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Digital Transformation for E-learning at the Tertiary Level in Bangladesh: Prospects and Challenges

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Abstract

In the 21st century, Higher Education Institutions have prioritized digital shift as an apparent and essential process for their institutions. In the face of the growing importance and demands of digital incorporation into the classroom and examination process, the HEIs in Bangladesh continue to impart online education even after the pandemic. Having this backdrop, the present research aims to identify the challenges that the HEIs in Bangladesh are facing in implementing digitalization. Since the present study aims to respond to the research questions of a qualitative and quantitative nature, data collection and analysis techniques from both methodologies are implemented, and the Mixed Method Research approach has been chosen as the methodology of this research. The findings of the study show that due to digital transformation, HEIs in Bangladesh are facing a number of challenges. The major challenges are no strategic vision, policy, and legislative structure; inadequate digital literacy of all stakeholders; poor internet network; lack of outcome-based digital platform of teaching and learning; lack of digital campus network information security; financial constraints; inadequate technological support; data enablement solutions are limited; artificial intelligence is not fully functional; limited digital academic library facilities, etc. The study has proposed several suggestions to overcome the challenges. These are a strategic vision for digital transformation; modernization of the curriculum, Learning Management System (LMS), etc. It then puts forward a framework for "digital maturity" that higher education institutions (HEIs) can adopt to assess their existing

digital strategies and enhance them by integrating various enterprises and methodologies.

Keywords: Digital maturity model, digital literacy, outcome-based digital platform, LMS, digital campus network security

Introduction

In the 21st century, higher education institutions (HEIs) recognize the digital shift as a crucial and inevitable evolution for their organizations. The third technological knowledge revolution, often referred to as the "digital revolution" (Benavides, Arias, Serna, Bedoya & Burgos, 2020, p. 1), serves as the foundation for the burgeoning landscape of information and communication technology. This transformation is reflected in the changing patterns of production, exchange, and services. Digital transformation is pivotal in modernizing broadcasting systems and reshaping the methods of knowledge delivery and education (as-Saudi, 2019). It also brings about significant changes in the dynamics of academic institutions and their environments, thus narrowing the digital divide and emphasizing the transition towards digital universities. Consequently, universities must adapt to the evolving variables and demands of this new reality (Ben Naji, 2020). In recent years, various technological advancements have propelled a surge in innovative educational projects focused on digital transformation within higher education. These initiatives represent genuine models of renewal for universities (Menendez, Machado & Esteban, 2016). In this landscape, HEIs have set objectives to modernize their approaches, implementing strategies to enhance and fully leverage digital capabilities while laying the legislative and technical groundwork (Madhi & Abu Hajeer, 2020). This shift has positioned these institutions within the digital revolution. Much like any transformative era, digital transformation requires a reorganization of structures and sectors, ultimately leading to profound changes in university operations (al-Balochia, al-Harasi, & al-Awfi, 2020). These ongoing changes highlight how the rapid integration of new media technologies and vast data volumes generates a notable level of unpredictability in daily organizational practices.

Digitization facilitates Higher education institutions (HEIs) to shift their resources and operations to cloud-based platforms or virtual networks, broadening access for more individuals while helping to manage costs and reduce environmental impact. The core aim of digital transformation in HEIs should be to redefine educational tools and enhance operational processes (Bond et al., 2018). Big data empowers graduates to explore new teaching methodologies while adapting to personalized learning experiences. University planning must evolve in tandem with digital advancements (Bond

et al., 2018), as it is not just about enhancing teaching methods, but also about adapting internal processes to better reflect the needs of both students and educators.

Therefore, the learning management system of educational institutions faces the challenges of sustaining because knowledge is exceeded continuously by evolving technologies (Bond et al., 2018). In addition, as digital transformation leads to practical and creative instruction and trust in artistry and entrepreneurship, it increases the educational and creative coverage of organizations (al-Balochia et al., 2019). As a result of a growing number of challenges, HEIs should blend digital technologies into their trade much with more reason than before. This will bring major changes in HEIs' work and how they deliver value to their stakeholders.

During the Covid-19 pandemic, online education all over the world has gone through an explosion. World's renowned universities offered full-fledged degrees on platforms like edX and Coursera. Though these programs have not replaced traditional classroom learning, they have provided alternate ways to the students. It has not only provided quality education but also saved time, budget, and distance. Like other parts of the world, online education has come a long way to be accessible in Bangladesh at all levels of education. We faced many problems during the pandemic period. The whole world has come to a standstill in the Corona crisis; naturally, our education system was also stagnant there. Many were bored and frustrated while sitting at home, just as many were suffering from the uncertainty of getting food daily.

Even in that grave situation, the initiatives that were taken by the HEIs to ensure the digitalization of education in classrooms. However, it has not been extended beyond the classrooms. Research (Bashir, Uddin, Basu, and Khan, 2021) shows that the public universities in Bangladesh faced several challenges to the successful implementation of online instruction during the COVID-19 situation. The challenges we have identified include access to technology, affordability, the ability to effectively use technology, teaching methods, availability of online study materials, assessment processes, and ensuring equity (Papachashvili, 2021). The stakeholders also have a lack of training on digital devices. Thus, a complete transformation of digitalized education has not been possible

In the face of the growing importance and demands of digital incorporation into the classroom and examination process, the HEIs in Bangladesh continue to impart online education. Considering that as a backdrop, the objective of this research is to uncover the constraints that Higher Education Institutions (HEIs) in Bangladesh encounter while trying to implement digitalization. It also intends to provide a likely solution to education professionals on how to transform their educational institutions.

Statement of the Problem

As digital adoption becomes more competitive for educational organizations, we have started to apprehend the extensive power of education-driven technology during the pandemic. To meet the demands of the digital age, educators need to explore additional methods for incorporating technology into their teaching practices. After the pandemic, almost all institutions throughout the world had to switch to distance learning. Though all of them faced challenges due to distance learning which is also the same for hybrid learning in some countries, it cannot be ignored that the need to step up digitalization is inevitable. Higher educational institutions like the universities have more potential to manage this than the others. In the face of the growing importance and demands of digital incorporation into the classroom and examination process, the HEIs in Bangladesh continue to impart online education. Researchers appropriately identify that further study should be conducted to find the impact of digital transformation on the HEIs in terms of theoretical and practical terms (Benavides et al., 2020). Though there has been much research conducted on DT during and after the pandemic (Sultana, 2022; Khan, Jahan, Sultana, Kabir, Haider, & Roshid, 2021; Khan, Bashir, Basu, & Uddin, 2020; Khan, Basu, Bashir & Uddin, 2021; Bashir, Uddin, Basu, Khan, Hardiyanti, Nugraheni, & Jemadi, 2021), very limited research works have been conducted on the digital transformation in Bangladesh. Having this backdrop, the current study seeks to uncover the hurdles that higher education institutions (HEIs) in Bangladesh are encountering in their efforts to embrace digitalization. It also intends to provide probable solutions to education professionals on how to transform their educational institutions.

Objectives of the Study

Broad Objective

The main objective of this research is to pinpoint the challenges faced by Higher Educational Institutions (HEIs) in the era of increasing digitalization and to offer recommendations for education professionals on how to effectively transform their institutions. Consequently, the study centers on the following specific objectives.

Specific Objectives

- To ascertain the extent to which the digital transformation practices and strategies are working in the HEIs in Bangladesh.
- To examine the obstacles faced by Higher Education Institutions (HEIs) in adopting e-learning in the context of growing digitalization.

- To provide a guideline to the education professionals on how to transform their educational institution and assist in the incorporation of different initiatives and approaches.

Research Questions

The gap in literature leads to the exploration of the following research questions:

- What is the current state of digital transformation practices and strategies of HEIs in Bangladesh?
- What challenges do Higher Education Institutions (HEIs) face in light of the rising trend of digitalization?
- How can we customize a guideline to help higher education institutions (HEIs) evolve and effectively integrate various initiatives and approaches of digital transformation?

Research Methodology

Since the present study aims to respond to the research questions of qualitative and quantitative nature, data collection and analysis techniques from both methodologies are implemented, thus Mixed Method Research (MMR) approach has been chosen as the methodology of this research. Data are collected through written survey questionnaires and interviews with the participants. Utilizing convenient sampling (Popham, 1993), the present study was conducted with a total number of 100 students. All the participants have experience in both online and offline courses at the tertiary level in Bangladesh. The total number of teacher participants was 10. All of them have more than two years of experience teaching both online and offline platforms. The survey data were processed using Excel, analysed using descriptive statistics, and presented using frequency and percentages. The qualitative data were transcribed and analysed according to major themes. To analyse the data four measurement scales (nominal, ordinal, interval and ratio) have been used. For itemized rating the Likert scale has been used.

Results and Discussion

Teachers' and Students' Opinions about Digital Transformation

Capacity and Challenges of the HEIs for Digitalization

Has your institution arranged any workshop or training for the students on different features of online learning?

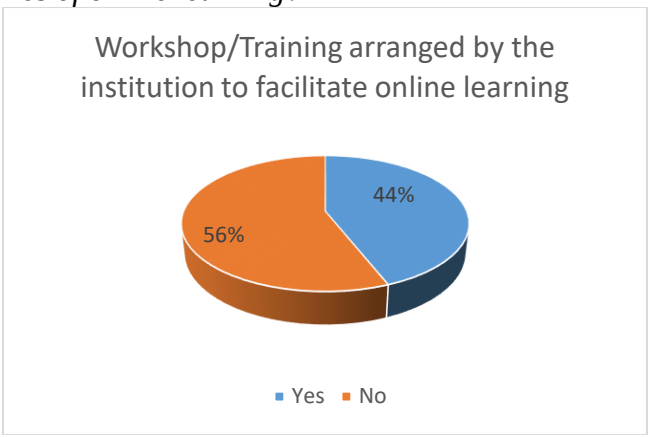

Chart 1: workshop/training arranged by the institution to facilitate online learning

The above chart shows most of the students (56%) asserted that there were no workshops/trainings on online learning have been arranged by their institutions. However, 44% of students confirmed that their institution arranged workshop/training to facilitate online learning which is quite encouraging.

Has your institution arranged any workshop or training on different features of online teaching?

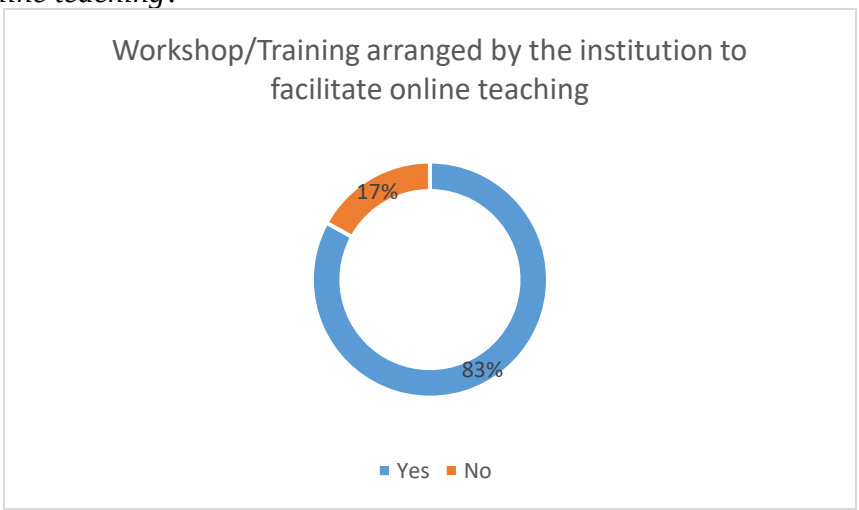

Chart 2: workshop/training arranged by the institution to facilitate online teaching

Most of the teachers (83%) asserted that they received workshops/trainings on online teaching arranged by their institution while some of them (17%) comment on negative. The result shows that the HEIs are providing training to their teachers and students which is a positive sign for the digital transformation of the HEIs.

Do your institution have policy and legislative frameworks, rules and norms to conduct online classes?

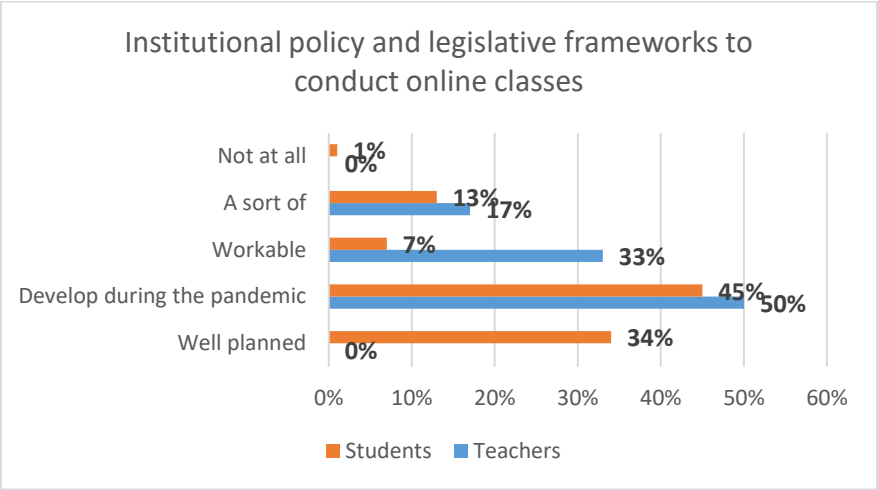

Chart 3: Institutional Policy and legislative frameworks, rules and norms to conduct Online Classes

The above statistics show that almost half of the students (45%) and teachers (50%) give an opinion that during the pandemic the online policy has developed, while 34% of students consider it well-planned. But a good number (33%) of teachers consider it workable and 13% of students and 17% of teachers think a sort of policy is there while 1% of the students are totally negative in this respect. According to this result, it is implied that most of the HEIs in Bangladesh have developed institutional policy and legislative frameworks, rules, and norms to conduct online classes during the pandemic which by the course of time is improving.

Does your institution have support structures, equipment, and finances?

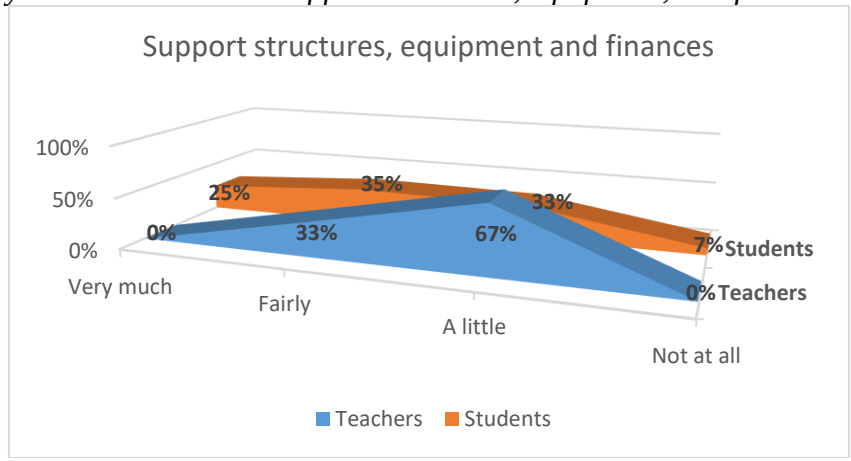

Chart 4: support structures, equipment, and finances

The statistics show that 25% of students claim that their institutions have enough support structures, equipment, and finances to conduct online classes. An almost similar number of students (35%) and teachers (33%) suggest that it is fairly enough. However, most of the teachers (67%) and 33% of students report that the support structure is little. And 7% of learners think that there is no support structure.

Does your institution have enough technical staff to support e-learning?

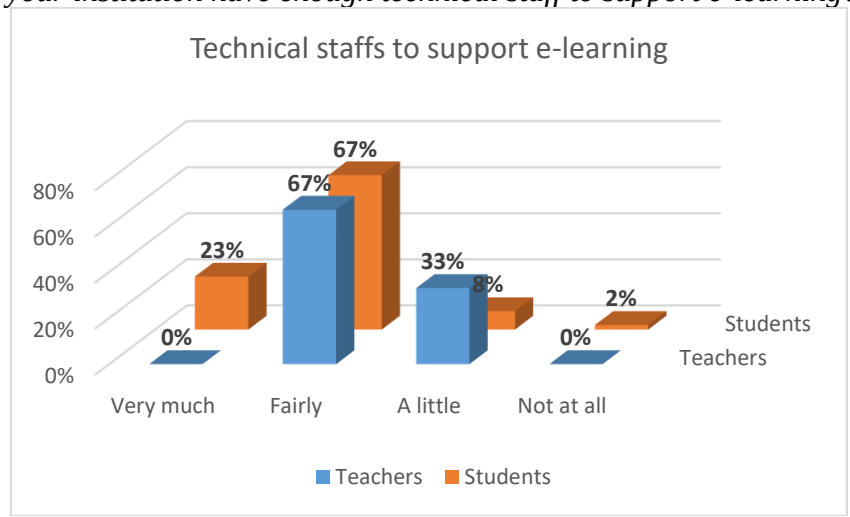

Chart 5: technical staffs to support e-learning

On the issue of technical staff to support e-learning, most (67%) of the students and teachers respond that their institutions have fairly enough technical staff to support e-learning; 23% of students consider it moderate;

while 33% of teachers and 8% of students think it is not adequate. And 2% of them think that there are no technical staff to support e-learning. The results show that HEIs are developing their workforce for digital transformation.

Do you receive any formal and informal incentive from your institution for conducting online classes?

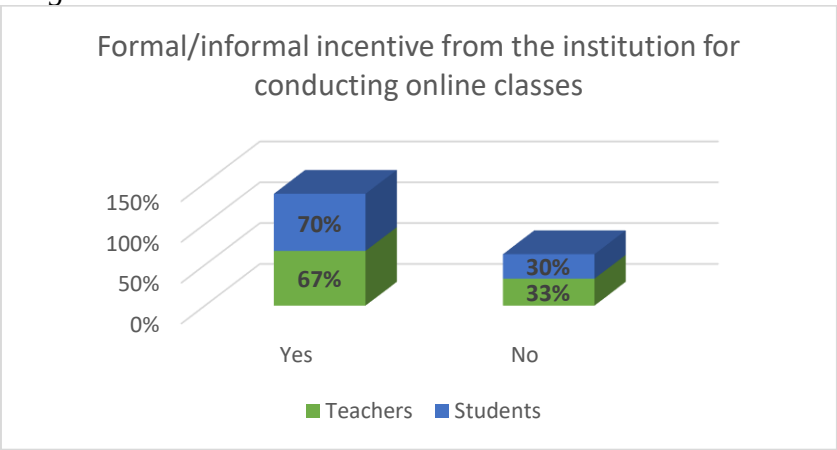

Chart 6: formal/informal incentive from the institution for conducting online classes

Almost all the teachers (67%) and students (70%) admit that they received both formal and informal incentives from the institution for conducting online classes. However, one-third of them state that they did not receive any incentive.

Do you have any previous knowledge and expertise in online classes?

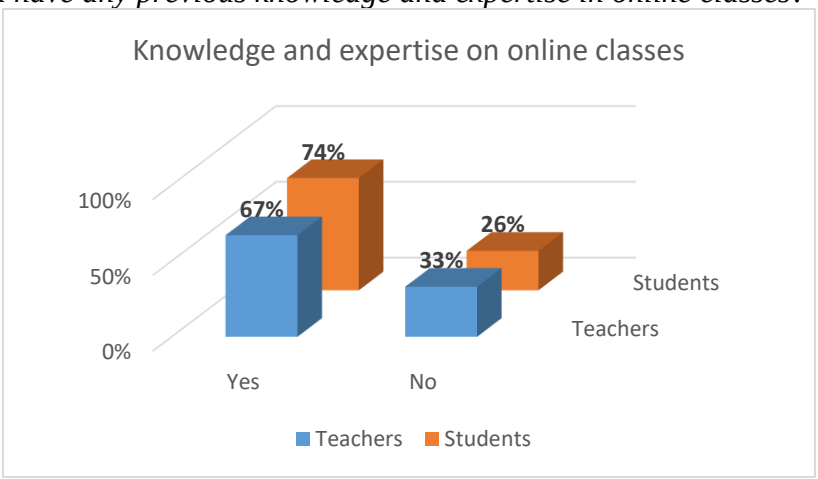

Chart 7: knowledge and expertise in online classes

It has been evident that a good number of students (74%) and teachers (67%) have the knowledge and expertise in online classes after the pandemic. That means during the pandemic, they became familiar with online teaching and learning. However, it also reveals that one-third of the population has not been exposed to online classes.

Rate your technological skills for online learning.

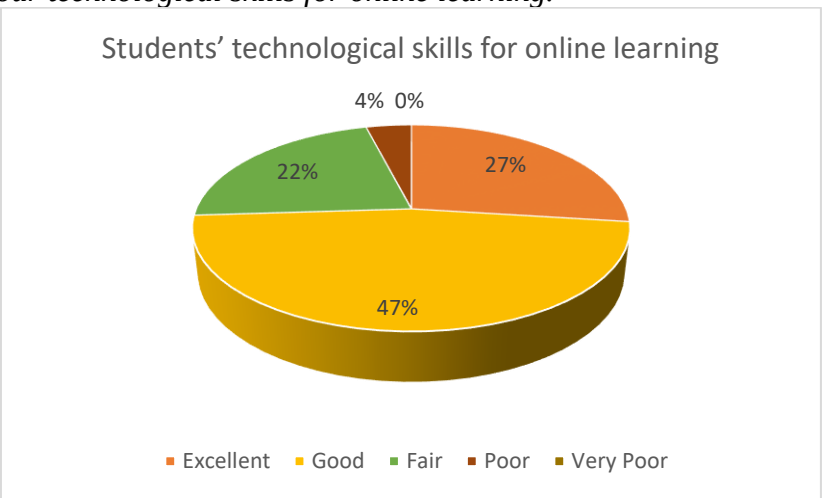

Chart 8: students' technological skills for online learning

47% of students responded that their technological skills for conducting online classes is good and 27% of them commented that it is excellent while 22% said it is fair. However, 4% of students admitted that they are technologically not sound.

Rate your teachers' technological skills for online teaching.
Rate your technological skills for online teaching.

50% of students responded that their teachers' technological skills for conducting online classes are good while 33% of the teachers themselves consider it. Similarly, 25% of students commented that their teachers' technological skills are excellent whereas 17% of teachers consider that their technological skills are excellent.

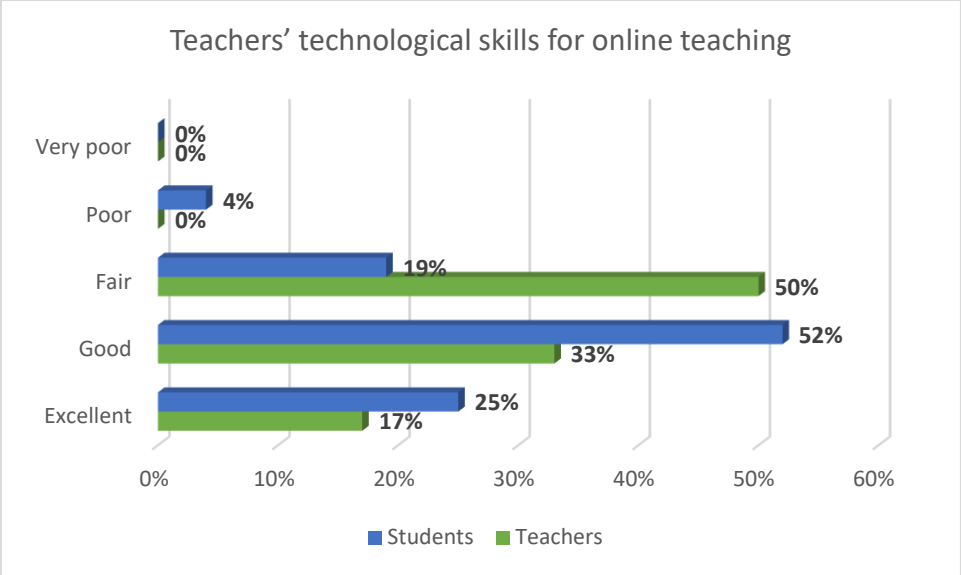

Chart 9: teachers' technological skills for online teaching

Interestingly, 50% of teachers consider that their technological skill is fair while 19% of students consider it fair. However, 4% of students demand that their teachers are technologically poor. Therefore, there is a similarity between students' assessments and teachers' claims. The fact is that teachers as 'digital emigrants' are equipping themselves with technology which is positive for digital transformation.

Do you have the necessary technological devices to support your online learning?
Do you have the necessary technological devices to support your online teaching?

The below bar chart shows that 67% of teachers, and 41% of students have adequate technological devices to support online teaching/learning while 33% of teachers and 44% of students comment that they have workable technological devices to take online classes.

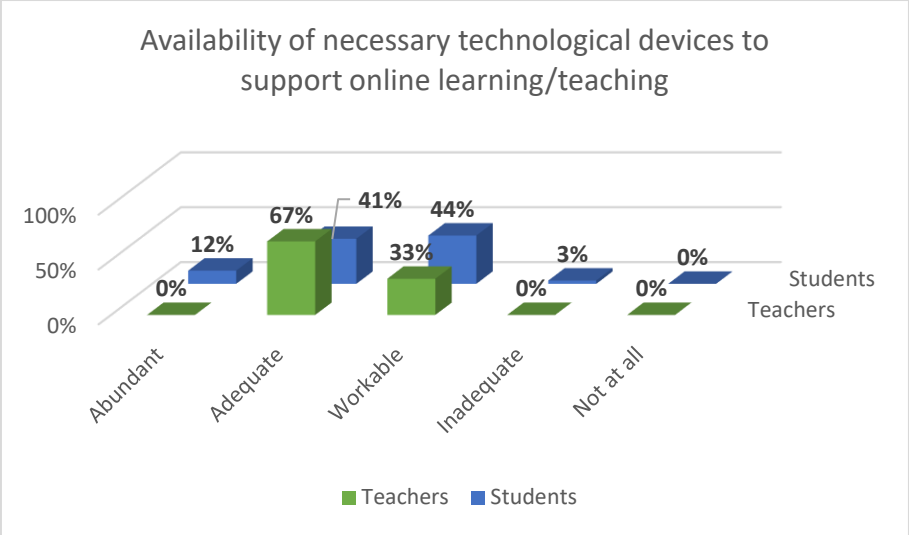

Chart 10: availability of necessary technological devices to support online learning/teaching

However, 3% of the students have inadequate technological support though 12% have abundant. The result shows that though the teachers and students have technological support still it is not the standard for digital transformation.

How is the quality of your internet connection?

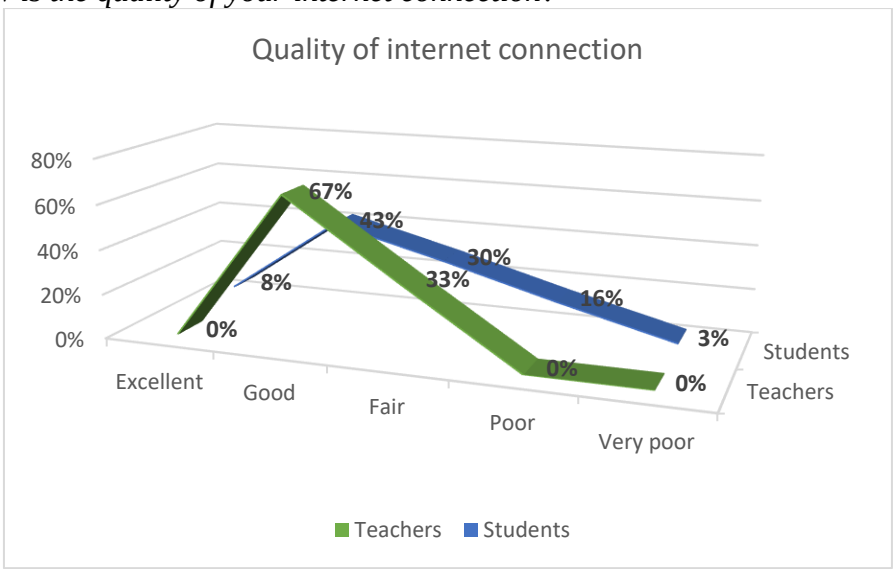

Chart 11: quality of Internet connection

The above chart shows the maximum number of students (good-43% + fair-30% = 73%) are having a good connection to internet, while 16% of

them comment that the internet connection is poor and 3% consider it very poor. Only 8% of students are having excellent uninterrupted internet connection. On the other hand, 67% of teachers comment that they have a good internet connection while 33% consider it fair. The fact is, neither of the respondents are giving their opinion about uninterrupted internet connection which is necessary for digital transformation.

Does your institution have a digital academic library?

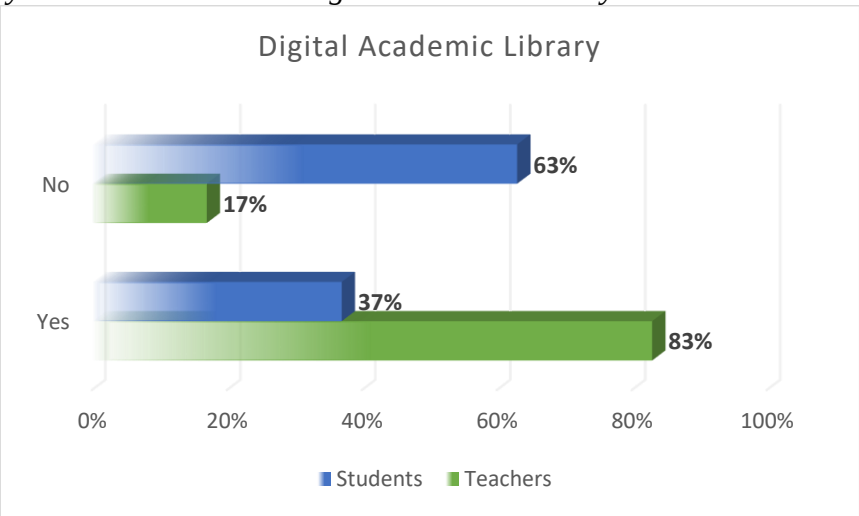

Chart 12: digital academic library

The above bar chart shows interesting statistics. While a maximum number of students (63%) comment that their institutions do not have a digital academic library, most of the teachers (83%) comment that the institutions have a digital academic library. It shows that either the students are not aware of the digital library facility, or they are not practice using library resources. However, if the situation is like that, then it is definitely a barrier to digital transformation.

Parameter of Digitally Transformed Campus

Does your institution provide the following services to create a digitally transformed campus?

Please indicate your opinion in the following areas. Tick (√) appropriate boxes.

Note: 1-very satisfied; 2-satisfied; 3-not sure; 4-unsatisfied; 5-very unsatisfied

Table 1: students' and teachers' response

Services	Respondents	1 (very satisfied)	2 (satisfied)	3 (not sure)	4 (unsatisfied)	5 (very unsatisfied)
1. Campus security	Students	57%	27%	8%	7%	1%
	Teachers	83%	17%	-	-	-
2. Information security	Students	38%	42%	9%	6%	5%
	Teachers	33%	17%	33%	17%	-
3. Student success	Students	20%	45%	29%	5%	1%
	Teachers	-	83%	17%	-	-
4. IT strategy	Students	24%	42%	22%	12%	-
	Teachers	-	67%	33%	-	-
5. Data enablement/assistance	Students	15%	37%	33%	13%	2%
	Teachers	-	50%	50%	-	-
6. Student centric services	Students	15%	32%	32%	16%	5%
	Teachers	-	50%	33%	17%	-
7. Affordability/low cost	Students	6%	25%	32%	29%	8%
	Teachers	-	-	50%	50%	-
8. Digital integration/ combination	Students	12%	43%	34%	10%	1%
	Teachers	-	83%	17%	-	-
9. Artificial intelligence	Students	10%	18%	49%	15%	8%
	Teachers	-	17%	50%	-	33%

Results in Table 2 show the combined responses in figures and percentages. The "Agree" and "Strongly agree" responses are combined and presented here as "Agreed" responses. In a similar fashion, the "Disagree" and "Strongly disagree" responses are combined and presented as "Disagreed" responses.

SL.	Respondents	Agreed responses	Not sure	Disagreed responses
1.	Students	84%	8%	8%
	Teachers	100%	-	0%
2.	Students	80%	9%	11%
	Teachers	50%	33%	17%
3.	Students	65%	29%	6%
	Teachers	83%	17%	0%
4.	Students	66%	22%	12%
	Teachers	67%	33%	0%
5.	Students	52%	33%	15%
	Teachers	50%	50%	0%
6.	Students	47%	32%	21%
	Teachers	50%	33%	17%
7.	Students	31%	32%	37%
	Teachers	0%	50%	50%
8.	Students	55%	34%	11%
	Teachers	83%	17%	0%
9.	Students	28%	49%	23%
	Teachers	17%	50%	33%

The significant results obtained from the survey and presented in Table 1 and Table 2 demonstrate students' and teachers' beliefs about the services to create a digitally transformed campus. The results are:

1. Like most of the students (84%), 100% of teachers ensure that their campus is secure.
2. Unlike the students (80%), 50% of teachers responded that their campus has information security. But 33% of them are not sure and 17% disagree with that.
3. While 65% of students believe that in a digitally transformed campus, they will be successful, 83% of teachers are positive about their students' success.
4. Like the students (66%), almost sa imilar percentage of teachers (67%) support that the campus has a comprehensive IT strategy.
5. Like the students (52%), almost a similar percentage of teachers (50%) think that they have data enablement to comprehend and connect the power of data and analytics. Therefore, 33% of respondents are not sure and 17% of them disagree whether their data enablement solutions can really help the university to meet their professional goals successfully.
6. Like the students (47%), only 50% of teachers think that the campus provides student-centric services. However, 33% of them are not sure and 17% disagree with this.
7. 37% of students disagree that their campus provides them with digital facilities at low cost. Moreover, 32% have doubts about the affordability of digital services. Similarly, 50% of teachers disagree that their campus provides them with digital facilities at a low cost. Moreover, 50% of them have the doubt about the affordability of digital services.
8. It is positive that 55% of students suggest digital integration which incorporates a complex and multidimensional process with different dynamics including, the digital culture of the center, the competency of teachers and students, the support of families, and innovation within educational programs. However, 34% of them are not sure and 11% disagree with that. However, most of the teachers (83%) suggest digital integration. Nonetheless, 17% of them have doubts about it.
9. Artificial intelligence is currently being used by teachers and education administrators to analyse and interpret data by enabling them to make better-informed decisions. It helps the administrators to schedule courses and individuals to manage their daily, weekly, monthly or yearly schedules. Therefore, personalized learning, plagiarism detection and 24/7 tutoring access are just a few ways AI enhances the classroom experience for both students and teachers.

The statistics show that most (49%) of the students are not sure about the integration of AI and 23% of them disagree with that. Regarding AI, it is a matter of grave that most teachers either disagree (33%) or have doubts (50%) about the implementation of Al. Only 17% of teachers consider that there is a provision for AI, and it is effective.

As part of the digital transformation, does your campus conforms the following nitty-gritties?

Please indicate your opinion in the following areas. Tick (√) appropriate boxes.

Note: 1-strongly agree; 2-agree; 3-Not sure; 4-disagree; 5-strongly disagree

Table 3: students' and teachers' response

SL.	Content	Respondents	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
I.	Supports business operations, learning and research	Student	13%	45%	26%	10%	6%
		Teacher	0%	83%	0%	0%	17%
II.	Sensitive research activities are always kept secure from threats.	28%	39%	24%	5%	4%	28%
		0%	17%	67%	16%	0%	0%
III.	Use real life, real-time data to drive strategic initiatives that improve performance, roll out upgrades and make infrastructure decisions.	Student	18%	42%	32%	6%	2%
		Teacher	0%	17%	50%	33%	0%
IV.	Whether it is on-premises or in the cloud, the ultimate goal of digital transformation is to provide a single platform as the foundation of your network and communications infrastructure.	Student	17%	46%	32%	4%	1%
		Teacher	17%	17%	50%	16%	0%

Table 4: combined responses of the students and teachers regarding the institutional conformity of digital transformation

SL.	Respondents	Agree	Not sure	Disagree
I.	Student	***58%***	26%	16%
	Teacher	***83%***	0%	17%
II.	Student	***67%***	24%	9%
	Teacher	17%	***67%***	16%

III.	Student	***60%***	32%	8%
	Teacher	17%	***50%***	***33%***
IV.	Student	***63%***	32%	5%
	Teacher	34%	***50%***	16%

From the Table 4:

We have found both the students and teachers ***conform*** that the HEIs provide support for business operations, learning and research (58%, 83%).

Only the students comment that the HEIs use real-life, real-time data to drive strategic initiatives (60%); and it is possible to provide a single platform through digital transformation (63%).

On the other hand, only ***the teachers*** are ***not sure*** that, in HEIs, whether the HEIs use real-life, real-time data to drive strategic initiatives (50%); and whether it is possible to provide a single platform through digital transformation (50%).

A considerable number of ***teachers disagree*** that HEIs do not use real-life, real-time data to drive strategic initiatives (33%).

Please indicate your opinion in the following areas. tick (√) appropriate boxes.

Note: 1-very satisfied; 2-satisfied; 3-not sure; 4-unsatisfied; 5-very unsatisfied

Table 5: students' and teachers' assessment of the existing capacity of e-learning

SL.	Content	Respondents	Very satisfied	Satisfied	Not sure	Unsatisfied	Very unsatisfied
a)	How do you evaluate the technical support in on-line classes?	Students	10%	44%	23%	19%	4%
		Teachers	0%	67%	17%	16%	0%
b)	How do you appraise the curriculum/instructional design in your present digital learning?	Students	12%	51%	26%	7%	4%
		Teachers	0%	67%	17%	16%	0%
c)	How much has your institution modernized the infrastructure capacity for digital learning?	Students	20%	52%	17%	7%	4%
		Teachers	0%	100%	0%	0%	0%
d)	The present curriculum/instructional design is development standards as well as platform standards for digital learning.	Students	16%	42%	34%	7%	1%
		Teachers	0%	67%	0%	33%	0%
e)	Teachers are highly qualified personnel to conduct on-line classes.	Students	24%	44%	23%	8%	1%
		Teachers	0%	33%	17%	50%	0%
f)	Digital learning can ensure the quality of education.	Students	17%	32%	35%	8%	8%
		Teachers	0%	33%	17%	50%	0%
g)	"My exam performance	Students	20%	30%	18%	16%	16%

	with the e-proctoring system was better than the one I would obtain in the face-to-face assessment".	Teachers	0%	0%	50%	33%	17%
h)	"The e-proctoring system use in the test positively impacted concentration, attention, time management, anxiety, understanding, and motivation during the exam".	Students	17%	28%	32%	12%	11%
		Teachers	0%	17%	33%	33%	17%

From Table 5, let us combine the 'satisfied' and 'unsatisfied' responses. It appears as below:

Table 6: combined responses of the students and teachers on the assessment of the existing capacity of e-learning

SL.	Content	Respondents	Satisfied	Not sure	Unsatisfied
a)	How do you evaluate the technical support in on-line classes?	Students	54%	23%	23%
		Teachers	67%	17%	16%
b)	How do you appraise the curriculum/instructional design in your present digital learning?	Students	63%	26%	11%
		Teachers	67%	17%	16%
c)	How much has your institution modernized the infrastructure capacity for digital learning?	Students	72%	17%	11%
		Teachers	100%	0%	0%
d)	The present curriculum/instructional design is development standards as well as platform standards for digital learning.	Students	58%	34%	8%
		Teachers	67%	0%	33%
e)	Teachers are highly qualified personnel to conduct on-line classes.	Students	68%	23%	9%
		Teachers	33%	17%	50%
f)	Digital learning can ensure the quality of education.	Students	49%	35%	16%
		Teachers	33%	17%	50%
g)	"My exam performance with the e-proctoring system was better than the one I would obtain in the face-to-face assessment".	Students	50%	18%	32%
		Teachers	0%	50%	50%
h)	"The e-proctoring system use in the test positively impacted concentration, attention, time management, anxiety, understanding, and motivation during the exam".	Students	45%	32%	33%
		Teachers	17%	33%	50%

From the Table 6:

We have found that both students and teachers are ***satisfied*** with the existing capacity of e-learning to the extent of technical support in online classes (54%, 67%); curriculum/instructional design of the present digital learning (63%, 67%); modernized infrastructure capacity for digital learning (72%, 100%); present curriculum development standards as well as platform standards for digital learning (58%, 67%).

68% of the students consider that their teachers are highly qualified personnel to conduct online classes. 49% of them think that digital learning can ensure the quality of education. 50% of students commented that their exam performance with the e-proctoring system was better than face-to-face assessment and 45% stated that the e-proctoring system used in the test positively impacted concentration, attention, time management, anxiety, understanding, and motivation during the exam.

The teachers give interesting data. While the students consider that their teachers are enough qualified to conduct online classes, 50% of teachers themselves admit that they are not enough qualified to conduct on-line classes and 17% of them are not sure about that. Similarly, while half of the students suggest that digital learning can ensure the quality of education, 50% of teachers disagree with that and 17% are not sure.

The teachers are also highly dissatisfied with the e-proctoring system. 50% of them are dissatisfied and 50% are not sure whether their students' exam performance with the e-proctoring system is better than the face-to-face assessment. This is supported by half of the students as 32% of them are not satisfied with the e-proctoring system and 18% are not sure. Both teachers and students further ensure this. While 50% of teachers disagree that the e-proctoring system used in the test does not positively impact concentration, attention, time management, anxiety, understanding, and motivation during the exam, 33% of them are not sure about the e-proctoring system. Similarly, 33% of students are dissatisfied and 32% of them are not sure.

Interview Data

Major impediments to digital transformation at the tertiary level of education in Bangladesh

When asked about what are the impediments to digital transformation at the tertiary level of education in Bangladesh, all of the interview respondents expressed that they have a positive attitude towards the digital transformation of higher educational institutions in Bangladesh. However, there are limitations that need to be overcome. In response, Teacher 2 revealed the following information:

> *We do not have any policy or legislative frameworks to conduct online classes. Moreover, we are not trained. Our internet network is poor.*

Another teacher (Teacher 6) focused on the following issues as major impediments to implementing digital transformation at the tertiary level.

> *Though we have technical staff, there is the scarcity of specialist technical staff to support e-learning. Our present data enablement solutions are very limited and Artificial*

> *Intelligence is not fully functional. Moreover, our data are vulnerable to cyber threats.*

8 of the interview respondents emphasised that there are major challenges for implementing digital transformation at the tertiary level in Bangladesh. They claim that e-learning contexts do not provide an input-rich environment for the learners.

Major steps that can be taken for digital transformation at the tertiary level of education in Bangladesh

Some of the interview respondents highlighted that there is a need to modernize the present curriculum to meet the new ways of digital learning. Some mentioned that we need a highly skilled workforce with technological skills. Teacher 4 said-

> *Since DT urges a practical and creative education, incorporating new digital cooperative learning, virtual reality, gamification and so on, both teachers and students need training.*

One (Teacher 8) of the teachers mentioned 'digital maturity'. Teacher 8 proposed that-

> *It is not necessary that the university should have the solutions of all digital problems, but the people within the university must have the skills and the tools to find those answers quickly and act upon the business needs of the organization rather than just talk about the digital needs*

Findings

Students and teachers' assessment of ethe xisting capacity of e-learning

We have found that both students and teachers are ***satisfied*** with the existing capacity of e-learning to the extent of technical support in online classes; curriculum/instructional design of the present digital learning; modernized infrastructure capacity for digital learning; present curriculum development standards as well as platform standards for digital learning.

Half of the students consider that their teachers are highly qualified personnel to conduct online classes; digital learning can ensure the quality of education; their exam performance with the e-proctoring system was better than face-to-face assessment; and e-proctoring system use in the test positively impacted concentration, attention, time management, anxiety, understanding, and motivation during the exam. But from the rest half, we got a negative response.

The teachers give interesting data. While the students consider that their teachers are enough qualified to conduct online classes, half of them

admit that they are not enough qualified to conduct the online classes and some of them are not sure about that. Similarly, while half of the students suggest that digital learning can ensure the quality of education, the teachers disagree with that.

Half of the respondents (both teachers and students) are highly dissatisfied with the e-proctoring system.

Capacity of the HEIs for digitalization

The result shows that the HEIs are providing training/workshop to their teachers and students which is a positive sign for the digital transformation of the HEIs.

The statistics reflect that during the pandemic the online policy has developed which is workable and but not well planned. According to this result, it is implied that most of the HEIs in Bangladesh have developed institutional policy and legislative frameworks, rules, and norms to conduct online classes during the pandemic which needs improvement and good planning.

According to the study, most of the teachers and students report that the support structure is very little.

On the issue of technical staff to support e-learning, most of the students and teachers respond that their institutions have fairly enough technical staff to support e-learning; though some of them consider it moderate; while some others think it is not adequate.

Almost all the teachers and students admit that they received both formal and informal incentives from the institution for conducting online classes. However, one-third of them stated that they did not receive any incentive.

Most of the students responded that their technological skills for conducting online classes are satisfactory though some of them admitted that they are not technologically sound.

The students responded that their teachers' technological skills for conducting online classes are good while the teachers consider that their technological skills are fair. Therefore, there is a similarity between students' assessments and teachers' claims. The fact is that teachers as 'digital emigrants' are equipping themselves with technology which is very positive for digital transformation.

We have found half of the respondents commented that they have adequate technological devices to support online teaching/learning. However, a good number of teachers and students claim that they have workable technological devices to take online classes and some of them have inadequate support. The result shows that though the teachers and students

have technological support but still it is not the standard for digital transformation.

The study shows a maximum number of students and teachers have a good connection to the internet, while a considerable number of them report that the internet connection is poor. Only a few students have excellent uninterrupted internet connections. The fact is, neither of the respondents are givingan opinion about uninterrupted internet connection which is necessary for digital transformation.

The study result shows that while a maximum number of students comment that their institutions do not have a digital academic library, most of the teachers comment that the institutions have the digital academic library. It shows that either the students are not aware of the digital library facility, or they are not practice using library resources. However, if the situation is like that, then it is definitely a barrier to digital transformation.

Students and teachers' belief about the services to create a digitally transformed campus

Almost all respondents agree that their campus is secure.

Though most of the students agree that they have campus network security, the teachers partially agree with that. The teachers think the present condition of digital campus network information security is not totally out of threat to it.

Most of the students and teachers believe that their institutions are offering them increased and more equitable access to digital learning resources which benefit them and provide a more engaging university experience.

Most of the students and teachers comment that their campus has a comprehensive IT strategy.

Regarding data enablement, we got a mixed response from the respondents. Half of the students and teachers think that they have data enablement to understand and harness the power of data and analytics. But the rest are either not sure or disagree whether their data enablement solutions and strategies can help the university quickly so that they can successfully meet their professional goals.

Most of the students and teachers comment that their campus does not provide them with digital facilities at a low cost. Moreover, one-third of them have doubt about the affordability of digital services.

It is encouraging that most of the students and teachers suggest digital integration which incorporates a complex and multidimensional process with different dynamics including, the digital culture of the center, the competency of teachers and students, the support of families, and innovation within educational programs.

Artificial intelligence (AI) is currently being used by teachers, students and other education stakeholders to analyze and interpret data by enabling them to make better-informed decisions. It helps the administrators to schedule courses and individuals to manage their daily, weekly, monthly or yearly schedules. Therefore, personalized learning, plagiarism detection, and 24/7 tutoring access are just a few ways AI enhances the classroom experience for both students and teachers. However the study results show that most of the students and teachers are not sure about the integration of AI and some of them disagree with that.

We have found both the students and teachers conform that the HEIs support business operations, learning, and research.

Students and teachers' responses regarding the institutional conformity of digital transformation

Both the respondents are ***not sure*** whether the HEIs are vulnerable to cyber threats; whether the data enablement is possible or not; and whether the "Freemium" software and on-demand services are cheaper.

Only the students confirm that, in HEIs, sensitive research activities are always kept secure from threats; data enablement can be extremely challenging to protect; communications network is of high capacity, secure and smart; the HEIs use real-life, real-time data to drive strategic initiatives; and it is possible to provide a single platform through digital transformation.

On the other hand, only ***the teachers*** disagree or are ***not sure*** that, in HEIs, the sensitive research activities are always kept secure from threats; whether the communications network is of high capacity, secure, and smart; whether the HEIs use real-life, real-time data to drive strategic initiatives; and whether it is possible to provide a single platform through digital transformation.

Major challenges for digital transformation

From the above discussion, we have found the following challenges for digital transformation in HEIs in Bangladesh which need to be addressed:

Most of the HEIs in Bangladesh have no policy and legislative frameworks, rules, and norms to conduct online classes.

There are clear differences in technology use between teachers and students. It reflects the difference between the 'digital natives' and 'digital immigrants' (Prensky, 2001). Therefore, the digital literacy of all stakeholders is an important challenge.

One of the major impediments to the successful implementation of online teaching and learning is poor internet networks. It hindersthe proper delivery and understanding of lessons. Lack of interaction and motivation are also caused due to poor internet networks. It also affects students'

performance. The fact is, HEIs in Bangladesh do not have uninterrupted internet connection which is necessary for digital transformation.

The existing format of pedagogy, curriculu,m and syllabus is not completely functional or outcome-based for digital platforms of teaching and learning.

The present condition of digital campus network information security is not totally out of threat.

For digital transformation, a challenge is related to the financial constraints of HEIs. As emerging technologies are often expensive, it causes financial constraints for DT. Access to these technologies is not open and their maturity level is still not ideal. Thus, it creates a financial burden on the students and teachers.

The technological support is not the standard for digital transformation.

Most of the institutions have less or no support structures, equipment, and finances.

Though the HEIs have technical staff, there is a challenge for specialist technical staff to support e-learning.

The present data enablement solutions and strategies is very limited.

The integration of Artificial Intelligence is not fully functional.

HEIs are vulnerable to cyber threats. The communications network is not of high capacity, secure, and smart.

Most of the HEIs in Bangladesh do not have a digital academic library.

Not all teachers are qualified enough to conduct online classes.

This creates a disparity in the degree of learning or knowledge comprehension among the students as all students in developing countries like Bangladesh, do not have the same access to internet facilities.

There is la ack of workshops/training being arranged on online learning by the HEIs.

Sensitive research activities are not always kept secure from threats.

The e-proctoring system is not effectively functional due to poor internet connection and unfamiliarity with the digital gateway.

Recommendations

Only institutional conviction of the need to exploit the boost of the digital revolution and the solid commitment of students, professors, researchers, staff, and managers, will allow the university to be successful in the digital era. This process entails the digital infrastructure growth, the development of the academic staff's skills to use digital methods in their teachin,g and the improvement of its students' digital skills, as well as other significant challenges among which we emphasized the knowledge

leadership and pedagogical and curricula changes. Thus, digital transformation is now imperative to develop a new educational paradigm (Saykili, 2019). Forthe digital transformation of the HEIs in Bangladesh, the present research would like to propose the following recommendations which have already been explored in many aspects in different contexts in other countries:

- Whatever the digital transformation strategy adopted, HEIs must have a strategic vision for digital transformation. Higher education institutions should set up their strategies with clear and specific goals for their DT. For doing so, it is important to have strong leadership and a specialized team that can confidently explain and implement their plans. A clear vision will make the team and stakeholders more involved and invested in the process of digital transformation (Rodrigues, 2017).
- According to Rodrigues (2017), generally, the young generations have more digital skills than older generations. The success of a digital strategy is strongly dependent on the ability of these different stakeholders to adapt to the emerging technologies and to make efficient use of them.
- There is a need to modernize the curriculum to meet current educational standards and techniques, including discovering new ways to accelerate digital learning and expanding the use of information and communication technologies (Bozhko, Maksimkin, Baryshev, Voronin, & Kondratyeva, 2016).
- In the present digital era, a new highly skilled workforce with technological skills and expertise in technology and contemporary knowledge is required.
- DT drives a practical and creative education, incorporating new didactic models for students to learn and teachers to teach, such as Digital Cooperative Learning, Virtual Reality, Gamification and so on (Abad et al., 2020). Betting on creativity and entrepreneurship, the DT applied in education advocates establishing learning methods based on individualized training, personalization of content, and the development of one's own skills, through social learning (Jahnke & Kumar, 2014).
- Training may be provided to teachers and students for online teaching and learning.
- It is essential to ensure a 4G/5G network nationwide.
- The Learning Management System (LMS) can be a significant help to both teachers and students. Thus, the advantages compensate for the disadvantages by far.

- Financial aid and mobile balance for underprivileged students can facilitate the students by bringing them an online platform. Laptops/Tablets/Smart mobile phones may be provided to the students either free of cost or based on interest-free loans.

Digital maturity model

Instead of digital transformation, we can adopt 'digital maturity'. Brown (2018, p. 12) suggests that "digital maturity doesn't necessarily mean the organization will have all the answers to all digital things, but it does mean that the people within the organization will have the skills and the tools to find those answers quickly and act upon the business needs of the organization rather than just talk about the digital needs". Thus, reaching digital maturity is an ongoing process that reveals around the organization over time. No organization can become digitally mature overnight. There are many frameworks for measuring digital maturity in other industries, (e.g., Iyengar et al., 2021; Kane et al., 2017), but very few for HEIs (Doneva et al., 2019; Duarte & Martins, 2011; Durek et al., 2017; Molina-Carmona et al., 2019; South Australian Government, 2015).

According to Alenezi (2021), the digital maturity (DM) of a HEI will grow by adding the implementation of: a) digitalization initiatives (DI) to optimize a business operation to achieve a specific benefit, mainly related to cost reduction, or to make processes faster and more efficient; b) IT governance best practices (ITGI), whose goal is to support better strategic decision-making about IT; and c) digital transformation initiatives (DTIs), which are business-driven initiatives whose purpose is to create new business processes that require overall strategic organizational change, using the latest digital technologies, and adding high value to all stakeholders.

If HEIs want to increase their digital maturity, they should work in all these areas, but if they want to accelerate their digital maturity, they should invest their efforts in DTIs. Thus, according to Gurumurthy and Schatsky (2019, p. 11), "an organization's digital maturity correlates with the scope of its digital transformation efforts" and "organizations that are more digitally mature are deriving greater benefit from digital transformation efforts […]. In other words, the more comprehensive and coordinated an organization's digital transformation efforts are, the more likely it is to be digitally mature".

There are different frameworks and models for the digital transformation of higher education institutions proposed by three leading firms: KPMG, Google, and Microsoft. It is also found that with such a high need for digital transformation, higher education institutes have been lagging behind other industries and business organizations due to several challenges. Therefore, in Bangladesh, our HEIs can adopt "digital maturity" models for the greater benefit of digital transformation efforts.

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