"Digitalization and higher education for sustainable development in the context of the Covid-19 pandemic: A content analysis approach"

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DIGITALIZATION AND HIGHER EDUCATION FOR SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF THE COVID-19 PANDEMIC: A CONTENT ANALYSIS APPROACH

Abstract

Higher education for sustainable development (HESD) in the Covid-19 pandemic faces different challenges. Empirically few studies to date have introduced much on the digitalization of higher education for sustainable development. This study aims to explore and explain the digitalization of HESD from different attitudes and to build linkages of the digitalization in HESD. Furthermore, the study makes content analysis where 1,200 tweets on digitalization in higher education for sustainable development are collected from Twitter, and 19 documents have further categorized information data via NVivo. In addition, 22 students and 9 instructors were invited for a semi-structured interview to further supplement this study and confirm its findings. This study finds that attitudes towards digitalization in the study area can be divided into three correlated attitude layers. Teaching attitudes and educational attitudes are the first level, and the second level is the digital platform attitude, technology use attitude, and resource attitude. Furthermore, network attitude, service attitude, and development attitude are the third level. Thus, through the analysis, this study suggests higher education institutions should make improvements in digitalized teaching, education quality via innovation, technological development, resources use, and development via creating a better digital platform or environment is essential for genuinely promoting the HESD.

Keywords	attitude toward digitalization, higher education for sustainable development, Covid-19 pandemic, technologic development
JEL Classification	I21, I22, I23

INTRODUCTION

Higher education for sustainable development (HESD) has been an essential frontline to promote sustainable development since the 21st century (Sonetti et al., 2019). This concept aims to use resources, platforms, and technologies of higher education to solve the problems in sustainable development (Pu & Jiang, 2021). The research on HESD is relatively mature in developed countries; the United States, Britain, Canada, and Australia have contributed more than half of the research (Boström et al., 2018). In recent years, developing societies have also created a lot of valuable research, such as China, Malaysia, South Africa, Brazil, India, and Mexico (Boström et al., 2018). HESD advocates that institutions, teachers, students, and other higher education personnel can integrate the concept of sustainable development into their different positions and play different roles (Shephard, 2015).

Higher education provides a large number of talents for sustainable development. The roles that these talents play in knowledge reserve in sustainable development cannot be underestimated (Liu et al., 2020).

The Covid-19 pandemic has proved the importance of digital equipment as a teaching mode in higher education to deal with particular situations (Petchroj, 2021). Digitalization is a concept that should be extended to all higher education stakeholders (Bozkurt et al., 2020).

The environmental protection and education attitudes of higher education may explain the level of HESD to some extent (Xiao, 2019). The attitude of human resources affects the employees' view of manufacturing digitalization (Koleva, 2019). Enterprise digitalization affects some behavior and attitude of policy executors (Sowmiya & Selvam, 2020). In the context of the Covid-19 pandemic, although academia has personally witnessed the importance of digitalization in higher education, there are few studies on attitudes towards digitalization (ATD). Gradually, there is evidence to illustrate the substantial rise of digitalization in HESD and make significant contributions (Grund & Brock, 2019). Incredibly, attitudes towards digitalization are still a relatively unfamiliar concept. Some enterprises have explained the related concepts (Sowmiya & Selvam, 2020). However, it is not easy to find evidence for this attitude towards digitalization in HESD research. Therefore, higher education during the Covid-19 pandemic is seeking a digital road to serve sustainable development. The study will answer the importance of attitude towards digitalization to HESD and interpret the attitude towards digitalization in this area of higher education during the Covid-19 pandemic.

1. LITERATURE REVIEW

The theory of planned behavior suggests that the attitude produces a behavior before understanding it (Miller, 2017). The prediction of attitude on behavior is an old topic, and the impact of attitude on sustainable practical behavior has been established in many contexts (Tommasetti et al., 2018). In the area of education, the attitude towards digitalization means a thorough understanding of the digitalization of higher education stakeholders, which leads them to use the digital way to promote sustainable development (Abad-Segura et al., 2020). Similarly, attitudes towards digitalization in higher education may have a specific predictive effect on its integration into digitalization (Pumptow & Brahm, 2021).

Supported by the technology acceptance model, the attitude of teachers and students towards the adoption of technology in higher education has had a positive impact on their technology use in work and learning. For example, computer technology can improve the efficiency of teachers' work (Njiku et al., 2019). Teachers' knowledge and attitude through technology will have a more immediate and convenient impact on students (Rohaan et al., 2010). At the same time, students' technology adoption attitude plays an active role in learning cooperation to master more knowledge in the online classroom (Magen-Nagar & Shonfeld, 2018). This attitude helps students in higher education shape global citizenship and promote sustainable development (Lee et al., 2017). Moreover, a technology acceptance attitude can also improve job satisfaction among enterprise employees (Elias et al., 2012).

The attitude towards digitalization in higher education is rarely discussed (Coman et al., 2020). The influence of the current pandemic period makes digitalization develop rapidly in higher education (Kamal, 2020). An increasing number of higher education institutions are seizing the opportunity to introduce digital-related content to build themselves based on transformation (Gamage et al., 2020). Therefore, the technology acceptance attitude is of great benefit to the development of higher education. On the other hand, the area of education that concerns this paper seems to be a mission and a responsibility that higher education should bear no matter what is appropriate. Based on the impact of the current virus-induced crises, higher education has gradually grasped the powerful function of digitalization and refreshed the understanding of HESD (Shareef et al., 2021). However, attitudes towards digitalization are not discussed in HESD technology, which is the problem that the study tries to solve. The solution to this problem will help understand the attitude towards digitalization in higher education. The paper will show the attitude towards digitalization in this area – and how it interprets HESD.

Education for sustainability is the most critical and vital topic in the next few decades (Wamsler, 2020), especially emphasizing the importance of education to environmental protection and poverty reduction on the 2030 agenda, and formulated 17 SDGs to be completed before 2030, which provided some guidance and suggestions for the future development of higher education (Lozano et al., 2017). This paper concerns a worldwide topic; the latter provides clues for the sustainable development of enterprises and tourism (Jetjiroj, 2021). At present, many countries encourage higher education to discuss HESD based on the cause of globalization (Rieckmann, 2018). In particular, developing countries are committed to exploring the mysteries. Table 1 shows key concepts in HESD research in Nigeria, Malaysia, and the United Kingdom. These concepts help realize the importance of institutions and talents in HESD.

Higher education for sustainable development is a new educational concept, which advocates an educational culture that enables individuals to reflect through multiculturalism, globalization, and future-oriented ways, which means that this education will be responsible for the complex impact of decision-making and behavior (Sipos et al., 2008). HESD is not only a "discipline" in the educational curriculum but also a form of "transformative learning" in social change (Sipos et al., 2008).

Table 1. Representative countries and contributions to HESD

Countries	The key to HESD research
Nigeria	Quality assurance management (Ekpiken & Abang, 2015)
	Youth empowerment (Ekpiken & Ukpabio, 2015)
	Quality control measures (Ebuara, 2012)
Malaysia	Institution and partnership (Khelghat-Doost et al., 2011)
The United Kingdom	Quality management system (Khoja, 2016)
	Sustainable Development Performance (Awuzie & Abuzeinab, 2019)

In addition, India (Chhokar, 2010), Egypt (El Bedawy, 2014), and China (Niu et al., 2010) researched this field and made contributions. From the comprehensive research of the latter field, the exploration of developing countries

seems to be more evident after 2015 (Hallinger & Chatpinyakoop, 2019). For higher education, HESD is not only achieved through the efforts of institutions. Teachers' courses, teaching plans, practice arrangements, students' learning contents, methods and ideas, institutional policies, views, and financial support are all the contents that HESD needs to pay attention to, according to Mulà et al. (2017). Therefore, the connotation of HESD is relatively affluent. The latter is defined as the effort of higher education to make contributions by using its talents, resources, platforms, technologies, and other aspects that may serve sustainable development (Stensaker et al., 2019). Sustainable development in higher education is a comprehensive concept, not a single focus on a unit. It emphasizes a cooperative coexistence relationship and distinguishes the competition mechanism. The process and results of HESD have even become an important indicator to measure the development of an institution (Beynaghi et al., 2016).

Before Covid-19, higher education paid attention to talents, policies, and courses for sustainable development. Covid-19 has changed the operation mode of higher education and provided a new choice for HESD (Sá & Serpa, 2020). If the study only pays attention to HESD like the tradition, it is evident that there will be more heart than strength. Higher education should re-examine methods to promote sustainable development in the context of Covid-19 (Sá & Serpa, 2020). Under Covid-19, higher education as a gateway to open social resources is a long-term battle.

Higher education is significant to achieve SDGs. Higher education can enable the next generation of students to master skills to deal with the challenges and opportunities of sustainable development and have a specific knowledge base and understanding ability, as well as promote the research of SDGs. Higher education can use the latest technologies, such as artificial intelligence, to help teachers and students get the best education experience. Therefore, HESD, in the context of Covid-19, pays more attention to digital technology, including the contribution of the network platform, online education, and shared resources to sustainable development. Digitalization has attracted more and more attention in higher education (Brunetti et al., 2020). Covid-19 has not

only brought harm to human health, but higher education has almost reached the freezing point for some time. The digital era has enabled higher education to find a new way out and continue to shoulder the mission of sustainable development.

To sum up, HESD in the Covid-19 pandemic breaks through the traditional concept of sustainable development of curriculum, policy, and cooperative service. This concept emphasizes synergy, that is, the efforts of students, teachers, and institutions, Moreover, digitalization plays an essential role in HESD (Tømte et al., 2019). Through digital products, technologies and methods, HESD will be promoted to a new development stage and background in a remarkable period (Xiao, 2019).

The aim of the study means to use the qualitative research to explore the role of digitalization on HESD, and expounds the impact of different digital attitudes of different groups in HESD.

2. METHODS

Qualitative research is an excellent way to explore new concepts and understand new research directions (Maykut & Morehouse, 2002). The paper adopts a bottom-up qualitative research method. The stakeholders of HESD mainly include school leaders, students, colleges, employees, support institutions, government and non-governmental organizations, alumni associations, and associations (Koester et al., 2006). The bottom-up research objects are students, employees, and institutions (Wang et al., 2020). The study adopts the method of an in-depth interview with students and employees and the method of content analysis with institutions to capture the web page information about HESD digitalization and analyze

the perception and attitude on higher education digitalization.

In the survey of teachers and students, purpose sampling was used to recruit college students from different majors and institutions, 21 students from different majors, institutions, and genders, and 9 teachers in the same situation. The sample includes 16 women (12 students, 4 teachers) and 14 men (9 students, 5 teachers). Five students are from public schools and 16 are from private universities. Six teachers are from private universities and three are from public universities. Their majors are quite diverse, mainly covering language, management, engineering, and education. The interview questionnaire is divided into three parts. The first part is the introduction, and the second part is the perception of higher education digitalization under the background of Covid-19. The third part is their attitudes towards digitalization in the context of Covid-19. The fourth part is their understanding of HESD in the context of Covid-19.

This study uses the method of content analysis to study digital perceptions and attitudes of higher education institutions in HESD. Twitter has gradually become a critical treasure house of education, economy, society, and management research. It studies the use of keyword searches in Twitter to retrieve higher education for sustainable development, digitalization in higher education, digital higher education institutions, and sustainable higher education. It captures data using NVivo's NCAPTURE function, converts the web page into PDF format, and imports it into NVivo12.0. Finally, this study obtained 19 texts with more than 2G memory, and then the subject coding analysis was carried out in the software. The study uses the method of triangular mutual evidence
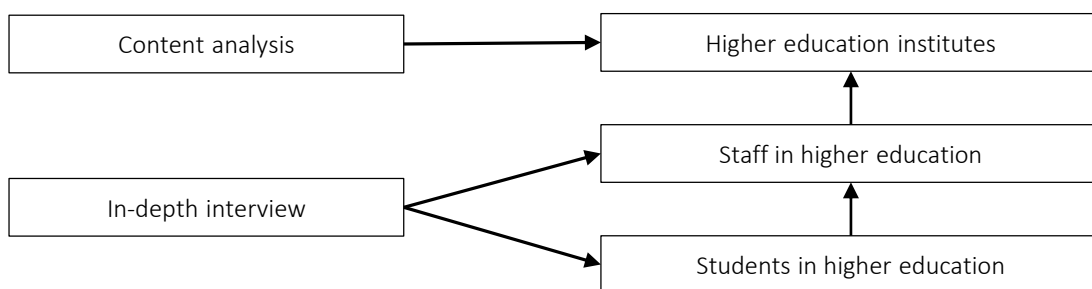
Source: Authors' elaboration.

Figure 1. Bottom-up research samples and methods

Figure 2. Hierarchy of students' attitudes towards digitalization in HESD

to verify the validity of conclusions. The dimensions of the triangle are students, employees, and institutions.

3. RESULTS

To explore students' attitudes towards the research topic, the paper uses the method of emotion coding to divide the interview content into four levels, including very negative, moderately negative, moderately positive, and very positive. Figure 2 fully reflects the different emotional attitudes of different participants towards the same topic. The attitude of college students reflects their growth in a certain field (Songyu, 2021). Based on this conclusion, Figure 2 describes the attitudes of different participants in the form of hierarchical coding.

Although different students have different emotional attitudes, they have neutral and positive attitudes. Of course, the study also observed some confusion in their ATD in HESD. This uneven phenomenon symbolizes the diversity of their attitudes towards digitalization in HESD. The study pays particular attention to this positive attitude. In this regard, the study continues to dig deeply into the attitudes towards different themes. Therefore, this study also uses hierarchical coding to analyze sentimentals revealing the attitudes towards prominent topics. Figure 3 found the most critical attitudes towards digitalization, teaching attitude, and educational attitude. These three categories are mainly neutral and positive.

To sum up, the study found that students' positive attitude towards digitalization is reflected in their recognition of equipment, platforms, and resources and their absolute convenience and achievements against the background of Covid-19. The neutral attitude is manifested in their sense of strangeness and unawareness of this new field.

Figure 3. Coding hierarchy of students' attitudes towards digitalization in HESD

The negative attitude found that digitalization has many shortcomings in higher education related to this field, such as technical shortcomings or different challenges in different stages of educational development. According to such rules, positive, negative, and confusing evidence of all sentimental nodes to prove the students' attitudes towards digitalization in HESD. Moreover, through Figure 3, it is found that students' attitudes include not only digital, teaching and education (Level 1), but also learning, network, development, management (Level 2), platform, school, service (Level 3), information, resources, technology and system (Level 4). Therefore, there are four levels of HESD's attitude towards digitalization, as shown in Figure 3. Moreover, their attitudes and perceptions of digitalization are consistent. Nevertheless, the emphasis is different. Attitudes focus on numbers, teaching, and education. Finally, the study concludes the data of students. In the study of HESD, students will be affected by teachers, tech-nology, teaching, platform, resources, and campus, to scope HESD. However, students' attitudes towards digitalization, teaching, and educational attitudes mainly affect their contribution to HESD. Of course, the second, third and fourth level attitudes also play an essential role in digitalization.

To test teachers' attitudes towards digital HESD, the study was conducted in the way of sentiment. A total of 630 references were obtained. The specific description is shown in Figure 4. It includes four types: very positive, medium positive, very negative, and medium negative. The most concentrated attitude is in the middle, followed by very positive, and then negative. This result shows that teachers' attitudes in HESD may also be uncertain, but there is an upward trend on the whole. On the other hand, a negative attitude will reflect higher education or teachers themselves, showing the diversified attitudes of higher education teachers towards digitalization of HESD.
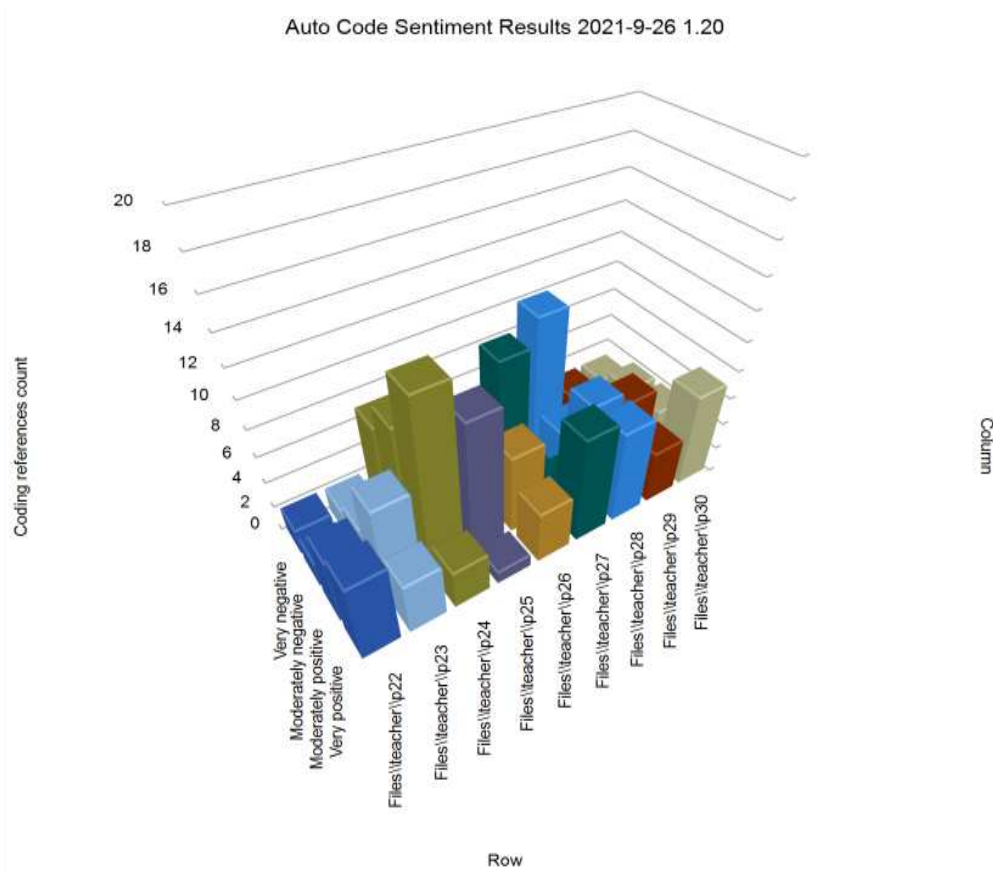
Figure 4. Matrix of teachers' attitudes towards digitalization in HESD

The study uses an analytic hierarchy process to observe further teachers' attitudes towards digitalization for HESD to analyze sentiment coding. Figure 5 finds that teachers have rich views and perspectives in information, school, platform, and teaching. Secondly, learning, development, and technical attitudes explain teachers' understanding of digital HESD. Attitude is reflected in the third level in education, network, and resources. Finally, the philosophy of service, curriculum, management, class, and classroom constructs the fourth level of attitude.

Therefore, the study shows that teachers' attitudes towards digitalization and digital perceptions are consistent. Still, their performance in some aspects is different, such as their perception of technology and attitude towards technology. Although the perception of technology is not much, the attitude towards technology is vibrant.

Through node comparison and analysis of coded data, there are 12 documents related with the digitali-

zation attitude of higher education institutions (HEI) and digitalization for sustainability in HEI. Thus, there is a typical relationship between the digitalization attitude of HEI and sustainable development in the study. It can also be inferred from this that the importance of the attitude towards the digitalization of HEI in sustainable development cannot be underestimated. The attitude towards the digitalization of HEI fully reflects the digital trend and the positive attitude of higher education institutions in dealing with the digital movement. As for digitalization for sustainability in HEI, it is a new topic, which is most closely related to the exploration of this study. About 120 references appear in Twitter data to explain its existence. The ATD of HEI shows a positive phenomenon. Table 2 shows that higher education institutions' attitude towards digitalization faces the *wave, trend, follow,* and *defense.*

The study observed 12 documents in common for digitalization for sustainability in HEI and the ATD of HEI by group analysis. The ATD of higher
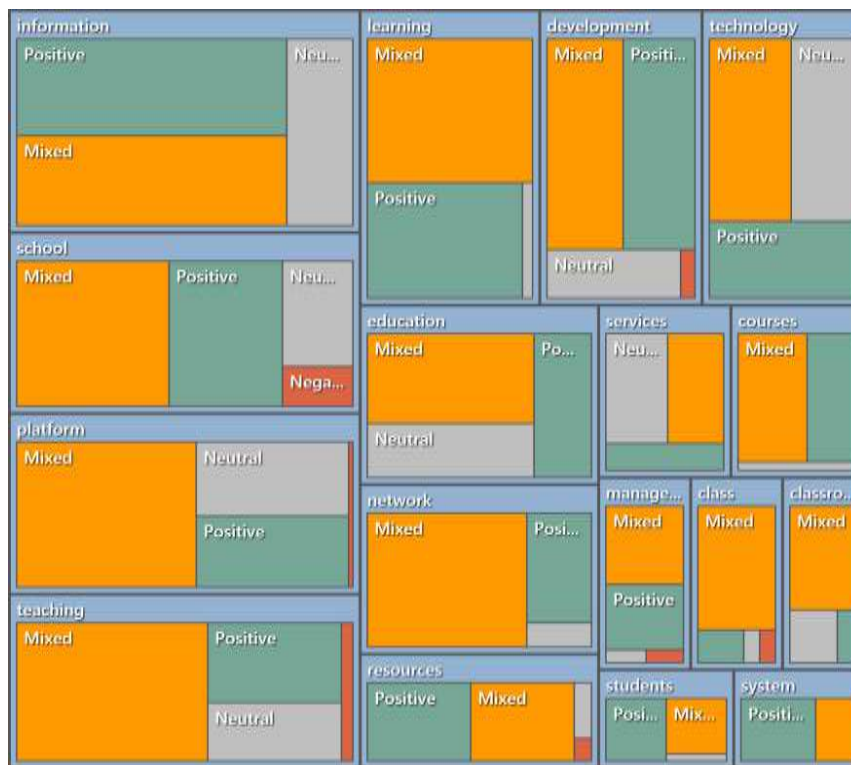
Figure 5. Coding hierarchy of teachers' attitudes towards digitalization in HESD

Table 2. Coding and reference of attitudes towards digitalization of HEI

Theme Code	Document	Reference
ATD of HEI	19	180
Digitalization wave in HEI	19	28
Digitalization trending in HEI	19	29
Digitalization following in HEI	19	35
Announce new defense	19	19

education is also closely related to sustainable development. The code in Table 2 advertises higher education's recognition and pursuit of digitalization with "*wave, following, trending*". In this regard, the study infers a consistency between the positive attitude towards digitalization of higher education institutions and sustainable development, which may be an essential premise to discuss higher education for sustainable development. Higher education's attitude towards digitalization is also to promote sustainable development against the background of Covid-19.

In conclusion, the paper uses the method of text analysis to find many commonalities between the richness and positive attitude of sustainable development in higher education institutions. Digital

teachers, students, products, and media in higher education may be essential tools, and higher education's role in HESD is more concerned. Moreover, the digitalization policy in higher education is also an important way of HESD. Higher education institutions have a positive attitude towards digitalization, actively catering to the advent of digitalization, and have taken some measures to solve their problems. This attitude is that higher education meets HESD, especially against the background of Covid-19, HESD will have new challenges for higher education institutions. It may be an excellent choice to solve relevant problems by digitalization.

The study uses the method of triangulation to explain the conclusion. Figure 7 aims to explore the ATD in HESD. Students have a positive attitude to-
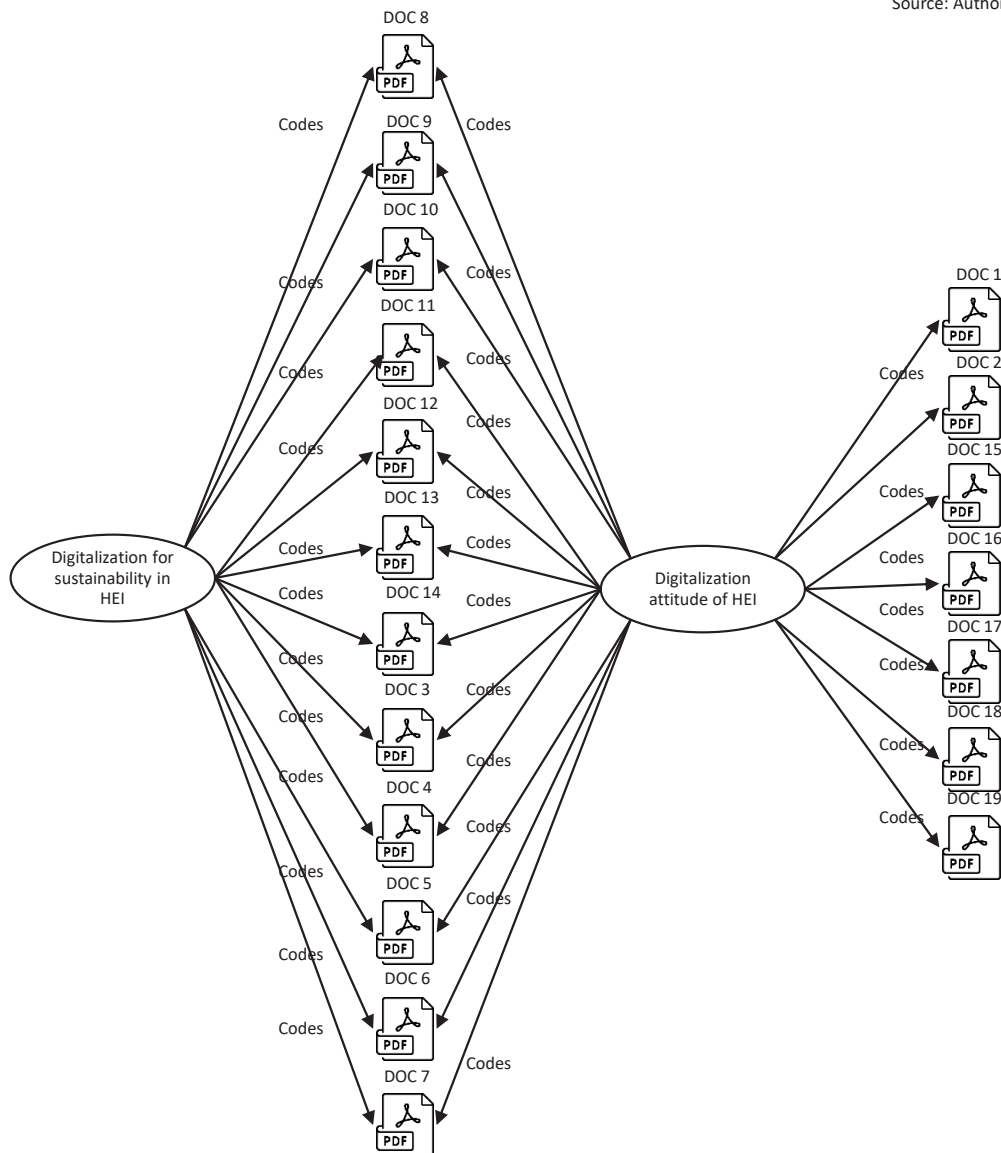
Figure 6. Commonalities between ATD and digitalization for sustainable development

wards HESD, expressed in three fields: digital, teachers, and education. Based on Covid-19, the study found students' trust in equipment, platform, and resources in the digital background. Moreover, the analysis divides students' attitude towards digitalization into four levels: digital, teaching, education (the first level), learning, network, development, management (the second level), platform, school, service (the third level), information, resources, technology, and system (the fourth level). The representatives of these four levels have positive attitudes, but the higher the group, the more concerned they are and the more eager to promote HESD through these fields. In terms of teachers, their attitudes towards digitalization are also multifaceted. The study also divides teachers' at-

titudes towards digitalization in HESD into four levels. Information, school, platform, and teaching are the codes with the most attitude nodes. The second is learning, development, and technology. The third is the embodiment of attitude in education, network, and resources. Finally, service, curriculum, management, class, and classroom construct the fourth level of mentality.

The attitude towards digitalization of higher education institutions in HESD proves a positive attitude through "*wave, following, trending*"; institutions are also aware of the importance of digitalization in HESD. Therefore, although from the perspective of teachers and students, their attitudes at

different levels reflect different understandings of HESD, which means that different identities will affect their attitudes towards the subject of this paper. However, institutional studies demonstrate their enthusiasm for the impact of HESD on students' and teachers' attitudes.

Furthermore, combined with the conclusion of a triangular relationship, it is determined that there are three levels of HESD attitude towards digitalization. The first level is teaching attitude and educational attitude. The second level is platform attitude, technology attitude, and resource attitude, and the third level is network attitude, service attitude, and development attitude. These levels are formed according to the close degree of the triangular relationship. For example, teaching attitude and educational attitude are shared by teachers and students and have many nodes. Secondly, platform attitude, technology attitude, and resource attitude are consistent, although they are different in the feedback of teachers and students.

4. DISCUSSION

HESD is facing many new challenges in the digital age. For higher education, digitalization should indeed become the focus of attention. At present,

the expectations of society for HESD are mainly students, teachers, and institutions. With the surge of the digital age, for example, online education has changed the mode of higher education and provided new opportunities for HESD (Pu & Jiang, 2021). This study shows the importance of teaching, learning, platform, resources, information, network, management, policy, and other factors in promoting digitalization in HESD because these are very important for interpreting the digital perceptions and attitudes in HESD. Against Covid-19, the topic of the study has had a social dimension as well as an impact on the world economy, education and science, and technology for a long time. Higher education plays an essential role in finding a new way for sustainable development (Jiang & Pu, 2021). In the digital age, technology, resources, and platforms have provided opportunities for sharing. Even sharing has become a new model of sustainable development (Pu & Pathranarakul, 2019). Stakeholders in higher education have gradually recognized this reality and made continuous efforts for it. Although this study allows recognizing the importance of digitalization to HESD in the face of Covid-19, cultivating digital perception and establishing a positive ATD has made an outstanding contribution to HESD. However, the study does have some limitations.
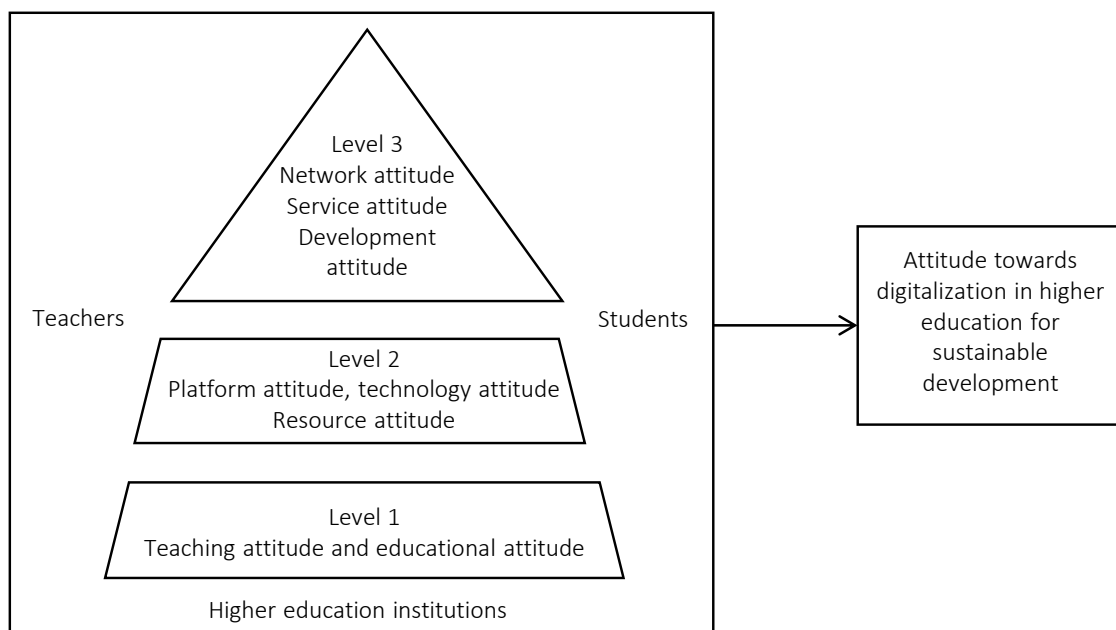
Source: Authors' elaboration.

Figure 7. Conceptual framework of perceptions and attitudes towards digitalization in higher education for sustainable development

The study uses the method of triangular mutual evidence to summarize and support the conclusions of qualitative data. This complementary method establishes the validity of the study. From the perspective of the Covid-19 digitalization, the study provides some stakeholders with the ATD of education for sustainable development in HESD. However, stakeholders in higher education are institutions, students, and teachers, and some other studies have not been discussed. Secondly, the paper explores the perception of institutions, students, and teachers on digitalization in HESD. It can only determine the different perceptions and attitudes, while other ethnological factors are not discussed. This aspect needs further quantitative statistics, which will also be the work of future research. Education for sustainability is not only the responsibility of higher education. More and more education departments know what to start with, which should allow them to address their particular concerns, and find appropriate solutions for them. Indeed, research in colleges and universities may not be different from education for sustainable development at other levels, such as primary education, secondary education for sustainable development, or online education. There are still many interesting areas worth exploring in the future.

CONCLUSION

This study aims to explain the digitalization of HESD from the perspective of attitudes and explain the connotation of digital attitude to determine and construct the connotation and relationship between digitization and the area of study. The paper clarifies the attitudes towards digitalization to three layers in HESD and shows there indeed existed teaching attitude, education attitude, technology attitude, resource attitude, platform attitude, network attitude, service attitude, and development attitude in HESD. Thus, this paper has made a theoretical breakthrough for the attitudes towards digitalization in HESD under the shadow of Covid-19. Moreover, this paper provides suggestions for HESD. Different stakeholders pay extra attention to the digital content. Although teachers and students converge, higher education institutions under the digital background shoulder a more realistic mission, and their attitude towards the platform and its development is more explicit.

Secondly, the study shows that attitudes towards digitalization are diverse. Higher education institutions' overall enthusiasm shows that higher education has a positive psychological foundation as a promotion and research platform for sustainable development. Leaders should use relevant resources to promote the construction of a digital campus and form the concept of sustainable development and should not despise the power of teachers and students. Therefore, the study believes that higher education should actively seize the opportunity of digital transformation: start with teaching, education, technology, resources, and platform, create a positive digital campus space construction, implement the concept of sustainable development, and truly achieve the goal of HESD.

AUTHOR CONTRIBUTIONS

Conceptualization: Ruihui Pu.
Data curation: Ruihui Pu, Danai Tanamee.
Formal analysis: Ruihui Pu, Danai Tanamee, Songyu Jiang.
Investigation: Danai Tanamee, Songyu Jiang.
Methodology: Ruihui Pu, Danai Tanamee, Songyu Jiang.
Project administration: Ruihui Pu, Danai Tanamee.
Supervision: Ruihui Pu, Danai Tanamee.
Validation: Ruihui Pu, Danai Tanamee, Songyu Jiang.
Visualization: Danai Tanamee, Songyu Jiang.
Writing – original draft: Ruihui Pu.
Writing – review & editing: Ruihui Pu, Danai Tanamee, Songyu Jiang.

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