ICCCM-JOURNAL OF SOCIAL SCIENCES AND HUMANITIES
2022; 1(2): 39-51
Published online 04 28 2022 (https://icccmjssh.com/)
doi: 10.53797/icccmjssh.v1i2.5.2022
e-ISSN 2811-4469

Application of Fuzzy Delphi Method (FDM) in Development of the Heutagogical and Technological Practices in Next Generation Learning Spaces (NGLS) Framework

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To Cite This Article:
Jaya, S., Zaharudin, R. ., Yaakob, M. N. ., & Ithnin, M. A. . (2021). Application of Fuzzy Delphi Method (FDM) in Development of the Heutagogical and Technological Practices in Next Generation Learning Spaces (NGLS) Framework. *ICCCM Journal of Social Sciences and Humanities*, *1*(2), 39–51. https://doi.org/10.53797/icccmjssh.v1i2.5.202

Abstract: The usability of suitable pedagogical strategies and activities in the classroom is a vital key in Malaysian education. Teachers need the transition from the conventional pedagogical approaches to digitalization approaches with student-centred. The teacher should move faster from the pedagogy, andragogy to the heutagogy approach, focusing on technology integration in teaching and learning. The Fuzzy Delphi Method is used in this article to develop heutagogical and technological practises in Next Generation Learning Spaces (FDM). Thirteen experts in curriculum, pedagogical and technology are involved in this research. The threshold value for the accepted elements for pedagogy strategies is 0.133, and the value (d) construct is 0.153 for teaching and learning activities. Hence the value (d) construct for the online tutorial is 0.050 and for online learning, the value (d) construct is 0.177. Therefore, the threshold value described the (d) value is lower than 0.2 ($d \leq 0.2$), which shows the acceptable elements indicator in FDM. The overall findings demonstrated the experts' consensus range between 75% to 100%. The α-cut value for acceptable elements also shows ≥ 0.5, a range value between 0.792 and 0.967. The defuzzification process will shift the ranking of the elements in developing the NGLS framework in teachers' pedagogy and technological practices. This research definitely creates a new transition in heutagogical and technological practices for Next Generation Learning Spaces to enhance education in the digital age.

Keywords: Next generation learning spaces, technology tools, Fuzzy Delphi Method, heutagogy

1. Introduction

The rapid development of technology demands that teachers and learners move fast in adopting technology in education. Teachers today are tasked with developing lifelong next-generation learners who can survive in global technology knowledge. Technologies play an essential part in the transition from traditional teachers-centred to student-centred approaches (Imms & Mahat, 2021; Qismullah Yusuf & Yunisrina Qismullah Yusuf, 2018; Ramlan Mustapha et al., 2021). MYDIGITAL has introduced the "My Digital Teacher" initiative by the Ministry of Education (MOE), which aims to stimulate and upskill teachers' knowledge to include digitalization in teaching and learning (Economic Planning Unit, 2021). The initiative is a plan to ensure teachers' agile and competent digital talent as needed in the 2030 Agenda for Sustainable Development plan for the next generations of learners (UNESCO, 2016, 2020). Pedagogical, even andragogical, are no longer sufficient to

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prepare the next generation of learners (Blaschake, 2021; Blaschke, 2012; Dewantara & Dibia, 2021). Teachers have to transform and disseminate skills, knowledge and value in future education embedded with suitable technology tools. In addressing the challenges, teachers need to prepare and bear in mind that technology never pauses and needs to be embedded in their pedagogies with digital culture in formal and informal learning (Ishak & Jamil, 2020; Nurul Natrah & Ahmad Shidki, 2020). To enhance the heutagogical practices in teaching and learning, the Ministry of Education has launched a new learning platform, Digital Educational Learning Initiative Malaysia (DELIMA), with collaboration from Google, Microsoft, and Apple, to encourage the digitalization among teachers in Malaysia (Microsoft, 2020). According to the Smart School Qualification Standard (SSQS) report 2020 by MOE, only 41% to 60% of teachers use virtual learning environments in their teaching and learning. The indicator illustrates the weakness value of 0.76 from the five indicator scales for using digital technology tools for teaching and learning. There is evidence that teachers face tough challenges because of a lack of technological knowledge, limited accessibility, and effective training to integrate digital technology in teaching and learning (Cheok & Wong, 2014; Ghavifekr et al., 2016; Muhamad Khairul et al., 2019). Although, most teachers find understanding the technology and online teaching and learning useful (Azlan et al., 2020; Hashim, 2014). Despite that, the incompetent and failing teachers' transition to the digitalization approach will impact the MOE aims. These can result in the lagging of the transition to ensure teachers fully embrace digital technology in pedagogies (Mohamed Nazrul Ismail, 2020). Hence, the researcher needs to develop the heutagogical and technological framework to integrate the appropriate practice, strategies and digital technology tools in next-generation learning spaces. The framework as a criterion model for heutagogical practices for applying to emerging technologies in NGLS.

1.1 Teaching with Digital Technology Approach in Next Generation Learning Spaces (NGLS)

Next-generation learning spaces (NGLS) will differ from last-generation learning spaces. NGLS provide a new learning interaction with the integration concept of pedagogy, space and technology. The ideas are basically from the Pedagogy-Space-Technology (PST) Framework (Radcliffe et al., 2008). The PST framework is a question-driven inquiry process to empower a diverse range of pedagogy and technology. Emerging technologies foster the interaction between pedagogy and learning spaces to enhance future learners. The future generation teachers' interaction is not only mediated by technology but with the skills, attitudes, and knowledge to optimize future generations' engagement (Keppell, 2014).NGLS demands a space that enables exploration by both teacher and student. NGLS should be allowed for multiple modes of instruction and learning, flexible space, and attention to teachers' personalized pedagogical and technology tools. Thus, personal learning environments as a potentially promising pedagogical approach to integrating formal and informal learning (Dabbagh & Kitsantas, 2012). Personalized learning supports students' self-regulated with the use of technology tools.

The personalized learning pedagogy is multidimensional and can be supported by Web 2.0 tools and social media. Examples of MOOCs and learning theories that exemplify these features are discussed (McLoughlin, 2013). Teenagers spend on average two hours daily using technology for leisure, especially browsing the Internet for fun and participating in social networks. There is, however, no easy transition in technology used in teachers' pedagogy between the everyday uses of technology and those commonly proposed in formal schooling (Hedberg & Ho, 2012; Paniagua & Istance, 2018). Technology may even be detrimental to learning if it is not appropriately integrated into the education setting. Through technology, the teachers and students should share equal and democratic access to the room amenity access to global resources and information. Table 1, explains the relationship between next-generation learning Space student-centred and the next generation classroom student-centred to support the NGLS framework.

Table 1. Next Generation Learning Space Student-centred and Next Generation Classroom Student-centred.

Next Generation Learning Space Student-centred	Next Generation Classroom Student-centred
All walls are active and shared between teachers and students	There is no "front" of the room
Students work in a group, including discussing, creating, problem-solving, producing, brainstorming, hypothesizing, etc.	Students face each other in collaborative settings
Students access Internet-enabled resources during class.	Multiple digital screens are present, usually one per group setting
Teachers and students share the technology.	Teachers and students can equitably access technology resources
Students use their mobile devices to take digital notes, share notes and access resources via the Internet.	Technology needs to be seamless and integrated
Student learning happens in real-time in the classroom, working collaboratively on open-ended problems or scenarios.	Furniture is mobile, and the room can be reconfigured to suit each learning encounter
Students ask questions and explore possible solutions.	The environment needs acoustic treatment to account for additional noise levels of students
Assessment occurs through a combination of individual and group problem-based learning assignments.	Students can present to each other and assess each other
Students are engaged	The space is humming with activity

Sources: *Adapted from (Fraser, 2014)*

Table 1 shows that there will be more demand for an interactive and collaborative classroom. Teachers can access online teaching and learning and create informal learning among students. Through the mobility of teachers' and students' devices, pedagogy and learning activities can occur anywhere, not just in the classroom or infra-structured is located.

1.2 Heutagogy in Next Generation Learning Spaces (NGLS)

Fostering digitalization in the digital age requires knowledge, critical thinking, creativity and skills in handling the application technology tools (Siemens, 2005). Heutagogy is the new concept of teaching and learning. Heutagogy is a progression approach from pedagogy to andragogy and heutagogy (Canning, 2010). The technological development in online learning and online tutorial offers unique opportunities for using heutagogy as a pedagogical framework (Analisa Hamdan et al., 2021; Narayan & Herrington, 2014). According to Hase and Kenyon (2007), heutagogy refers to self-determined learning and applies a holistic approach to enhance and develop the next generation learners' abilities and capabilities (Blaschake, 2021; Porman Lumban Gaol, 2020; Qismullah Yusuf & Yunisrina Qismullah Yusuf, 2018). This holistic approach is preparing the next generation for transition into the workforce.

The heutagogical approach recognizes teachers and students the need to be more flexible in teaching and learning (Hase & Kenyon, 2007; Kenyon & Hase, 2001). Teachers also can instruct students to learn online through YouTube, Telegram, WhatApps and all the resources created by thousands of internet providers. It is an active student-centred on active online learning (Azlina Musa et al., 2021; Kadek et al., 2021; Ramlan Mustapha et al., 2021; Syed Lamsah Syed Chear & Muhamad Yusoff Mohd Nor, 2020). Teachers may find it exciting to move forward using digital technology and technology tools such as smartphones, interactive audiovisual, tablets, laptops, notebooks and PCs to achieve the goal with the students (Nurbanati et al., 2021; Sage et al., 2020; Sundar, 2020. Effective use of technology tools improves the teachers and has given ways to various learning

strategies and approaches. Meanwhile, active learning, student-centred, personalized learning, blended learning, and project-based learning combine the conventional education system with all digital systems as heutagogy approaches. Heutagogy offers active collaboration between students and teachers; students become active learning agents while teachers are a facilitator in guiding the learning. Self-reflection from the students is the most important in heutagogy. The teachers must reflect on whether the teaching material and technology tools used in teaching and learning are appropriate or need to be redesigned and called a doubleloop in heutagogy (Blaschke, 2012; Dewantara & Dibia, 2021; Narayan & Herrington, 2014).

The emerging technology tools in learning spaces forced the teachers and learners to move into the internet spaces and introduce students to new material, interactive audio-video conferencing and rapid homework exchange over the network (Galway et al., 2020; Nambiar et al., 2018; Sage et al., 2020). Video conference classrooms on Google Meet, Zoom, YouTube, telegram have become new elements of technology tools in the learning space (Ahmad Alif Kamal et al., 2020; Hidayat & Shafie, 2020; Kadek et al., 2021; Khaydarova & Uz, 2020; Muhamad Khairul et al., 2019). The heutagogy approach with the technologies' ubiquitous spaces attempts to provide flexibility to teachers and learners in the online learning and tutorial. Teaching and learning connect virtually and physically; the ability to interact with different contexts in a wider range of spaces. (Edwards et al.,2021; Johnson, L., Adams Becker, S., Cummins, M., 2014; Siemens, 2005).

In conclusion, the future education will be much faster than expected and the heutagogical and technological approaches can play as the transition approach in teaching and learning. Heutagogical and technological practices capture the attention and discussion in promoting stakeholder engagements, especially for relevant contributions in terms of teachers' training, policies, and teachers skills to ensure the realization of new NGLS in both physical and virtual space (Dewantara & Dibia, 2021; Kenyon & Hase, 2001). In the development of the collaboration networks among teachers and students, critical issues raised include connectivity, teachers' roles in learning spaces finding the ways to solve the conflicts in applying the technology in the heutagogy approach (Analisa Hamdan et al., 2021; Edwards et al., 2021; Langdon Warren, 2021)..

2. Research Method

The design and development research (DDR) approach type 2 is used in developing the heutagogical and technological framework in Next Generation Learning Spaces (NGLS) (Richey & Klein, 2007). The researcher used the Fuzzy Delphi Method (FDM) in phase 2 (DDR) to obtain the experts' consensus to validate and identify the selection of the constructs and elements in the framework. The Fuzzy Delphi has been improved by Kaufman and Gupta (1988) since it is introduced by Murray, Pipino and Gigch (1985) (Mohd Ridhuan Mohd Jamil & Nurul Rabihah Mat Noh, 2020; Saedah Siraj et al., 2021). Other researchers have used the improved technique of FDM to meet their scope of the study, time-saving by reducing the number of rounds for experts' assessments, cost-saving and influencing the experts to express their professional views individually (Fadzilah Bee Abdul Rahman et al., 2021; Kamarudin Ismail et al., 2021; Sanura Jaya et al., 2022; Yaakob et al., 2020).

The researcher focuses on pedagogical and technological practices in developing the next generation learning spaces (NGLS) framework. The elements in the framework are obtained from the threshold (d) value, percentage of expert agreement, and the value of Fuzzy score (A) in the defuzzification process using the FDM's three requirements. The elements of the pedagogical and technological practices as shown in Table 2.

Table 2. The elements of the pedagogical and technological practices in the NGLS framework

No of elements	The elements of the pedagogical and technological practices
	Teachers' pedagogy strategies
E1	Teacher-centred
E2	Student-centred
E3	Blended learning
E4	Personalized learning
E5	Project-based learning
E6	Active learning
	Teachers' pedagogy activities
E1	Homework
E2	Test and Quizzes
E3	Coding and Programming
E4	Online Tutorial
E5	Online Learning
	Technology application tools for online learning
E1	YouTube
E2	GCSE POD
E3	Telegram
E4	WeChat
E5	WhatsApp
	Technology application tools for online tutorial
E1	Zoom
E2	Screen Casting
E3	Loom
E4	Google Meet
	Technology application tools for Coding and Programming
E1	Hour of Code
E2	Scratch
E3	MIT App Inventor
E4	Arduino
E5	Magnet code

The researcher uses purposive sampling, the most suitable and appropriate sampling, to get a consensus view in the FDM (Mohd Ridhuan Mohd Jamil & Nurul Rabihah Mat Noh, 2020; Saedah Siraj et al., 2021). The selection of the experts is based on expertise in their respective fields, knowledge, skills and years of experience. The numbers of experts are 10 to 15 as suggested by Adler & Ziglo (1996), and 1 to 50 experts, as explained by Jones & Twiss (1978). The heterogeneous experts are involved, and the researcher used 13 experts in this study. However, the number of 13 experts is sufficient to obtain information and experts' agreement due to the difficulty of getting a response from an expert and the lack of time limiting obtaining the data. Table 3 shows the number of selected experts according to their field of expertise.

Table 3. Number of selected experts

Field of expertise	Number of experts
Curriculum expert	4
Lecturer in Teachers' Training College	3
Technology expert	3
Learning space expert	3
Total number of experts	13

The expertise criteria are based on:
1. Professor or senior lecturer in technology and ICT
2. Professor or senior lecturer in curriculum and instructional design.
3. Professor or senior lecturer in the field of Professional Studies
4. Professor or senior lecturer in learning spaces, buildings and environment.
5. Have a Doctor of Philosophy Degree in the related field.
6. IPG lecturers who have served ten years and above in education.

To identify the suitable constructs and elements, the 7 point Likert scale is used to develop the heutagogical and technological used in the NGLS framework. The analytical results are more accurate on 7 points Likert scale, and the value of ambiguity is lower than on 5 points Likert scale (Kamarudin Ismail et al., 2021; Mohd Ridhuan Mohd Jamil & Nurul Rabihah Mat Noh, 2020; Saedah Siraj et al., 2021). The differences between 7 Likert scales and 5 Likert scales as shown in Table 4.

Table 4. Comparison between the 7 points Likert scale and 5 points Likert scale

Likert Scale	Language Variable	Fuzzy Scoring	Average %	Likert Scale	Language Variable	Fuzzy Scoring	Average %
1	Strongly disagree	(0.0,0.0,0.1)	3.3	1	Strongly disagree	(0.0.0.0,0.2)	6.7
2	Moderately disagree	(0.0,0.1,0.3)	13.3	2	Moderately disagree	(0.0,0.2,0.4)	20.0
3	Slightly disagree	(0.1,0.3,0.5)	30.0	3	Neutral	(0.2,0.4,0.6)	40.0
4	Neutral	(0.3,0.5,0.7)	50.0	4	Moderately agree	(0.4,0.6,0.8)	60.0
5	Slightly agree	(0.5,0.7,0.9)	70.0	5	Strongly agree	(0.6,0.8,1.0)	80.0
6	Moderately agree	(0.7,0.9,1.0)	86.7				
7	Strongly agree	(0.9,1.0,1.0)	96.7				

Source : Saedah Siraj et al.,2021

Table 4 compares the 7 Likert scales and 5 points Likert scale. The 7 Likert scales show the values m_1 (0.9 implies the assumption of 90% agreed), m_2 (1.0 implies the 100% agreed) and m_3 (1.0 also implies the 100% agreed). The comparison indicates the highest Fuzzy scale selected will show the accuracy of the experts' agreement (Kamarudin Ismail et al., 2021; Muhammad Nidzam Yaakob, 2016; Nurul Rabihah Mat Noh et al., 2019; Sukor Beram et al., 2021).

The researcher must determine which linguistic variables were employed in this study and convert them to Fuzzy triangular numbers. As shown in Figure 1, the Fuzzy triangular number, which represents the minimum, reasonable, and maximum values indicated by three values: (m1, m2, m3),

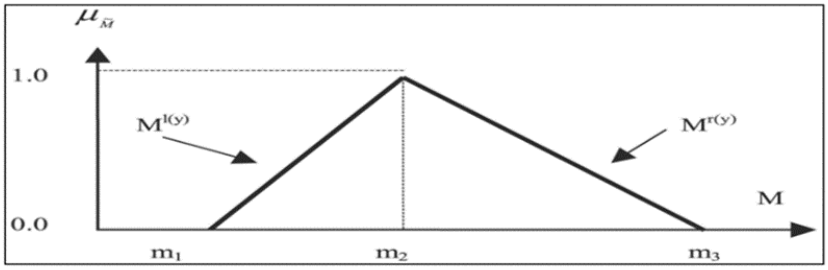

Figure 1. The Triangular Fuzzy Number

Refer to Figure 1, the calculation of the threshold value, *d* is using the following formula:

$$d\left(\tilde{m},\tilde{n}\right)=\sqrt{\frac{1}{3}\left[(m_1-n_1)^2+(m_2-n_2)^2+(m_3-n_3)^2\right]}.$$

The FDM's first requirement is to identify the threshold (d) value. The (d) value has to be equal to or less than 0.2 ($d \leq 0.2$) will be accepted. The acceptance requirement also needs an experts consensus of more than 75 % (Chen ,2000; Cheng & Lin, 2002; Chu & Hwang, 2008; Murray & Hammons, 1995). Therefore, the last requirement is the process of defuzzification. To define the ranking and acceptable elements, the average of the Fuzzy number should have the Fuzzy (A) ≥ value α cut = 0.5 (Tang & Wu, 2010; Bodjanova, 2006). The calculation of the defuzzification refers to the Amax value as the formula shows:

$$Amax = 1/4\ (M1+M2+M3)$$

3. Results and Discussion

A total of 21 items were accepted from the 25 items in pedagogical and technological constructs. Table 5 summarises the Fuzzy Delphi method analysis for the pedagogical and technological practices in the NGLS framework.

Table 5. The elements of the pedagogical and technological practices in the NGLS framework

Number of elements	Construct and elements	Threshold (d) value	% Expert Consensus	Amax Score	Ranking	Outcome
	Teachers' pedagogy strategies					
E1	Teacher-centred	0.555	0%	0.538		Rejected
E2	Student-centred	0.040	100%	0.951	3	Accepted
E3	Blended learning	0.054	100%	0.944	4	Accepted
E4	Personalised learning	0.148	85%	0.895	5	Accepted
E5	Project-based learning	0.000	100%	0.967	1	Accepted
E6	Active learning	0.000	100%	0.967	1	Accepted
	Value (d) Construct	***0.133***				

Number of elements	Construct and elements	Threshold (d) value	% Expert Consensus	Amax Score	Ranking	Outcome
	Teachers' pedagogy activities					
E1	Homework	0.310	31%	0.718		Rejected
E2	Test and Quizzes	0.215	85%	0.859		Rejected
E3	Coding and Programming	0.111	85%	0.918	3	Accepted
E4	Online Tutorial	0.108	92%	0.923	2	Accepted
E5	Online Learning	0.022	100%	0.959	1	Accepted
	Value (d) Construct	***0.153***				
	Technology application tools for online learning					
E1	YouTube	0.182	85%	0.887	3	Accepted
E2	GCSE POD	0.072	100%	0.928	1	Accepted
E3	Telegram	0.183	85%	0.879	4	Accepted
E4	WeChat	0.293	46%	0.792		Rejected
E5	WhatsApp	0.157	92%	0.892	2	Accepted
	Value (d) Construct	***0.177***				
	Technology application tools for online tutorial					
E1	Zoom	0.000	100%	0.967	1	Accepted
E2	Screen Casting	0.082	92%	0.931	3	Accepted
E3	Loom	0.116	85%	0.910	4	Accepted
E4	Google Meet	0.000	100%	0.967	1	Accepted
	Value (d) Construct	***0.050***				
	Technology application tools for coding and programming					
E1	Hour of Code	0.054	100%	0.944	3	Accepted
E2	Scratch	0.054	100%	0.944	3	Accepted
E3	MIT App Inventor	0.040	100%	0.951	2	Accepted
E4	Arduino	0.022	100%	0.959	1	Accepted
E5	Magnet code	0.082	92%	0.931	5	Accepted
	Value (d) Construct	***0.050***				

According to the FDM accepted elements, the value has to meet the threshold value ($d \leq 0.2$), the expert percentage more than 75 % and the Amax value (A) ≥ value α cut higher than 0.5. These three requirements are necessary to illustrate the acceptable element by the experts. Those elements that do not meet the criteria will be removed.

Refer to Table 5, which presents the elements of the pedagogical and technological practices in the NGLS framework. From the teachers' pedagogy strategies elements, it can be seen that active learning and project-based learning are in the first ranking of the elements based on the defuzzification process. E5 and E6 show the threshold (d) value is 0.000 based on the Fuzzy Delphi method analysis. The expert consensus also illustrates 100 % agree the elements are the most important in pedagogical practices. The Fuzzy score (A) ≥ value α cut also shows 0.967 higher than

the 0.5 required by the FDM requirement for the acceptable ranking elements. The data shows a clear trend of rejected elements for the teacher-centred as show 0% experts consensus; the threshold is exceeded the threshold value of 0.2 ($d \leq 0.2$)

Table 5 shows that online tutorials and online learning are the most acceptable elements for pedagogical activities, as strong evidence from the experts. The threshold values range from 0.022 to 0.108. The Fuzzy score $(A) \geq$ value α cut between 0.959 and 0.923. The defuzzification score also illustrated the ranking for E5 at ranking number 1 and E4 at ranking number 2. However, the homework and test and quizzes are rejected elements by the experts. Conclusion: there is a clear rejection trend with the threshold value of homework is 0.310 and test and Quizzes are 0.215 higher than 0.2. The coding and programming also illustrates the expert consensus percentage 85 % higher than 75 % and the threshold value is 0.111 at the third ranking of the acceptable elements.

As been seen in Table 5, the elements for online learning shows the ($d \leq 0.2$) = 0.177 .The threshold (d) value for online tutorial also show ($d \leq 0.2$) = 0.050 as strong evidence for acceptance of elements by experts. However, E4 shows as rejected element with the threshold value =0.293 and 46 % consensus by the experts and Amax for E4= 0.792. Despite that, it is necessary to meets these three requirements. All the elements in E1 (d) and E4 (d) =0.000, E2 (d)=0.082 and E3=0.116 are accepted elements in online tutorial. The expert consensus also illustrates the percentage range between 85 % to 100 %. The Fuzzy score $(A) \geq$ value α cut range between 0.967 first ranking E1 and E4 and 0.931 value for E2 0.910 for E3 at the fourth-ranking of the elements. For the coding and programming, all five elements are accepted by the experts. The threshold value shows for E1 and E2 =0.054, E3=0.040, E4 =0.022 and E5 =0.082. The experts' consensus ranges between 92 % to 100%, which is clear evidence of the acceptable elements. The defuzzification process value also shows the value of α-cut ≥ 0.5. The result shows that E4 is at the first ranking number, E3 at ranking number 2, E1and E3 shared at the number 3 and E5 as the fifth ranking for the element types of technology application tools for coding and programming.

4. Discussion

Next-generation learning spaces framework will possibly become a practical heutagogical and technological approach in line with the Ministry of Education blueprint to adopt digitalization in teaching and learning with active learning (Ministry of Education, 2013). Due to ubiquitous accessibility, the framework can provide a new dimension to education. The findings show strong evidence to support the strategies and activities of the heutagogical approach. Active learning illustrates a threshold value =0.000 ($d \leq 0.2$) and at the first ranking in the pedagogical elements. Followed by project-based learning, students centred, blended learning and personalized learning. The findings have a clear rejection of the teachers centred. In the heutagogical approach, the learning can be in the formal and informal space; teachers as facilitators deliver the instruction as supported (Blaschke, 2012; Dewantara & Dibia, 2021; Hultum, 2009).

Students are independently active in applying the collaboration among peers. The heutagogy approach in NGLS can be face-to-face or virtually, and the students' interaction and collaboration lead the teaching and learning process. Most of the FDM experts agree on the NGLS framework's technology elements. The findings show that the threshold value for online tutorial and online learning elements is between 0.177 and 0.050, indicating the acceptable elements in terms of technology tools. The findings show strong evidence that online tutorials and online learning are suitable elements for the NGLS framework and align with the heutagogy approach concept. These findings reflect the significant roles in changing heutagogy practices in NGLS (Blaschke, 2012;

Edwards et al., 2021), who also found emerging technologies in next-generation learning as a suitable educational approach. There are similarities to those (Hensley, 2020; Şentürk, 2020), who explained that teachers need to enhance their skills in multiple modes of online tutorial and online learning to foster active learning in NGLS (M.Yaqoob Koondhar et al., 2021; Nurbanati et al., 2021).

This study set out to develop NGLS framework with the heutagogical and technological approach. The findings have identified that the knowledge and skill related to the practice and use of technology tools can improve teachers' confidence as a new dimension in teaching strategies. The heutagogy approach integrated into the framework can benefit the teachers, more capable teachers and learners, and as a guideline to the teachers to engage with the learners. Through this approach, online tutorials and online learning are increasingly dependent on digital technology, connectivity, and access to knowledge and learning. Technological features fully support NGLS. These findings have important for use of online tutorial and online learning such as Google Meet, Zoom, Screen Casting, YouTube, Telegram in dealing with the recent phenomena of next generation formal and informal learning (Abidin & Saputro, 2020; Ahmad Alif Kamal et al., 2020; Hidayat & Shafie, 2020; Ishak & Jamil, 2020). The heutagogical and pedagogical approach in the NGLS framework supported leaners to gain more ability to investigate the ideas, engage with peers in active learning; and information discovery and sharing. The online learning and online tutorial can support self-determined learning in heutagogy approach (Blaschake, 2021; Qismullah Yusuf & Yunisrina Qismullah Yusuf, 2018).

5. Conclusion

The NGLS framework with heutagogical and technological approach as a beginning to adapt the digitalization in Malaysia education. The approaches that more flexible, and facilitates the information delivery to the students. The framework is in line with the MOE requirement to enhance our education in future with new dimension of education. The possibility of the usability of the heutagogical and technological framework in (NGLS) as needed by next generation learners. These findings highlighted important issues that the NGLS framework as a guidelines in heutagogical and technological approach. The framework also played an important role in education by the Ministry of Education (MOE) and further discussion into this new heutagogical approach for emerging technologies in the new curriculum to ensure the technology competency among teachers. There is a need for new instructional package and teachers' preparation and development programs; able to effectively and successfully capture the new roles in NGLS.

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