned task and upload through Edmodo. ** Write a self-reflection about the cultural values that have been instilled during the learning process and uploaded to Edmodo. **

Information:

* Educators instill the educational values of Makassar Bugis Culture.

** Students implement the educational values of Bugis Makassar culture.

Result and Discussion

Data analysis and discussion are presented sequentially. The correlation analysis between character and resilience is shown in Table 2. As depicted in Table

2, the Pearson correlation value is $p = 0.000$ which indicates the relationship between character and resilience. The correlation between character and resilience was 0.817 (Table 3). Table 4 illustrates the extent to which characters contribute to or affect resilience.

Table 2. The Correlation between Character and Resilience

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	672.163	1	774.173	36.701	0.000
Residual	1539.170	119	18.896		
Total	3113.333	120			

Table 3. Regression Coefficient on the Correlation between Character and Resilience

Model	Non-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	43.457	5.076		8.342	0.000
Character	0.397	0.076	0.817	5.967	0.000

Dependent Variable: Resilience

Table 4. Regression Analysis on the Correlation between Character and Resilience

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.817	0.907	0.310	4.35160

Predictors: (Constant), Character

Multiple regression analysis shows that the regression coefficient (R) is 0.817 and the coefficient of determination is (R²) 0.907. It indicates that the character contributes 90.7% to resilience, while the remaining 9.3% was influenced by other variables. This finding implies that the character can promote resilience as it can shape positive attitudes and self-confidence more optimally. Therefore, character and resilience still have a high correlation, even after the decline of Covid-19 pandemic.

This phenomenon is possible because the positive characters can help the students to control their emotions in a better and more directed way. Several

studies have reported that character cannot be separated from resilience, and vice versa. Thus, these two variables are very important to be addressed (Warnecke & Lewine, 2019). These results are in line with research (Blekic et al., 2020) that students who have high engagement are able to show hard-working and diligent behavior both in class and outside of class. This attitude is indicated by the presence of positive emotions, such as being happy and always feeling curious in the learning process.

The Covid-19 pandemic forces students to develop their character and resilience. Character is the initial capital in determining the quality of students (Counts, 2013), without character, Indonesia will experience a moral crisis in the future which in turn will have a bad impact on Indonesia. Characters are important for teaching and learning at the undergraduate level and also necessary for academic success in secondary schools

(Almerico, 2014). Characters can develop the capacity to investigate assumptions and to understand concepts clearly, hence it can facilitate the development and accommodation of knowledge (Puji et al., 2017).

As shown in Table 5, the value of $p = 0.000$ indicates a correlation between character and critical thinking. The correlation between characters and critical thinking has a regression coefficient of 0.411 (Table 6). Table 7

illustrates the extent to which characters contribute or influence critical thinking.

Table 5. The correlation between character and critical thinking

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2470.923	1	2480.923	121.617	0.000
Residual	1534.115	119	20.317		
Total	4215.038	120			

Table 6. Regression Coefficient on the Correlation between character and critical thinking

Model	Non-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	22.569	5.281		4.282	0.000
Critical thinking	0.757	0.169	0.411	11.228	0.000

Dependent Variable: Critical Thinking

The results of multiple regression analysis shows that the value of the regression coefficient (R) is 0.411 and the coefficient of determination is (R²) 0.401. This means that the character's contribution to critical thinking skills is 40.1%, while the remaining 59.9% is influenced by other variables. The low contribution is caused by the character indirectly being unable to form critical thinking skills in a short time during the learning process, but can still provide changes in behavior that have an impact on thinking skills. Several studies have asserted that there is a relationship between character and critical thinking, in which character can affect student academic success (Fatmawati et al., 2019). According to Jamaluddin et al. (2021b) characters such as discipline and hard work can indirectly form a critical attitude towards a person's higher-order thinking concept.

Table 7. Regression Analysis on the Correlation between character and critical thinking

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.411	0.401	0.613	4.50847

Predictors: (Constant), Character

The contribution of character in the critical thinking process can be the factor causing the change in one's way of thinking. As long as the students' character is positive, then it can give positive effect on the students' thinking process, especially in their critical thinking skills

(Rodríguez et al., 2019). A student can give maximum thought when it is based on an awareness to be a better individual in the future (Akib, 2016).

The development of science in the 21st century has created a sense of urgency in students, especially to acquire the character and critical thinking skills needed in their future career (Kristjánsson, 2020). Critical thinking is an important skills thing to be mastered since it has been included as one of four competencies that is demanded to be mastered, including creative thinking, communication, and collaboration skills. This study asserts that it is crucial to develop positive characters that will promote students' higher order thinking skills, especially their critical thinking skills. In addition to the characters, resilience can also have a fruitful influence on critical thinking.

As shown in Table 8, the value of $p = 0.000$ indicates a relationship between resilience and critical thinking. The correlation coefficient which shows the relationship between resilience and critical thinking is 0.335 (Table 9). Table 10 summarizes the contribution and effect of resilience on critical thinking.

Table 8. The Correlation between Resilience and Critical Thinking

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2143.257	1	2033.257	78.655	0.000
Residual	1981.781	119	25.944		
Total	4115.038	120			

Table 9. Regression Coefficient of the Correlation between Resilience and Critical Thinking

Model	Non-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	8.981	8.082		1.121	0.020
Resilience	0.883	0.121	0.335	8.884	0.000

Dependent Variable: Critical Thinking

Table 10. Regression Analysis on the Correlation between Resilience and Critical Thinking

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.335	0.508	0.503	5.19357

Predictors: (Constant), Resilience

After the Covid-19 pandemic, the results of the analysis shows that resilience has an influence on critical thinking by 50.8%. These results imply that resilience is important to be empowered when it comes to improving critical thinking skills in learning. Resilience is the basis of success in one’s life and it determines the superiority of a nation (Calhoun et al., 2019). Resilience is important because it involves emotional control and a calm attitude of a student (Galizty & Sutarni, 2021). Such attitude is important because it can provide the mood/confidence as well as motivation for students to do various activities. Several studies have found that positive resilience is able to foster the entire student learning process (Galizty & Sutarni, 2021; Sumardani & Matulesy, 2021; Warnecke & Lewine, 2019).

Resilience has a pivotal role in establishing self-quality to be better and better as well as to escape from

the trap of “comfort zone.” It is in line with (Wilson et al., 2019), resilience is a tough attitude to overcome challenges and difficulties, and always work hard to find a solution through a higher-order thinking process. Therefore, strengthened resilience can help students to develop competencies during the learning process (Burton, 2020.).

Data on Table 11 shows that there is a relationship between character, resilience, and critical thinking. The correlation coefficient for character and critical thinking is 0.442, while the correlation coefficient for resilience and critical thinking is 0.315 (Table 12). Table 13 illustrates the extent to which character and resilience contribute to and influence critical thinking skills.

Table 11. The Correlation between Character, Resilience, and Critical Thinking

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2911.660	2	1550.830	97.432	0.000
Residual	1123.379	119	15.845		
Total	4035.038	120			

Table 12. Regression Coefficient of the Correlation between Character, Resilience, and Critical Thinking

Model	Non-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	-0.753	6.436		-0.305	0.017
Critical Thinking	0.551	0.171	0.442	7.704	0.000
Resilience	0.557	0.202	0.315	6.587	0.000

Dependent Variable: Critical Thinking

Table 13. Regression Analysis on the Correlation between Character, Resilience, and Critical Thinking

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.850	0.723	0.715	3.85293

Predictors: (Constant), Character, Resilience

The growth and development of good character will encourage students to grow with the capacity and commitment to always do their best (Nasional, 2011). An individual with good and tough character is someone who tries to do the best for the sake of God, himself, others, the environment, the nation, the country, and the international world (Bulach, 2002). Education is not only about knowledge transfer, but also about the way to develop one’s character to be better, to master thinking skills, and to understand learned concepts (Almerico, 2014).

The resilience of students after the Covid-19 pandemic shows that this variable is important to pay attention to because it has an impact on other skills and knowledge that are useful for improving the quality of human resources. Students who have strong resilience

will succeed in school even during less favorable situations and conditions. The students will try to do their best to carry out their learning in order to improve their higher order thinking skills (Vidergor et al., 2019).

Higher order thinking, such as critical thinking skills, of the students will increase when they are able to think and act differently to utilize imagination, sharpen intuition, arouse curiosity and to solve important problems around them (Rodríguez et al., 2019). Personal quality of students in the future will be at a high level if the current educators are willing to use and apply critical thinking skills in every learning process to produce quality learning outcomes (Husna, 2019).

Character, resilience, and critical thinking skills are essential to be mastered by students. Character and resilience have a correlation that can make a person always behave positively, whilst critical thinking skills can shape students to generate ideas and analyzes from a sharp mind (Suhirman & Yusuf, 2020). These three variables are essential for one to adapt during a pandemic such as Covid-19 and during an era of rapid technological development. One of the efforts in the field of education that can be done to produce quality human

resources both in terms of attitudes, knowledge and skills is by presenting an effective and efficient teaching and learning process.

The syntax of Cultural Values-Based Flipped Classroom Model can successfully provide a correlation between character, resilience, and critical thinking. There are three main stages in the model in shaping the character, resilience, and thinking skills of students during the learning process, namely pre-class, during class, and after class. During the pre-class, educators apply Bugis Makassar educational values on the Edmodo timeline and students' worksheet so that students can read and understand the educational values of Bugis Makassar Culture before entering the class. The process of reading and understanding the educational values can form students' awareness of what attitudes need to be implemented during the learning process. Furthermore, they can also be informed on what materials need to be understood before entering the class (Jamaluddin et al., 2021a).

In the second stage, i.e. during the class activity, the educator emphasizes on providing stimulus and advice in accordance with cultural values to be applied during the learning process. The formation of character and resilience becomes more effective with affectionate verbal delivery to provide comfortable impression for students (Jamaluddin et al., 2022). The learning process of Cultural Values-Based Flipped Classroom Model can enhance students' critical thinking through report writing following an investigation as well as through the discussion process (Figure). The process of investigations and discussions can solve erroneous ideas and misconceptions, thus it helps to develop students' conceptual understanding (Bhakti & Astuti, 2018).



Figure 1. Discussion process

In the third stage, i.e. after class activity, students write self-reflection about the character values that have been implemented during the learning process. Furthermore, they also write learning journals about the learning materials that have been studied. The students will then upload their self-reflection on the Edmodo platform to be reviewed by the educators regarding the

suitability of character and resilience values with the actual students' attitude during the teaching and learning process. Moreover, the educators will also review students' assignments to assess their conceptual understanding regarding the learned concepts.

Appropriate and effective learning activities can empower character, resilience, and critical thinking skills. In addition, several different studies also write that these three variables can be enhanced through a problem-based learning model, because it can create meaningful and effective learning to bring up character values and critical thinking skills (Bahri, 2016; Suhirman & Yusuf, 2019, 2020). Educators can consider problem-based learning strategies as alternative learning, especially for freshman in a university to empower character, resilience, and critical thinking skills that have a major contribution to learning outcomes. In general, when character and resilience are consistently practiced in the learning process, it will have positive influence on critical thinking skills.

Conclusion

There is a correlation between students' character and resilience ($p=0.000$); character and critical thinking ($p=0.000$); resilience and critical thinking ($p=0.000$); character, resilience and critical thinking ($p=0.000$). The occurrence of such correlation is due to the potential of character and resilience to influence, empower, and improve students' critical thinking skills.

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