



# Exploring the Impact of Modernism and Postmodernism Ideologies on Humanities Education: A Case Study of Students Perspectives

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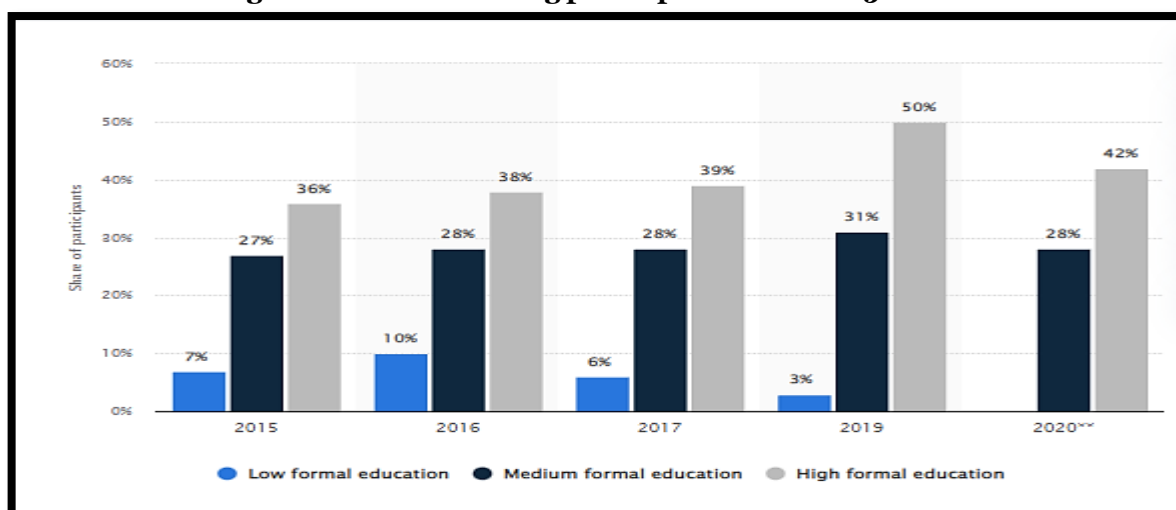
## ARTICLE INFO ABSTRACT

The current study investigates the deeper implications of modern and postmodern educational ideologies on the human experience in the classroom. The research examines beyond formal theoretical structures to investigate how these different concepts affect the lives of students. Modernity's emphasis on reason, logic, and consistent information has certainly provided generations with critical skills and a basis for handling a complex world. However, its inherent stiffness can suppress innovation, eccentricity, and refinement in taking hold of other perspectives. Postmodernism, on the other hand, supports a much more extensive and inclusive approach. It enables students to take part in more critical thinking, understand many perspectives and experiences and gain deeper insights into the value of human experiences. Postmodern classrooms are likely to provide students with the curriculum that reveal the realities of society, where various descriptions exist in opposition to leading power structures. However, the reality generally lies in the middle between these two extremities. The current research also examines by what means these opposing beliefs emerge in real-world classrooms, as well as their effect on student involvement, motivation, and overall well-being.

**Keywords:** Education, modernity, post-modernity, technological implementation, student development.

## INTRODUCTION

Education sectors are developing different types of educational changes in their system to get a more effective impact on the learning processes of the students. Applying different strategies helps the students to get more attraction towards their studies. More growth and personal exploration can be achieved by the students through this process. Among all these modernism and postmodernism are two distinct phases of educational changes taken up by the schools. There are different education systems that brought the modernism system for growing a wider perspective to the students. The educational institutes that are not applying modern technologies to their schools comes under post-modernity. Modernism is all about rapidness, standardization of the different processes for getting most of the advantage through the process, changing the policies, educational system, and syllabus, and constantly improving the student's perspective about a topic is the main structure of modernism. In all the educational sectors which incorporate relativity theory in their educational process, more basic knowledge, and real situation-based knowledge are provided to the students comes under postmodernism system. Both factors can change the educational process effectively. In one process continuous development of the new and innovative process of education is being discovered. On the contrary in the post-modernism system of education the student constructs their individual identities through proper self-evaluation. Both of the factors provide advantages in the educational system and in the student's educational process differently. Postmodernism system enables the students to think critically and test the traditional norms. It inspires the students to develop the ability to construct one's own understanding and to develop independent thought. Postmodernism also provides opportunities for the students to go for interdisciplinary learning by encouraging correlations between different areas of knowledge. In postmodernism, social and emotional learning are important elements in developing empathy, self-awareness, and social responsibility.

**Figure 1. Online learning participants from 2015 to 2020**

(Source: statista.com, 2022)

Both online learning systems and offline learning system is been adopted by schools. Incorporating different technologies in the schools and growing their critical thinking process. Incorporating new and digital technologies in the educational sectors comes with creating modernity in schools. In the year 2019 around 3 % of low formal learning participants. In the year 2020, around 28 % of medium formal participants and 42 % of high formal participants are gaining knowledge through online learning portals. All this digital transformation in the educational sector comes under modernity for the students. Modernity is a section of the progressive education process. Through these different ideas and philosophies can be collected by the students and implemented in the education process. At the time modernity is included in schools then more diverse knowledge can be achieved by the students and through that different cultures and their customers can be understood by the students. At the time when students are moved through the postmodernity experiences, they can seek individuality among other students. Diverse sources of "identity, seeing knowledge, flexible education process are a part of postmodernity. The schools are based on postmodernity values and all the students are allowed to build their own perspectives and own knowledge by judging real situations. The focus on critical thinking and self-reflection is the most effective impacts of postmodernism in the education system. There are both positive and negative impacts present oi the students for both modernity and postmodernity in the education process.

### Literature Review

Through modernization, more educational opportunities can be achieved for students. Social connection depression also can be happened in the process. These two factors of postmodernity and modernity not only have an influence on student's education process but also on the humanities factors also get influenced by this (Rostoka et al., 2022). Managing the approaches of humanities to maintaining behaviours and social processes is very important. Applications of newly developed knowledge in the decision-making process also provide more achievements in human factors. Education is one process that has a direct contribution to modernization. This process is connected with human resources and through that more resource development and education development is being achieved by the personnel. Education has a power through which traditional thinking processes can be changed and converted to new processes. Habits, values, and attitudes of the process can be changed through the educational process (Nugraha & Rafii, 2021). At the time more broad minds are present behind the educational process then students will get more chances to learn new and different things for their educational and personal development. The main focus for doing the research process is to understand the different features between modernity and postmodernity in the educational sectors. These two approaches have diverse influences on the humanities approaches. For getting more advantage in the educational sectors and providing the correct guidance to the student's quality of humanity in the teachers is very important. Providing quality education to the students and preparing them for facing real situations is done by the teachers. Analysis of all these aspects is done through this research work. Modernity and postmodernity are two stages that allow the student to make the educational process easier. In the modernization process of digital implementation in education, the process was present but most of the technology is being used for teaching students in a large group of students. A more group-based learning schedule is present in the process. Proper communication and discussion process is also available in education. In the post modernization process, more individual studies are being forced by the teachers or the educational sectors. Through the utilization of the digital process, one student can take different classes as per their choice (Koschorke, Thomas & Rossman, 2019). There are several cases, in which students can join the classes from

their homes on any type of day. No proper time limit or time frame is present for them. That makes a huge impact on the enrolment factor. Dealing with the outer society and overcoming all the issues that the students will face in the real life can be interpreted by educational studies. In the time of modernization in the schools, only digital implementation is present where it was needed (Tetsova, Dudina & Holovko, 2020). For example, to discuss a topic in a more relevant manner, teachers use video presentations of graphs and charts. All the materials work as additional material for the studies. After that almost all of the education process became digitalized. Students can access the classroom through their laptops from their homes. Basic and advanced level of knowledge is only achieved by the students through the digital process (Davis & Walsh, 2020). Improvement and more strong digital presence in education not only helps the students but also harms the behavioural management of the students. Disciplines cannot be pull off by students in the post-modernization time. The decision-making process has a major impact on the student's life. At the time teaching process have different problems related to real situations then the students get the idea of how to take control of the process. Through understanding, more improved knowledge can be attained by the students. Communication and group-based discussion helps to describe the student's different problems and ways of overcoming them (Chistyakov, 2019). Through that, the application of an educational process or theory can be understood by the students. Along with building educational knowledge creating own personal or humanity approaches is also very important for students. A more unique perspective is developed by the students when they get diverse knowledge from the internet and other sources. The students do not have to pursue the traditional syllabus, different and unique types of tasks and courses can be achieved by the students. For this student gets attracted to the schools which have this type of opportunity (Kestel & Korkmaz, 2019). Through taking the classes more unique human values are being developed in the students. The unique point of view and thinking process can be achieved by the students. Personality of students can be developed through open communication and open discussion session. More group discussion is faced by the students more knowledge gathering can be achieved by them. Every aspect of culture is understood by them and the cultural differences that is present among the students are also analysed by them. This diversification helps the students to develop more approaches to their personalities (Voronkova, Punchenko & Azhazha, 2020). Through strong humanity, the students can get their unique personality that helps them to stand out and make their own statements. Modernism created the way for mass education with its focus on reason, reform, and standardised knowledge. Postmodernism has taken the discipline forward with increased inclusivity, critical sensitivity, and recognition of social construction of knowledge. The interaction between these ideologies keeps going as they continue to redefine the terrain of education by posing challenges to critical thinking and creativity in response to changing demands of learners and society.

### Hypothesis

- H1: Modernity and postmodernity do not have a significant impact on student's enrolment decision
- H2: Modernity and postmodernity do not have a significant impact on educational behaviours of the students
- H3: Modernity and postmodernity do not have a significant impact on application of decisions of students in education sectors
- H4: Modernity and postmodernity do not have a significant impact on creating humanity approaches amount students
- H5: Humanity approaches do not have any significant approaches in personality development among the students.

### METHODOLOGY

The main objective of the paper is to find the difference between modernization and post-modernization in the enhancement of humanity approaches in the educational sectors. With the extensive literature review, several gaps and the impact of modernity and post-modernity are analysed. A theoretical model was constructed for describing the study that is presented in Figure 2. Descriptive and exploratory research is been used in the research. Structural analysis and factor analysis both are also utilised in the methodology. "Structural equation modelling is being used for getting wider facets of the variables. The survey was done among the students for knowing their thoughts about the factors of modernization and post-modernization in the educational sectors. The sample size is 800, the responses are used to collect an effective output. For the current study both descriptive and exploratory research process is been used. Primary and secondary data is been collected from the school-going students. Five points of the Likert scale is used to collect all the responses "agree (1) to strongly disagree (5)". For investigating the collected result "exploratory factor analysis, structural equation modelling analysis and confirmatory analysis" was been done through AMOS.

**Figure 2. Conceptual model****(Source: Authors compilation)**

All the research ethics is being maintained in the research process. Enough time is provided for the respondents for giving their responses. According to their views, the respondents provided their responses, and no manipulation or forceful action is done with them. The main purpose for which the data is been collected is also mentioned to them. All the personal details of the respondents are maintained confidential, proper data privacy is obtained in the process (Navalta, Stone & Lyons, 2019). For using the secondary collected data proper references is been given. Therefore, proper research ethics is supported properly.

**Data analysis**

The “Kaiser-Mayer-Olkin (KMO)” helps to measure the amplexness of testing. this is been used in the research for discussing the relationship that is present between the variables. Along with that, the KMO variables estimation is present between 0 to 1.0. the KMO value must to be greater than 0.5.

**Table 1. KMO Bartlett's Test of Sphericity****KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.513
Bartlett's Test of Sphericity	Approx. Chi-Square	305.228
	df	66
	Sig.	.000

The KMO value of 0.513 indicate only marginal sampling suitability, indicating possible limits, but significant Bartlett's test of Sphericity with a p-value of 0.000 ensures a significant level of correlations among the variables—a requirement for factor analysis.

**Table 2. Factor loading with Component Matrix****Component Matrix<sup>a</sup>**

	Component				
	1	2	3	4	5
modernism_is_better	.819				
Idealism/Postmodernism	.797				
use_of_technology		.696			
confusion_isolation_disillusionment		-.535			
Postmodernism/ modern society		.420			
postmodernism_develops					
rapidness_and_standardization			.668		
how_why_and_when			.601		
age				-.504	.479
Gender				.476	
opportunity_for_pricing				.454	.627
perspective_and_subjective					-.419

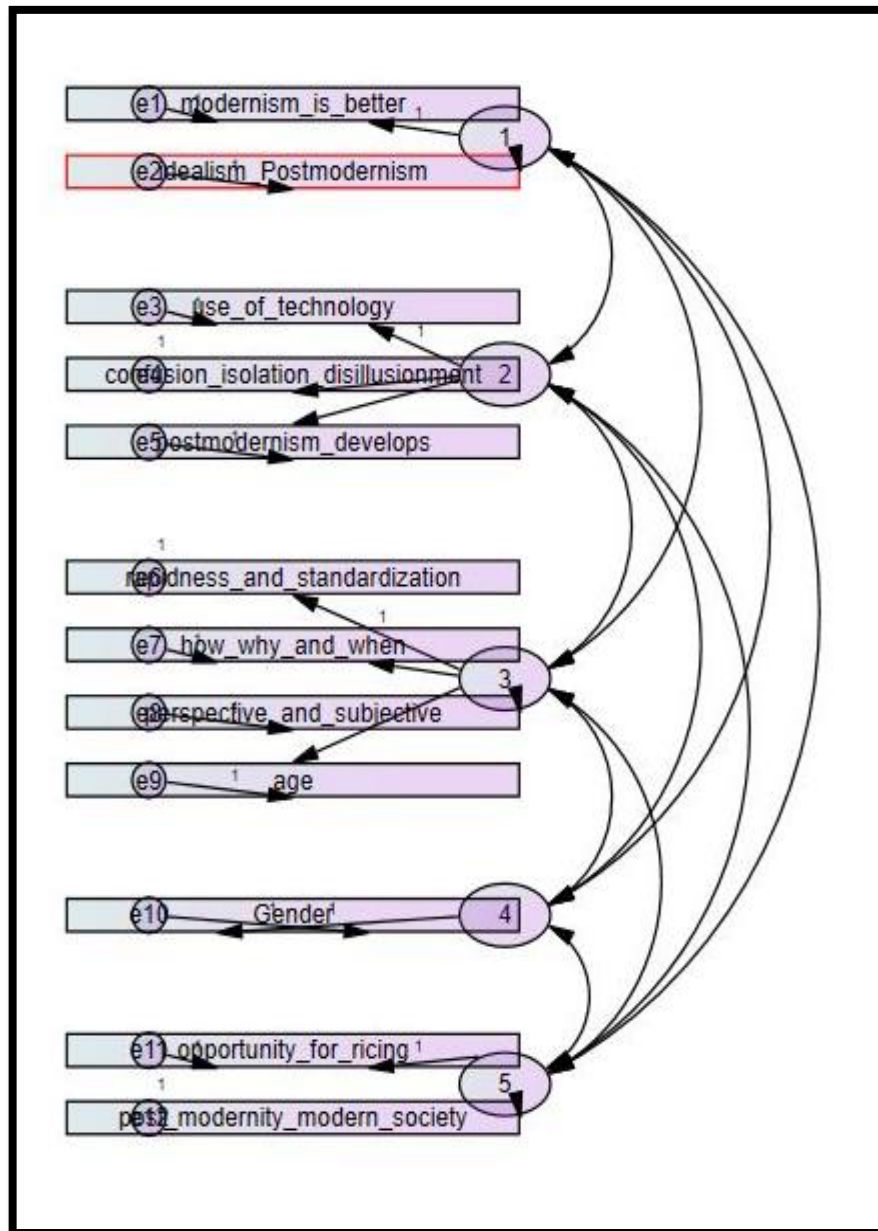
Extraction Method: Principal Component Analysis.

a. 5 components extracted.

Table no 2 indicates that the first component i.e. "Modernism is better" and "Idealism/Postmodernism" loads highly on this component (0.819 and 0.797, respectively) indicates that the variables are clearly covarying and representing a factor connected to a positive perception of modernism and perceived advantages it may involve. The component of the "Use of technology" variable weights strongly on this component (0.696) showing that this variable is strongly connected with factor that is related to the function of technology in education. The component of "Rapidness\_and\_standardization" (0.668) and "How\_why\_and\_when" (0.601) loads vastly on

this component showing a factor relating to efficacy, standardization, and the reasons behind educational practices. The component of "Opportunity\_for\_pricing" (0.627) and "Confusion\_isolation\_disillusionment" (-0.535) load highly onto this component reflecting a factor in connected to weakness of certain educative approaches. Finally, the component "Age" (0.479) and "Gender" (0.476) loads modestly on this component, suggesting that the individual demographic features might affect perceptions and practices of education. The component matrix helps to extract all the components present with the items for getting an authentic result in the research. All the factors present in the research and co-related with each other provide a positive factor.

**Figure 3. Model of relationship between factors model of modernity and post-modernity and humanity approaches in the educational sector**



This structural equation model implies a model whereby a few latent constructs are to be determined by observed variables. Latent Variable 1 seems to be measuring an ideological dimension, perhaps a statement of comparative position or attitude of the relationship between modernism, postmodernism, and perhaps idealism, as suggested by its correlation with "modernism\_is\_better" and "Idealism\_Postmodernism." Latent Variable 2 seems to be measuring the social and psychological consequences of technological progress and postmodernity development, perhaps including perceptions of fragmentation or changed social relations, as suggested by its correlations with "use\_of\_technology," "cohesion\_isolation\_disillusionment," and "postmodernism\_develops." Latent Variable 3 most likely measures fundamental principles of postmodern theory, highlighting subjectivity, contextual knowledge, and experience of speeding-up social change, as it is affected by "rapidity\_and\_standardization," "how\_why\_and\_when," and "perspective\_and\_subjective." Latent Variable 4 obviously measures demographic variables, i.e., "age" and "Gender." Lastly, Latent Variable 5 perhaps reflects the percept of an individual on structures in society and the availability of opportunities in



the midst of modern and postmodern structures of society, as suggested by its correlation with "opportunity\_for\_ricing" and "post\_modernity\_modern\_society." This model enables the exploration of interdependencies among such latent constructs, as indicated by the direction arrows, which symbolize possible causal directions or influences among such complex theoretical factors.

**Table 3. Factor loading with Rotated Component Matrix**

**Rotated Component Matrix<sup>a</sup>**

	Component				
	1	2	3	4	5
modernism_is_better	.816				
idealism /Postmodernism	.810				
use_of_technology		.762			
confusion_isolation_disillusionment		-.680			
postmodernism_develops					
rapidness_and_standardization			.728		
how_why_and_when			.582		
perspective_and_subjective			-.561		
age				-.712	
Gender				.544	
opportunity_for_ricing					.800
postmodernity_modern_society					.602

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Table 3 shows that the component of "Modernism\_is\_better" (0.816) and "Idealism Postmodernism" (0.810) shows the maximum loads on this component concluding that the factor is firmly linked to positive insights of modernism. The component of "Use\_of\_technology" is the highest, with a loading of 0.762, representing a strong connection and the role that technology plays in education. The component of "Rapidness\_and\_standardization" and "How\_why\_and\_when" also load powerfully on this component, with 0.728 and 0.582, respectively. suggesting that the factor relates speed and standardization. The component of "Age" loads -0.712 suggesting that there is some factor related to age in differences in perspective about education. The component of "Opportunity\_for\_pricing" (0.800) and "Postmodernity\_modern\_society" (0.602) reflect a factor pertaining to economic aspects of education and also the link between postmodernism and modernity. This has enhanced the clearness of factor structure for example, "Age" had loadings on Component 4 and Component 5 in the unrotated matrix. However, it loads sharply and clearly on Component 4 in the rotated matrix.

**Table 4. Factor loading with Total Variance**

**Total Variance Explained**

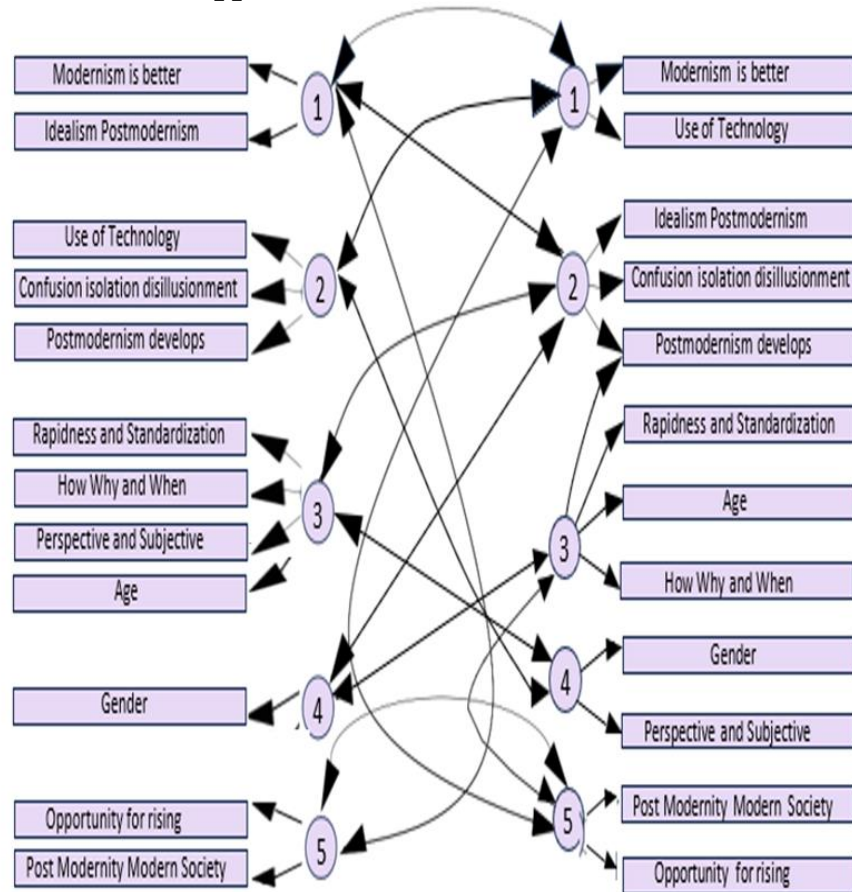
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% Variance	Cumulative %	Total	% Variance	Cumulative %	Total	% Variance	Cumulative %
1	1.472	12.270	12.270	1.472	12.270	12.270	1.466	12.219	12.219
2	1.321	11.011	23.281	1.321	11.011	23.281	1.288	10.732	22.951
3	1.264	10.532	33.813	1.264	10.532	33.813	1.251	10.426	33.377
4	1.106	9.219	43.032	1.106	9.219	43.032	1.109	9.238	42.615
5	1.055	8.794	51.826	1.055	8.794	51.826	1.105	9.211	51.826
6	.996	8.296	60.122						
7	.935	7.788	67.910						
8	.896	7.468	75.378						
9	.859	7.161	82.539						
10	.804	6.697	89.236						
11	.717	5.979	95.215						
12	.574	4.785	100.000						

Extraction Method: Principal Component Analysis.

Table 4 indicates that the first five components, cumulatively explain 51.826% of the total variance in data. These five dimensions depicts a variability witnessed in the dataset. The first five components have the eigen values of more than one. This shows that all the components are worth mentioning and are defining meaningful

patterns within the dataset. The rotation process has somewhat adjusted the variance, clarified by each component. The findings disclose that there is role of student behaviour and development. The extraction of five components advocates that there are rudimentary factors that is driving student behaviour and decision-making regarding the concepts of modernity and postmodernity. The same may include attitudes toward modernism, the place of technology, the centrality of efficiency, the rate of change in society, and personal values and beliefs. The outcomes recommends that the factors that are related to modernity and postmodernism play a significant role in moulding student behaviour and development. Then again, further research is required to fully identify the nature and extent.

**Figure 5. Structural model of factors of modernity and post-modernity to enhance humanity approaches in educational sectors**



**(Source: Authors compilation)**

According to this sample, all the sufficient metrics that describe the appropriate factor are mentioned in this part. Overall variance is analysed for the matrices through the extraction process. The findings indicate that the humanities education has to be reframed within the postmodern context of diversity, critical thinking, and incorporation of technology. Increased focus on a student-centered approach with an emphasis on active learning and real-world applications would help in making the humanities relevant to the students. This study describes the different impacts of modernity and post-modernity on the education system. All the influence that is present in the student's education process is also described through this. All the findings that are present in this paper describe the influences of students' behaviours and humanity changes. The respondents expressed a very wide array of views on Modernity and Postmodernism. Some saw it as an age of progress, reason, and individual freedom; for others, it represented order and structure. Postmodernism was referred to as a time of uncertainty and fragmentation—some described it in terms of celebrating diversity and individualism, while others referred to a kind of loss of meaning and a questioning of established truths. Further few respondents were influenced by both many respondents felt Modernity in shaping their belief in science and progress, and Postmodernism in questioning authority and embracing diverse perspectives. Others believed that postmodernism produced anxiety it permitted them to look at themselves with more emphasis on individual expression. Responses portrayed a rather complex interplay between Modernity and Postmodernism

## CONCLUSION

Finally, it can be summarised that modernity and mainly post-modernity factors are affecting the humanity approaches in the educational sectors. In addition to that, all the features that are present in inducing the students and their learning and understanding process are also mentioned here. The transition from modernity to postmodernity has brought variation in the landscape of humanities education. The effective way for teachers to ensure the significance of the humanities in today's 21st century is by understanding the students' perceptions and reconsidering the pedagogical strategies.

## REFERENCES

1. Chistyakov, D. (2019, July). Media praxis in constructing symbolic space: Intercultural approach. In *4th International Conference on Contemporary Education, Social Sciences and Humanities (ICCESSH 2019)* (pp. 2176-2179). Atlantis Press. Retrieved on October 2022, from: <https://www.atlantispress.com/article/125912225.pdf>
2. Davis, B. P., & Walsh, J. (2020). The politics of positionality: The difference between post-, anti-, and de-colonial methods. *Culture, Theory and Critique*, 61(4), 374-388. Retrieved on October 2022, from: <https://www.academia.edu/download/64290115/The%20politics%20of%20positionality%20--%20Davis%20and%20Walsh.pdf>
3. Xu, C., Wang, C., & Yang, N. (2019, November). Postmodern psychological consultation and therapy in ideological and political education in colleges. In *2nd International Conference on Humanities Education and Social Sciences (ICHESS 2019)* (pp. 117-124). Atlantis Press. Retrieved from: <https://www.atlantispress.com/article/125924205.pdf>
4. Kestel, M., & Korkmaz, İ. (2019). The Impact of Modernism and Postmodernism on Teachers. *Online Submission*, 1(1), 28-33. Retrieved on October 2022, from: <https://files.eric.ed.gov/fulltext/ED59610.pdf>
5. Koschorke, A., Thomas, M., & Rossman, S. (2019). Facts shifting to the left: From postmodernism to the postfactual age. *PMLA*, 134(5), 1150-1156. Retrieved on October 2022, from: [https://repository.up.ac.za/bitstream/handle/2263/76279/Koschorke\\_Facts\\_2019.pdf?sequence=1](https://repository.up.ac.za/bitstream/handle/2263/76279/Koschorke_Facts_2019.pdf?sequence=1)
6. Matviichuk, T., Branitska, T., Solovyov, V., Marchenko, O., Kovalchuk, A., Boreiko, N., & Gerasymova, I. (2022). Developing Pedagogical Mastery in Future Physical Education Teachers in the Context of Postmodern Paradigm of Education. *Revista Romaneasca pentru Educatie Multidimensionala*, 14(2), 50-72. Retrieved on October 2022, from: <https://lumenpublishing.com/journals/index.php/rrem/article/download/4591/3711>
7. Navalta, J. W., Stone, W. J., & Lyons, S. (2019). Ethical issues relating to scientific discovery in exercise science. *International journal of exercise science*, 12(1), 1. Retrieved on October 2022, from: <https://digitalcommons.wku.edu/cgi/viewcontent.cgi?article=2483&context=ijes>
8. Nugraha, M., & Rafii, M. (2021). COMPARISON OF THE PARADIGM INTEGRATION OF SCIENCE AT STATE ISLAMIC UNIVERSITIES. *Journal of Applied Trans integration Paradigm*, 1(1), 69-96. Retrieved on October 2022, from: <http://e-journal.lp2m.uinjambi.ac.id/ojs/index.php/jatp/article/download/1030/529>
9. Rostoka, M., Cherevychnyi, G., Luchaninova, O., & Pyzhyk, A. (2022). Philosophical and Pedagogical Discourse in the Postmodern Educational Space: Peculiarities of Distance Learning. *Postmodern Openings*, 13(4), 244-272. Retrieved on October 2022, from: <https://www.lumenpublishing.com/journals/index.php/po/article/download/5105/4022>
10. Scott, C., & Coetser, Y. (2021). Decolonisation and Rehumanising through Reclaiming the Humanities in ODEL. *African Journal of Inter/Multidisciplinary Studies*, 3(1), 178-196. Retrieved on October 2022, from: <https://journals.co.za/doi/pdf/10.51415/ajims.v3i1.928>
11. Shrestha, N. (2021). Factor analysis as a tool for survey analysis. *American Journal of Applied Mathematics and Statistics*, 9(1), 4-11. Retrieved on October 2022, from: <http://article.sciappliedmathematics.com/pdf/AJAMS-9-1-2.pdf>
12. Tesar, M., Gibbons, A., Arndt, S., & Hood, N. (2021). Postmodernism in education. In *Oxford research encyclopedia of education*. Retrieved on October 2022, from: Postmodernism in Education | Oxford Research Encyclopedia of Education.
13. Tetsova, O., Dudina, O., & Holovko, I. (2022). Master Training of Translation Specialists in the Context of the Postmodern Educational Paradigm. *Postmodern Openings*, 13(1 Sup1), 395-411. Retrieved on October 2022, from: <https://www.lumenpublishing.com/journals/index.php/po/article/download/4762/3631>
14. Thao, N. T. P., Van Tan, N., & Tuyet, M. T. A. (2022). KMO and Bartlett's Test for Components of Workers' Working Motivation and Loyalty at Enterprises in Dong Nai Province of Vietnam. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, 13(10), 1-13. Retrieved on October 2022, from: <https://tuengr.com/V13/13A10MM.pdf>



15. Kharat, A. S. FROM CLASSICISM TO POSTMODERNISM: A BRIEF SURVEY OF LITERARY THEORY AND CRITICISM. [https://researchhub.org.in/research-hub/admin/uploaded Image/ research/ 1730 198 215.pdf](https://researchhub.org.in/research-hub/admin/uploaded%20Image/research/1730198215.pdf).
16. Campbell, M. (2018) Postmodernism and Educational Research. *Open Journal of Social Sciences*, **6**, 67-73. Doi: 10.4236/jss.2018.67006. Retrieved on October 2022, from Postmodernism and Educational Research.
17. Voronkova, V., Punchenko, O., & Azhazha, M. (2020). Globalization and global governance in the fourth industrial revolution (industry 4.0). *Humanities Studies*, (4 (81)), 182-200. Retrieved on October 2022, from: [http://humstudies.com.ua/ article/ download /2094 02/209694](http://humstudies.com.ua/article/download/209402/209694).
18. Kahraman, A. D. (2015). Relationship of modernism, postmodernism and reflections of it on education. *Procedia-Social and Behavioral Sciences*, **174**, 3991-3996. Retrieved on October 2022, [https://www.sciencedirect.com/science/article/pii/S1877042815012057/pdf?md5=62bfd64d31cbc3849 00coe71ad4ce53e&pid=1-s2.0-S1877042815012057-main.pdf](https://www.sciencedirect.com/science/article/pii/S1877042815012057/pdf?md5=62bfd64d31cbc384900coe71ad4ce53e&pid=1-s2.0-S1877042815012057-main.pdf)