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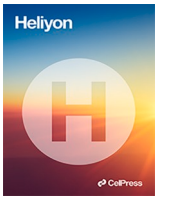

Factors affecting student readiness towards OBE implementation in engineering education: Evidence from a developing country

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A B S T R A C T

Engineering universities in the South Asian region have been investigating the efficacy of Outcome-Based Education (OBE) in preparing their students to meet the demands of the Fourth Industrial Revolution (4IR). Evaluating students' motivations towards OBE is crucial for its successful implementation into engineering degree programs. This research aims to explore students' readiness towards OBE implementation at one of the prominent engineering universities in Bangladesh. To achieve this aim, an instrument was developed to comprehensively measure students' readiness towards the implementation of OBE. The survey instrument with a 7-point scale, measuring six constructs of the proposed model, such as (a) Students' awareness, (b) Teachers' commitment, (c) Institutional support, (d) Perceived easiness, (e) Students' motivation, and (f) Self-efficacy, was developed and administered to a pilot sample of sixty-eight participants (N = 68) from two engineering domains: Civil and Environmental Engineering (CEE), and Computer Science and Engineering (CSE). The final data was collected from a cohort of Three Hundred and Seventy participants (N = 370), distributed across four engineering domains. A structural equation modeling (SEM) with the help of the Smart-PLS software was conducted to determine the construct validity of the measurement model and to evaluate the model fit. Results from the analysis indicate no significant positive effect of teachers' commitment (TC) on students' readiness (SR). However, the results reveal a significant positive effect of students' awareness (SA) and perceived easiness (PE) on students' readiness (SR). Results also reveal no significant moderating role of institutional support (IS) on the relation between the exogenous variables (IS, SA, PE) and the endogenous variable (SR). The research recommends Institutional Support as essential for instructors and students to implement outcome-based education (OBE) in engineering education.

1. Introduction

There is a growing concern over how Bangladesh economy will face the challenges of the "Fourth Industrial Revolution (4IR)" which is driven by new technologies, such as digital machines, artificial intelligence, robotics, and big data [1]. The challenges emerge from the nature of work and future job market requirements. These could be translated into three main reasons: (a) an increase in job-related tasks in the last decade that calls for new skills [2]; (b) employers' preference to diverse skills, a combination of cognitive, non-cognitive (soft) and technical skills, rather than technical skills only [3]; and (c) new technologies introduce novel practices which require new levels of knowledge, skills and attitudes in the job market. In order to face these challenges, engineering education (Eng. Ed) should design their curriculum in a way that it can produce graduates capable of securing employment in the 4IR context. Therefore, a vital question arises: how do engineering universities in Bangladesh along with other developing countries prepare their graduates for future workforce requirements?

A number of studies have proposed solutions to the challenges underpinning Eng. Ed. The Outcome-Based Education (OBE), among other solutions, has been accepted as a seal of approval in accreditation of engineering programs [4]. Two key underlying purposes of

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implementing OBE in Eng. Ed emerge: *first,* Eng. Ed offers myriad programs that require integration of knowledge (complex mathematical and engineering concepts), skills (design, problem-solving, innovation, etc.), and attitudes (ethics, social and environmental responsibilities, etc.). Therefore, engineering universities are expected to produce graduates who will have certain levels of competencies (knowledge, skills and attitudes) that can be measured by OBE. *Second,* if engineering programs are accredited, their degrees will be recognized worldwide, thus offering graduates opportunities for further studies and employment in different parts of the world.

Considering the above reasoning, countries such as USA, UK, Singapore, Malaysia, have already implemented OBE in various university programs [5]. Bangladesh has taken various initiatives towards implementing OBE, realizing the benefits it yielded in other countries. As a result, the University Grants Commission (UGC) of Bangladesh instructed universities should revise their curricula based on OBE [6]. This compelled higher education institutions, particularly engineering universities to take initiatives towards practical implications of OBE. Islamic University of Technology is not an exception. As a subsidiary organ of the Organization of Islamic Cooperation, Islamic University of Technology plays a crucial role in producing graduates not only to the host country, Bangladesh, but also to the other remaining member states. Moreover, the diverse background of the Islamic University of Technology environment necessitates the implementation of OBE that will take into consideration the globally available job opportunities. Towards this endeavor, the university has taken initiatives to implement OBE to align with the UGC recommendations.

On the other hand, literature reports that educational institutions face diverse challenges during the implementation of OBE [4]. Since Islamic University of Technology is now at the implementation stage, it is imperative to conduct this proposed research as it will play a vital role in assessing the experiences (opportunities and challenges) of students and suggest a systematic approach to tackle the various issues that may hinder the successful implementation of this education system. Considering this background, the objective of this research is to explore students' level of readiness towards OBE implementation in their various disciplines of study. In order to translate this objective, the following research question was constructed for investigation:

What is the relationship between students' readiness towards OBE implementation and other facilitating factors such as teachers' commitment, students' awareness, perceived easiness, and institutional support?

1.1. Theoretical underpinnings

The purpose of this study is to investigate the relationship between students' readiness towards the implementation of OBE and other contextual factors such as teachers' commitment (TC), students' awareness (SA), perceived easiness (PE) and institutional support (IS). This study integrates three prominent theoretical frameworks, such as Technology Acceptance Model (TAM), Social Cognitive Theory (SCT), and Self-Determination Theory (SDT) in order to establish a comprehensive theoretical model that guides the main research question. The first theory, TAM [7] focuses on the factors including perceived easiness, students' awareness and institutional support in relation to OBE implementation. This model suggests that students who believe the system is easy to use, are aware of its benefits and receive adequate support from the administration are more likely to be ready for OBE implementation. The second theory, SCT [8] emphasizes the significance of social factors in students' readiness for OBE. For example, students' interaction with teachers, peers, and the institutional environment may influence students' readiness. According to this theory, students having more self-efficacy to adapt to OBE are more likely to be prepared for its implementation. The third theory SDT [9] focuses on human motivation and the factors contributing to intrinsic and extrinsic motivation in a particular context. In the OBE context, teachers' commitment and institutional support may influence students' motivation, which is considered a sub-construct of students' readiness and self-efficacy. Hence, these prominent theoretical frameworks, TAM, SCT and SDT, integrated in this study, aimed to establish a comprehensive framework that offers insight into the relationship between students' readiness towards OBE implementation and contextual factors such as perceived ease of use, teachers' commitment, awareness of OBE benefits and institutional support. Incorporating individual, social, and contextual factors, the comprehensive model offers a holistic understating of students' readiness towards OBE implementation. This theoretical model may be utilized to investigate and validate the proposed relationship, ultimately advancing student readiness research in the OBE context.

2. Literature review

2.1. Students' readiness

OBE implementation is becoming ubiquitous across the globe, which leads to increasing research interest in formulating ways to achieve effective and sustainable implementation. However, one important aspect that is yet to receive substantial attention is the students' readiness to adopt the new curriculum. Readiness to change has been considered a crucial aspect of any change process Errida and Lotfi [10], which determines the extent to which the change agents such as employees in an organization [11], patients in the hospital [12], or students at schools [13] embrace or resist the course of a change process. Readiness has been defined by several authors from various fields of study, some of which are general, while others are contextual. For example, from the organizational change perspective, readiness is referred to as the extent to which the organization is prepared to adopt to changes [14]. This change readiness has been further divided into two dimensions: change readiness at the organizational level, and individual change readiness. Organizational readiness entails the environmental and contextual aspects of where the change is being implemented. These include the socio-cultural readiness, commitment, and capacity readiness of the organization to implement the change [15, 16]. While individual change readiness involves the stakeholders' (students' in this study) skills, abilities, motivation and perception towards the change process [13, 16, 17]. However, individual change readiness which is the main focus of this study, has been referred to as the degree to which people or groups are ready, willing and able to embrace and support a proposed change in a system [11,18]. Othman

et al. [18] defined individual readiness as the "willingness and ability to do something". However, willingness is the term used to express motivation which is evident in the widely cited definition of motivation by Robbins et al. [19]. Rivaldo [20], also suggested that motivation coupled with ability lead to performance of a behavior. Naji et al. [13], emphasize the importance of assessing whether change recipients are ready for the target transformation or not. This is in fact crucial for effective and sustainable change outcomes [21]. Moreover, lack of individual readiness (students' readiness in this study), may result in lack of engagement, low motivation, and negative attitude towards the change process, which may in turn lead to failure of long-term achievement [22]. However, assessing change recipients' readiness is determined by what factors constitute readiness itself. Readiness is a multi-dimensional phenomenon [23] and its constituting factors may vary based on context, needs, and what is required of the change recipients to accomplish. Therefore, students' readiness to changes in their learning process was reviewed in this study to uncover the dimensions of readiness factor.

2.2. Motivation and self-efficacy

Motivation and self-efficacy have been used in recent studies to account for students' readiness to changes in teaching and learning approaches, conditions, and environments [13,24–31]. For example, Al Mamun et al. [24], identified motivation and self-efficacy as the two key constructs of students' readiness. Similarly, Naji et al. [13], highlighted the main aspects to be considered when evaluating students' readiness for transiting to a new system as: motivation and interest; self-efficacy; and self-directed learning. Hence, in this study, the notion of students' readiness as constituted in the works of [13, 21, 24] was used to operationalize the aspects of students' readiness to OBE as the level of students' willingness to exert efforts in optimal knowledge building (motivation), coupled with beliefs in their ability to successfully accomplish the required tasks to achieve the specified learning outcomes (self-efficacy). Moreover, it is worth mentioning that, improving motivation and self-efficacy is vital in ensuring successful change efforts [13, 21]. Thus, to provide avenue for effective improvement, the level of students' readiness and its relationship with other associated factors such as awareness [32–34], perceived easiness [31, 35], institutional support [24], and teachers' commitments [34] need to be understood at first. Meanwhile, literature on each of these factors and their hypothesized influence on students' readiness were overviewed in the following sections.

2.3. Teachers' commitment

The quality of educational system heavily depends on the teachers who remain the key players in guiding and carrying out the instructional activities. Teachers are the source of motivational drive through which students acquire quality education and sustain high level of performance [36]. It has been reported in various studies that, students' achievement is associated with teachers' commitment and quality teaching [36–39]. Teachers' commitment refers to their dedication, motivation, and active involvement in embracing and incorporating the OBE approach into their instructional practices. This commitment plays a crucial role in the successful implementation and sustainable use of the new approach. Teachers' commitment is critical for ensuring students' readiness to adopt a new system. In the context of OBE, teachers are more likely to give their students the support and direction they need to successfully accept and adopt the new approach when they are committed to it. This has been supported by several studies from the literature [34, 37, 38, 40, 41]. For example, Rhaffor et al. [34], identified teachers as reflective practitioners having a vital role to play in ensuring a smooth transition into the OBE approach. Altun [41], suggested that teachers' commitment is associated with creating an effective learning environment in which students enhance their abilities for greater achievement [41]. Similarly, a significant association between teachers' commitment and students' aptitude was also discovered [37]. Furthermore, it was discovered that, teachers' commitment led to a statistically significant positive influence on the students engagement as well as academic achievement [38]. Finally, after discovering that, committed teachers contribute effectively to the achievement of their students. Mart [40], suggested that, as long as teachers sustain their personal commitment to teaching profession, through creating an effective learning environment, they can influence students' learning" [40]. Effective leaning environment in the context of OBE here entails creating awareness, provision of continuous guidance and support of the change recipients. This will thereby enhance students' motivation as well as their believe in the ability to adopt the new system (self-efficacy), by facilitating their readiness to effective implementation. Overall, it can be understood that teachers' commitment is an important factor in facilitating students' readiness to adopt OBE approach. Committed teachers are more likely to provide the necessary guidance and support to their students, which will consequently foster their readiness for its adoption as well as successful implementation. Hence, we therefore hypothesized that:

H1. Teachers' commitment will have a significant positive influence on students' readiness to adopt OBE implementation.

2.4. Students' awareness

The ability of students to recognize their tasks and participate actively in their own learning depends on their awareness [42]. To facilitate the effectiveness of OBE implementation, it is important that students should be provided with necessary information for the initial take up of the new curriculum. Making students aware of their program and learning outcomes, is part of the essential role of the institution to make the change recipients ready [11, 13, 43]. It is also crucial that students understand how the transition is being implemented, and in which ways they will be supported in obtaining their Program Outcomes (POs), so that they can build a strong belief that the change is worthy of acceptance. Thus, accepting change may promote students' positive attitude and motivation, and thereby facilitate successful implementation of the new curriculum. For example, Naji et al. [13], emphasized that if students are given

sufficient explanation that the change is needed, they are more likely to develop motivation and positive attitudes and establish trust and peer support in their environment [13]. Hence students' awareness of OBE may influence their readiness to its implementation. Based on this argument, we hypothesized that:

H2. Students' awareness of OBE implementation process will have a significant influence on their readiness to embrace the new approach to accomplish the required learning outcomes and program outcomes.

2.5. Perceived easiness

Perceived easiness has been defined as the extent to which a person believes that a system is easy [44]. It was also defined as the feeling of a person about the effortlessness of using a system [45, 46]. Technology Acceptance Model (TAM) [47], a popular tool for understanding how people embrace new technologies, suggested that perceived ease of use, is a crucial element in establishing users' attitudes and behavioral intentions towards a new technology [48–53]. The model implies that, the perceived ease of use of a system effects users' perceived utility of the system, which in turn affects their intention to utilize it. However, the assertion of this model may not be limited to technology only, rather it can be applied to any system that may require certain efforts from the user. In addition, perceived easiness has also been referred to effort expectancy [54]. Effort expectancy was further clarified as one's perceived degree of ease associated with a system [54]. To put this into context, OBE implies that, students play a vital role in the process of teaching and learning [55]. Consequently, students' active involvement in the process requires additional efforts, which may not be present in the traditional process. Thus, if students perceived that, the new OBE approach is easy for them, they will be more likely to believe in their ability to successfully perform their tasks, and that will increase their level of readiness to adopt the system. It can therefore be assumed that students' readiness to adopt the new OBE approach is significantly influenced by how easy they consider it. Students are more likely to be motivated to embrace a new system if they believe it to be user-friendly. But, if people think that the system is challenging to use, they could feel frustrated, reluctant, and less inclined to use it. Based on the theoretical underpinnings described, we hypothesized that:

H3. Students' perceived easiness will have a significant influence on their readiness to adopt OBE implementation.

2.6. Institutional support

Change implementation can be affected by organizational factors, amongst which support from the environment becomes crucial [13, 22, 56]. Institutional support is essential for enhancing motivation and self-efficacy which together are prime to achieving effective implementation of the desired change [21]. Previous studies emphasized the need for support from the institutional administration during transition to a new system [13,24,57–59]. Consequently, Al Mamun et al. [24] stressed that institutional support can accelerate students readiness during online learning transition. Similarly, Damit et al. [59], reported that, lack of administrative support as one of the major causes of limitations to effective OBE implementation. Hence, institutional support becomes a crucial factor to be considered during implementation of a new system in general, and OBE in particular. When students are provided with the necessary support and required resources, they are more likely to feel motivated and gain confidence in adopting OBE. Moreover, institutional support can play a moderating role in students' readiness to OBE implementation. Previous studies on students'

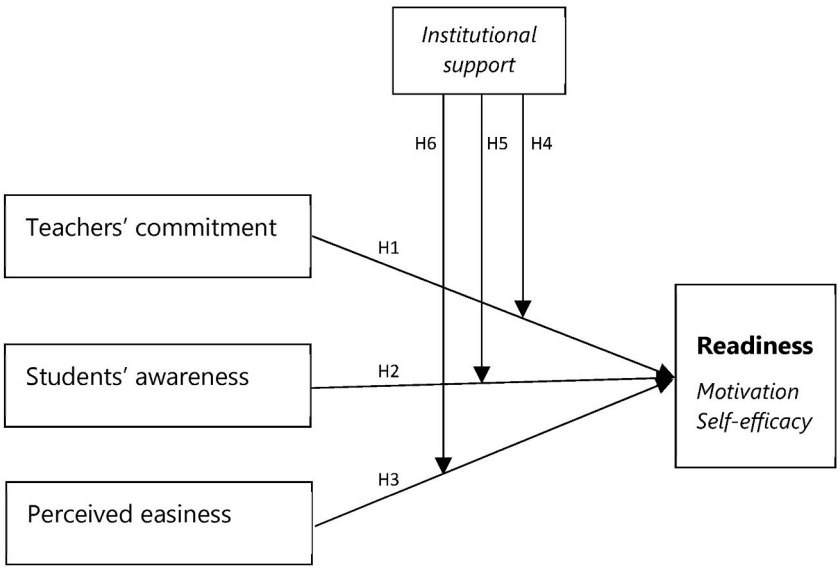

Fig. 1. Conceptual model and hypothesis.

adaptation to new systems reported a moderating effect of institutional support on various determining factors [57 60 61]. For example, Lukman et al. [57], reported a significant moderating role of institutional support between students' attitude and social entrepreneurship intention. They further iterated that lack of institutional support from the implementing environment results in a declined students' motivation to indulge in the necessary activities that are prime to successful implementation. Moreover, Cheng et al. [62], reported a significant moderating role of trainees' perceived support between perceived usefulness of e-learning and perceived intention to use the system. Thus, this study adopts the role of institutional support as a moderator between students' readiness to adopt OBE and other important determinant factors such as teachers' commitment, students' awareness, and perceived easiness of adopting the new approach. Therefore, the following hypotheses were formulated.

H4. Institutional support will have a significant moderating role in the relationship between teachers' commitment and students' readiness.

H5. Institutional support will have a significant moderating role in the relationship between students' awareness and students' readiness.

H6. Institutional support will have a signification moderating role in the relationship between students' perceived easiness and students' readiness.

The conceptual model and hypotheses derived from the above discussions is presented in Fig. 1.

3. Research philosophy and methods

In this study, the positivism paradigm was adopted as the chosen research philosophy. Positivism emphasizes the objective and scientific exploration of phenomena through empirical observation and measurement [63]. Employing this paradigm in our study aimed at generating quantifiable data that could be statistically analyzed, thereby enabling us to identify patterns and relationships within the students' population being studied. Moreover, this approach ensured a systematic and structured investigation, which allows for the establishment of causal relationships between variables, as well as using statistical methods to test the strength and significance of the relationships [64]. Hence, the positivism paradigm guided this research process from the initial stage of developing the survey instrument through the subsequent stages of data collection, analysis and interpretation of results. The research design involved quantitative data collection method with a survey questionnaire administered to a sample of students with the aim to capture their perceptions and readiness towards OBE implementation in a standardized and measurable manner. The quantitative data collection method, scale rating and demographic information allow us to conduct rigorous statistical analysis. An elaborated discussion on research design and methods employed is presented in the following sub-sections.

3.1. Study design and procedure

The study applied a quantitative approach through a cross-sectional survey design to investigate the progress made so far in implementing OBE in Bangladesh country, particularly at Islamic University of Technology, one of the leading universities of engineering and technology in the country. The study was conducted in two phases. The first phase of the study involved the development, validation, and application of the research instrument that can be applied to test the proposed model which aimed to examine students' readiness in the implementation of OBE, as well as examined other influential factors that may significantly affect students' readiness. In the second phase, the validated instrument was administered to the whole sample across the four engineering domains using a Google form through email invitations. Detailed explanations on the sample, procedure, and instrument were given in the following sections. Ethically, this study followed the procedure approved by the 48th meeting of the Committee for Advanced Studies and Research of the Islamic University of Technology University, Bangladesh country under the resolution 7, Dated on 13 July 2021. Informed consent was obtained from all participants prior to data collection.

3.2. Sample

Participants were engineering students at Islamic University of Technology, one of the universities currently implementing OBE in Bangladesh. The participants were drawn from four engineering domains: Computer Science and Engineering (CSE), Civil and Environmental Engineering (CEE), Electrical and Electronic Engineering (EEE), and Mechanical and Production Engineering (MPE). The selection of four engineering domains for this study was done based on the prevalence of the domains in almost every engineering university across the country. Thus, the domains were chosen to ensure that diverse engineering disciplines, representing both traditional and emerging fields were captured by the study. For example, EEE and CSE were selected due to their significance in modern technological advancements, whereas MPE and CEE were selected due to their significance and essential role in infrastructure development and manufacturing sectors. These four domains are the stems from which other emerging engineering fields evolved. Consequently, their inclusion aimed to obtain insights into students' readiness towards adopting OBE implementation across diverse engineering specializations. Moreover, these four domains are the main engineering domains implementing OBE in the university at the time of conducting this study. To ensure that all participants of the study have experienced OBE instructional approach, a purposive sampling was employed in the study. In doing so, the entire university students became the targeted population while students from those specific departments that have already started implementing OBE (CSE, CEE, EEE, and MPE) became the purposive sample and we recruit all via email invitations. The total number of valid responses obtained were 370, with 299 (80.8 %) male and 71 (19.2 %)

female respondents. A total of 76 (20.5 %) respondents are within the age group of 15–20, 279 (75.4 %) respondents within the age group of 21–25, 11 (3.0 %) respondents within the age group of 26–30, while 4 (1.1 %) respondents are within the age group of 30 and above. The respondents' profile in this study is shown in Table 1.

3.3. Instrument

The instrument used for data collection of this study comprised six components adopted from prior studies [24,31,34,55] (see Table 2). The entire instrument is divided into three sub-sections. The first section contains the participants' demographic data; such as age, gender, engineering domain, and academic year. The second section contains responses of the participants and 45 items drawn and modified from six constructs to fit the current context of the study. These include *Students' awareness* (SA) with eight items adopted from Isa et al. [55] and Rhaffor et al. [34], *Teachers' commitment (TC)* with seven items, adopted from Rhaffor et al. [34], *Perceived easiness (PE)* with seven items, adopted from Tang et al. [31], *Institutional* support *(IS)* with nine items, adopted from Al Mamun et al. [24], *Students' motivation (SM)* with seven items, adopted from Tang et al. [31], and *Self-efficacy (SE)* with seven items, adopted from Ref. [24]. In the first phase of the study, survey instrument with a 7-point scale, measuring six constructs of the proposed model (*Students' awareness, Teachers' commitment, Institutional* support*, Perceived easiness, Students' motivation, and Self-efficacy*), was developed. Instrument was then sent to four OBE implementation experts, for validation of its content and phase. Among the four experts, two of them are within the university where the research was carried out, and the other two are external experts from other institutions. After minor modifications of the instrument based on experts' opinion and confirming validity of the contents, the instrument was then administered to a pilot sample of sixty-eight participants (N = 68) from two engineering domains: Civil and Environmental Engineering (CEE), and Computer Science and Engineering (CSE). Analysis of data collected from the pilot sample revealed a good reliability co-efficient for each construct with Cronbach's Alpha values of SA = 0.85, TC = 0.91, PE = 0.92, IS = 0.92, SM = 0.95, SE = 0.95. While in the second phase, after preliminary validation, and confirming reliability of the instrument using data from the pilot study, data was collected from the larger sample, which include a cohort of three hundred and seventy participants (N = 370), distributed across four engineering domains. The degree at which the respondents agreed or disagreed to the statements of the 45 items of the questionnaire was obtained using seven point scale as follows: *Strongly agree = 7; Agree = 6; Partially agree = 5; Neutral = 4; Partially disagree = 3; Disagree = 2; Strongly disagree = 1.*

3.4. Data analysis and procedure

Data was analyzed using IBM SPSS 27, and Smart PLS 3.2.9 softwares. IBM SPSS [65], was used to establish the descriptive analysis of the data, while Smart PLS [66], was used to establish the model fit. In doing so, Partial Least Squares Structural Equation Modelling (PLS-SEM) [67] was applied to the quantitative data. PLS-SEM has gained wide acceptance as a multivariate statistical procedure [68–71]. PLS-SEM was employed in two phases: Measurement Model Specification and Structural Model Assessment [72, 73]. In Measurement Model, the quality of the constructs were assessed, in which the measurement of the quality criteria begins with the evaluation of the factor loadings, and then followed by the establishement of Composite Reliability (CR), convergent validity, and

Table 1
Profile of the respondents.

	n	%
Gender		
Female	71	19.2
Male	299	80.8
Age		
15–20	76	20.5
21–25	279	75.4
26–30	11	3.0
Above 30	4	1.1
Academic year		
First year	95	25.7
Second year	66	17.8
Third year	89	24.1
Fourth year	120	32.4
Engineering domain		
CEE	116	31.4
CSE	93	25.1
EEE	106	28.6
MPE	55	14.9
Participated in OBE training		
Yes	125	33.8
No	245	66.2

Note: N = 370; CEE = Civil and Environmental Engineering; CSE = Computer Science and Engineering; EEE = Electrical and Electronic Engineering; MPE = Mechanical and Production Engineering.

Table 2
Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
SA	370	1.38	7.00	4.85	1.37
TC	370	1.00	7.00	4.67	1.61
PE	370	1.00	7.00	4.51	1.48
IS	370	1.00	7.00	4.41	1.52
SM	370	1.00	7.00	4.38	1.61
SE	370	1.00	7.00	4.41	1.57
SR	370	1.00	7.00	4.40	1.53

discriminant validity while in Structural Model Assessment is applied to evaluate path co-efficients and test the significant effects of each. Additionally, PLS-SEM has been widely applied in recent studies related to students' learning in both Engineering Education, and general higher education reasearch [74–80].

4. Data analysis and results

4.1. Measurement model

Measurement Model Assessment was done following the guidelines of Hair et al. [81], to confirm the validity and reliability of the

Table 3
Reliability Co-efficients, and factor loadings.

Constructs	Items	Factor Loading	Cronbach'sAlpha	Composite Reliability	Average Variance Extracted (AVE)
Institutional Support	IS1	0.83	0.90	0.92	0.62
	IS2	0.78			
	IS3	0.73			
	IS4	0.81			
	IS5	0.73			
	IS6	0.83			
	IS7	0.82			
Perceived Easiness	PE1	0.83	0.89	0.92	0.65
	PE2	0.83			
	PE3	0.84			
	PE4	0.81			
	PE6	0.78			
	PE7	0.76			
Student Awareness	SA1	0.53	0.90	0.92	0.63
	SA2	0.82			
	SA3	0.83			
	SA4	0.88			
	SA5	0.90			
	SA6	0.82			
	SA7	0.69			
Self-Efficacy	SE1	0.85	0.92	0.94	0.72
	SE3	0.88			
	SE4	0.89			
	SE5	0.84			
	SE6	0.78			
	SE7	0.85			
Student Motivation	SM2	0.90	0.95	0.96	0.81
	SM3	0.92			
	SM4	0.90			
	SM5	0.91			
	SM6	0.85			
	SM7	0.91			
Teachers' Commitment	TC1	0.82	0.92	0.94	0.68
	TC2	0.86			
	TC3	0.82			
	TC4	0.86			
	TC5	0.86			
	TC6	0.83			
	TC7	0.76			

model. At this stage, the following measurement statistics were computed and observed, such as reliability co-efficient, convergent validity, discriminant validity, and factor loadings.

4.1.1. Reliability Co-efficient, and factor loadings

At first, results from the PLS-SEM were used to evaluate the factor loading indicators. The factor loadings were evaluated based on the recommended threshold value of 0.50 [81]. Hence, items with factor loadings below the minimum threshold were removed. These include one item (SA8 from Students' awareness), one item (PE5 from Perceived easiness), two items (IS8 & IS9 from Institutional support), one item (SM1 from Students' motivation), and one item (SE2 from Self-efficacy). Items for each factor with corresponding factor loadings are presented in Table 3. Reliability analysis for this study was performed using both Cronbach's Alpha and Composite Reliability (CR). The analysis revealed acceptable values for each construct ranging from 0.894 to 0.953 for Cronbach's Alpha (IS = 0.899, PE = 0.894, SA = 0.895, SE = 0.922, SM = 0.953, and TC = 0.93), and 0.918 to 0.962 for Composite Reliability (IS = 0.920, PE = 0.918, SA = 0.919, SE = 0.939, SM = 0.962, and TC = 0.938). Both Cronbach's alpha and Composite Reliability values were greater than the recommended minimum threshold of 0.7 [81] as shown in Table 3.

4.1.2. Convergence validity and discriminant validity

Convergent validity was assessed using average variance extracted (AVE). For this study, convergent validity results showed that all constructs attained values greater than the recommended threshold of (AVE) 0.5 [82]. Hence, convergent validity is achieved. AVE values obtained by each construct are shown in Table 3. For the discriminant validity, two major criteria are widely reported in the literature, such as *Fornell and Larcker Criterion* [82], and *Heterotrait-Monotrait* Ratio (HTMT) [83]. In this study, both criteria were used to observe the discriminant validity. For the *Fornell and Larcker Criterion*, discriminant validity was established when the square root of AVE for a construct is greater than its correlation with all other constructs. Results from the analysis in each case show that, the values of the square root of AVE were greater than all the values of its correlation with other constructs. Discriminant Validity is therefore confirmed as depicted in Table 4. Furthermore, Henseler et al. [83], suggested a HTMT value of less than 0.9. However, in this study the HTMT values in all cases are below the recommended threshold ranging from 0.623 to 0.892 as shown in Table 5. Hence, discriminant validity using both Fornell & Larcker, and HTMT criteria is achieved.

4.2. Goodness of fit criterion

In PLS path modelling, goodness of fit has been suggested by Tenenhaus et al. [84], ranging from 0 to 1 ($0 \leq GoF \leq 1$), considering a communality cut-off value of 0.5 [82]. Wetzels et al. [85], formulated the *GoF* criteria for small, medium, and large effect sizes of R^2 as $GoF_{small} = 0.1$, $GoF_{medium} = 0.25$, and $GoF_{large} = 0.36$ (see equation (1)). These values serve as the baseline for validating model fit in PLS. The computed *GoF* value in this study is 0.683, which exceeds the minimum threshold for larger effect sizes of R^2 GoF >0.36 [85]. Hence, the model achieved a good fit with respect to the baseline values [86]. Furthermore, another measure to report goodness of fit in PLS is the SRMR value. Hu and Bentler [87], suggested that SRMR value less than 0.10 or 0.08 is considered a good fit. The obtained value of SRMR in this study is 0.061, which confirmed a good model fit.

$$GoF = \sqrt{\overline{AVE} * \overline{R^2}} \tag{1}$$

4.3. Evaluation of a Structural Model

The assessment of Structural Model was made to evaluate the hypothesized relationships and validate the proposed hypothesis. The analysis begins with the computation of the co-efficient of determination (R^2), which is a measure that explains how well a statistical model predicts an outcome [88]. The results obtained in this study revealed R^2 value of 0.706 for the endogenous variable SR, which is above the required threshold value of 0.10 [89] and therefore supports the model's predictive power [88]. Moreover, Effect size (f^2) was computed to observe the change in the co-efficient of determination (R^2) when a specified exogenous construct is removed from the model. The relative effect sizes (f^2) obtained in this study shows that SR was predicted by all exogenous variables (IS, PE, SA) except for TC influence on SR, where the effects was significantly low [90]. The values of (R^2) and (f^2) statistics are shown in Table 6. Besides, inner VIF for the model was computed to assess multicollinearity in the indicators [82]. However, Hair et al. [81], suggested that multicollinearity may be neglected if the VIF value is less than 5.0. The inner VIF values observed in this study are all below recommended cut-off value as indicated in Table 6. Lastly, the predictive relevance (Q^2) of the model was evaluated to assess the

Table 4
Discriminant Validity using Fornell and Larcker Criterion.

Constructs	IS	PE	SA	SE	SM	TC
IS	**0.79**					
PE	0.77	**0.81**				
SA	0.50	0.63	**0.79**			
SE	0.74	0.81	0.57	**0.85**		
SM	0.74	0.81	0.53	0.84	**0.90**	
TC	0.73	0.74	0.64	0.65	0.62	**0.83**

Note: Square root of AVE values in Bold along the diagonal.

Table 5
Discriminant Validity using HTMT Ratio.

Constructs	IS	PE	SA	SE	SM	TC
IS						
PE	0.85					
SA	0.55	0.70				
SE	0.81	0.89	0.62			
SM	0.79	0.86	0.57	0.89		
TC	0.79	0.82	0.71	0.70	0.65	

predictive ability of the model. Q^2 value ranges from 0 to 1. Q^2 is computed for reflective endogenous construct only (SR). In practice, a Q^2 value of (2 % < Q^2 < 15 %) is considered a weak predictive relevance, (15 % < Q^2 < 35 %) is considered a moderate predictive relevance, and (Q^2 > 35 %) is considered a strong predictive relevance [91]. In this study, the predictive relevance of Q^2 of the model is 0.639 (see Table 6), indicating a strong predictive relevance of the model [91], and that 63.9 % of the variance in the endogenous variable is explained by the predictor variables. The structural equation model established in this study is presented in Fig. 2 (see Table 7).

4.4. Hypothesis testing (direct effect analysis)

The significance of a direct path indicates whether the relationship between the two variables is statistically significant or not. In this study, the significance of direct paths and estimate standard errors were determined through a Bootstrap Resampling Technique with 5000 resamples as recommended by Ringle et al. [66]. Results from the analysis indicate that, there is no significant positive effect of Teachers' Commitment (TC) on Students' Readiness (SR) ($\beta = -0.040$, $t = 0.726$, $p > 0.05$), which implies that, **H1** is not supported. However, the results indicate a significant positive effect of Students' Awareness (SA) on Students' Readiness (SR) ($\beta = 0.126$, $t = 2.875$, $p < 0.05$), implying that, **H2** is supported. Likewise, it was observed that there is a significant positive effect of Perceived Easiness (PE) on Students' Readiness (SR) ($\beta = 0.450$, $t = 7.983$, $p < 0.05$), implying that, **H3** is supported as well. The results of the direct relationships hypotheses are shown in Table 6.

4.5. Hypothesis testing (moderation analysis)

In moderation analysis, **H4** evaluates whether IS has a significant moderation effect on the relationship of TC and Students' Readiness SR or not. The results show no significant moderating role of IS on the relation between TC and SR ($\beta = -0.069$, $t = 1.182$, $p > 0.05$), which implies that H4 is not supported. **H5** evaluates whether IS has a significant moderation role in the relationship between SA and SR or not. The results show that there is no significant moderating role of IS on the relationship between SA and SR ($\beta = 0.052$, $t = 1.133$, $p > 0.05$), which implies that, **H5** is also not supported. Lastly, **H6** seeks to evaluate the significant moderation role of IS on the relationship between PE and SR. The results show that, there is no significant moderating role of IS on the relationship between PE and SR ($\beta = 0.069$, $t = 1.165$, $p > 0.05$), which implies that H6 is not supported as well. The results of the moderation analysis are presented in.

5. Discussion, and research implications

5.1. Discussion

The current study investigates the level of engineering students' perceptions of readiness factors (motivation and self-efficacy) towards adopting OBE in Bangladesh, and how the combined readiness factors are influenced by other associated factors. Specifically, based on our conceptualized model, the study examines the impacts of teachers' commitment, students' awareness, and perceived easiness on students' readiness with the moderating effect of institutional support. Results from the data revealed a moderately low level of students' readiness to implement OBE. This indicates the need for more efforts in enhancing the students'

Table 6
Results of Structural Model Path Co-efficient (direct effect).

Hypothesis	Relationship	β	SD	*t* – Value	*P* – value	Decision
H1	TC → SR	0.04	0.06	0.73	0.47	Not supported
H2	SA → SR	0.13	0.04	2.88	0.00	Supported
H3	PE → SR	0.45	0.06	7.98	0.00	Supported
	R^2		f^2	Inner VIF	Q^2	
SR	R2 = 0.706	IS → SR	$f^2 = 0.19$	2.77	0.64	
		PE→ SR	$f^2 = 0.22$	3.09		
		SA → SR	$f^2 = 0.03$	1.85		
		TC → SR	$f^2 = 0.00$	2.98		

Table 7
Results of moderation analysis.

Relationship	Bias correlated 95 % confidence internal. LL UL		β	SD	*t* – Value	*P* – value	Decision	Moderation effect
H4: TC*IS → SR	−0.19	0.04	−0.07	0.06	1.18	0.24	Not supported	No Moderation
H5: SA*IS → SR	−0.04	0.14	0.05	0.05	1.13	0.26	Not supported	No Moderation
H6: PE*IS → SR	−0.04	0.20	0.07	0.06	1.17	0.24	Not supported	No Moderation

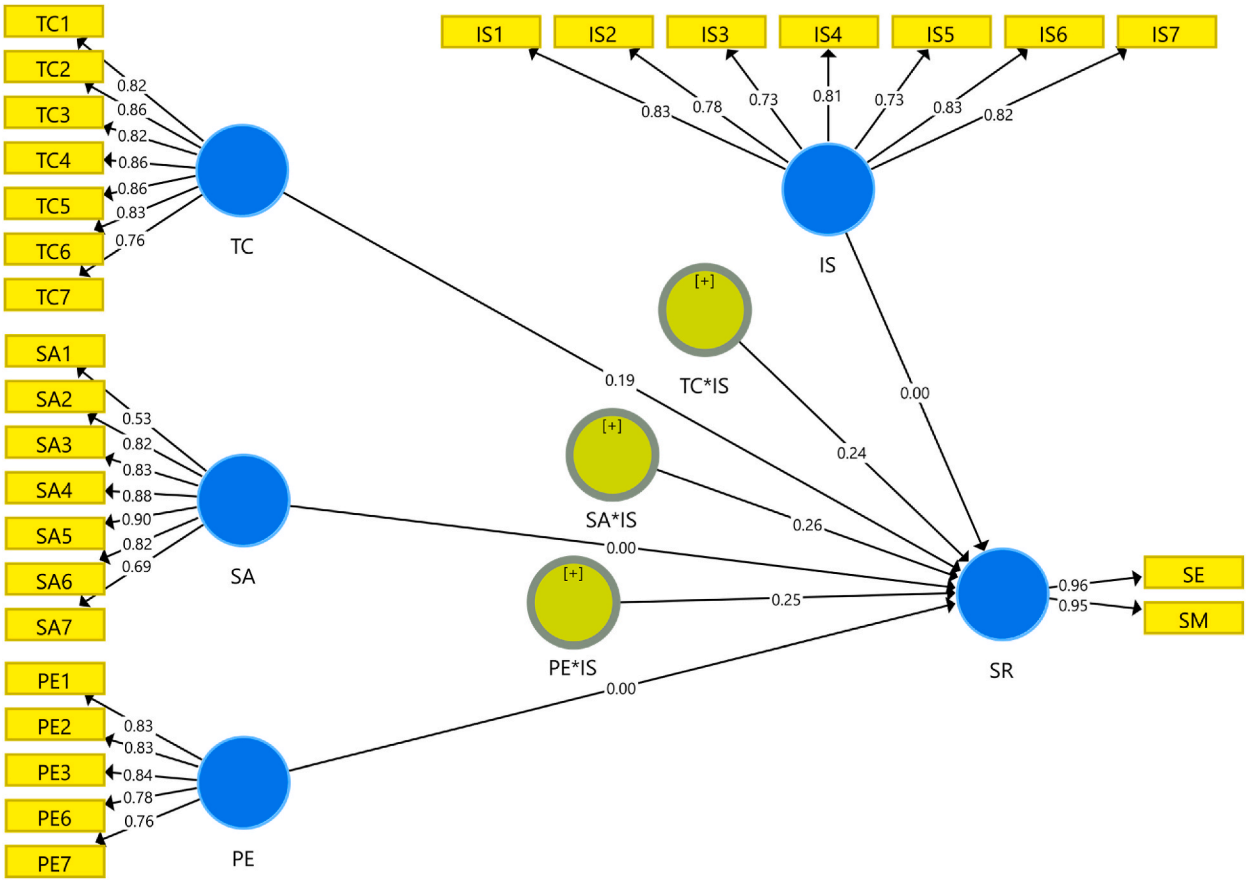

Fig. 2. Structural equation model.

motivational factors such as creating more awareness, significant support, provision of adequate resources, and sufficient training.

Based on previous theoretical underpinnings, the model developed for this study conceived three direct effects of the associated factors (teachers' commitment, students' awareness, and perceived easiness) on the students' readiness. In the first direct effect, the research hypothesized that, teachers' commitment has a direct influence on students' readiness. Previous literature emphasized the importance of teachers' commitment for students' achievement of their program objectives [36, 38]. Rhaffor et al. [34], also emphasized the impact of teachers' commitment for a smooth transition to OBE approach. However, result of the current study indicates that there is no direct significant influence of teachers' commitment on students' readiness to implement OBE. This result is contrary to the previous studies that reported significant impact of the teachers' commitment on students' motivation and achievements. This includes the study of Altun [41], which suggested that teachers' commitment is associated with students' enhanced abilities (self-efficacy), and achievement. Furthermore, Mart [40], reported a positive influence of teachers' commitment on students' learning via creating effective learning environment which in turn improves their motivation. The contradicting result obtained in this study may be attributed to several factors. First, the differences in study design, sample profile, and statistical models may lead to the discrepancies in the results. For example, while the current study applied quantitative approach with all participants from one university, the study of Altun [41], employed qualitative approach, with samples drawn from secondary school, high school, and university graduates. Secondly, data was collected from students of different academic year (see Table 1), with fourth year students having the highest percentage among the participants from all academic year. Since students' experience and exposure to the new approach vary across academic years, their perceptions and expectations regarding how their teachers are committed to ensuring their achievement may vary, and consequently affect the measurement structure of the constructs. This argument is in line with the view of

Park [92], that teachers' commitment can be influenced by variables related to students' profiles. For example, students' academic levels have been found to significantly impact teachers' commitment to student learning [93]. Specifically, students of higher academic level may denounce teachers' teaching practice and their commitment to ensuring positive students' learning outcome. Students' socio-economic variables were also found to be correlated with teachers' commitment [94]. Likewise, school organizational variables such as (public vs private), (city vs rural), size, and population are correlated with teachers' commitment [92]. Furthermore, the effect of teachers' commitment may have indirect effect on students' readiness through its effects on other factors of the model. Therefore, further studies may evaluate the relationship between teachers' commitment and other associated factors, to examine whether direct or mediating effect exists. Hence, in further study, these factors could be controlled while observing the effects of teachers' commitment on readiness so that a clear understanding of the effects could be obtained.

In the second hypothesis, the research theorized that students' awareness has a direct positive influence on students' readiness to adopt OBE approach. The result of the study confirms that students' awareness has a direct positive impact on students' readiness. This result corroborated the argument of previous research that awareness is an essential factor in making change recipients ready [34, 43]. In e-learning, for example, lack of preparedness has been consistently reported as a severe problem [95–97]. This lack of preparedness is what Wagiran et al. [98], referred to low students' awareness and lack of effective technological skills, which negatively affects the implementation of e-learning. Moreover, this result is consistent with the findings of Rhaffor et al. [34], that students' awareness has a significant role in a successful implementation of OBE.

In the third hypothesis, the research theorized that, perceived easiness has a direct positive significant impact on students' readiness. The outcome revealed that perceived easiness of the students' roles in OBE adoption significantly facilitates their readiness to embrace the approach. This was found to be in line with previous reports that perceived easiness facilitates positive attitude and behavioral intentions to use a system [48, 53]. This finding is also consistent with the result of Islami et al. [99], which reported a significant positive influence of perceived ease of use on the attitude towards using tutorial application. In the same manner, the finding corroborates the reports of Tahar et al. [100], that perceived ease of e-filing has significant positive effect on technology readiness.

Lastly, this study puts forward that, institutional support has a significant moderating effect on the relationships between the model's independent variables (teachers' commitment, students' awareness, and perceived easiness) and the dependent variable (students' readiness). Previous studies reported institutional support as important determinant of students' readiness to adopt new system [57, 60, 61]. However, the result of this study was contrary to earlier studies that reported the moderating role of institutional support, such as the study of Lukman et al. [57], which reported a significant moderating effect of institutional support between the students' attitude and their intention of adopting social entrepreneurship. This result also contradicts the study of Cheng et al. [62], which reported a significant moderating role of institutional support in e-learning adoption model. The insignificant moderating role found in the current study may be attributed to the following reasons: the differences in the contexts of the studies such as cultural background, administrative leadership, and institutional differences may influence the relationship between the dependent and independent variables [101, 102]. For example, the extent of institutional assistance that students have access to, may differ between countries or academic institutions, which may subsequently impact the moderating role that institutional support may have on students' readiness. Secondly, the academic literature may tend to publish studies with significant outcomes as opposed to non-significant results. Thus, it is possible that earlier research was skewed towards discovering a significant moderating effect of institutional support, which would account for discrepancy between the findings of the current study and earlier research. For example, the study of Xu and Yang [103], reported non-significant moderating role of perceived organizational support in the relationship between teachers' job stress and burnout. They however discovered a mediating role of the perceived organizational support instead. This is an indication that institutional support may have other effects such as direct or mediation. Further study may investigate the existence of direct and/or mediating effects of institutional support as well.

5.2. Theoretical and practical implications

In practice, the findings of this study identified students' perceptions that may provide useful information to the engineering students towards implementation of OBE in Bangladesh and other similar contexts. It is important to note that, students need to understand how OBE operates and which factors have influence on their willingness of participations in OBE. Without students' active participations in OBE implementation, the desired outcomes of engineering education may not be achieved. In order to improve this situation, the stakeholders (university administrators) should provide supports in enhancing students' motivational factors such as creating more awareness, and provision of adequate resources. Besides, organizing training programs for students might be an additional approach before starting semester that will boost up their readiness. Additionally, the faculty members may be benefited from this result by considering students' awareness which is an integral factor for a successful implementation of OBE. Therefore, at the beginning of the semester, teachers should clarify the importance of OBE, POs and COs of their subjects to their students, so as to keep them aware of what to expect, and what is expected from them in the new instructional approach. Besides, faculty members may consider these results in designing COs of a particular subject that will not only support in creating a conducive learning environment of implementing of OBE, but also assist in achieving learning outcomes of a particular subject. Khan & Hasan suggests that teacher training programs may help them adapt to new policy implementation, such as integrating Information and Communication Technologies (ICTs) in teacher training programs may help teachers utilize ICT and open-source technologies in classrooms [106,107]. As such, trained teachers on OBE may easily incorporate OBE elements in teaching and learning situations.

The outcome of this study confirms that perceived easiness has an impact on implementations. Therefore, this result will help and guide the academic staff to design strategies to empower students into being active learners and in creating a conducive learning

environment that will be easy for the engineering students. Additionally, the OBE framework presented in this study may help ensure maintaining a linkage between the skills provided by the institution and industry demand [108]. Furthermore, policy makers in Eng. Edu of Bangladesh and other developing countries may consider these findings for improving the conditions that will facilitate in enhancing students' readiness and related factors that will in turn support implementing OBE. The findings of this study may guide curriculum designers and educators in implementing OBE approach in new settings. Understanding the factors that influence students' readiness to adopt OBE allows for the identification of specific areas that need attention during the implementation process. For example, this study reveals that students' motivation and self-efficacy are critical determining factors of students' readiness. Thus, curriculum designers for OBE can incorporate strategies that foster intrinsic motivation and provide opportunities for students to develop their self-efficacy. Since OBE implementation is at the initial stage in Bangladesh, the findings from this study may guide institutional decision-making processes related to the adoption and implementation of OBE approach. Universities and other educational institutions may use the insights gained from this study to assess the feasibility and potential challenges that may be encountered during the implementation process. The insights may also help administrators to make informed decisions, allocate resources effectively, and plan for necessary infrastructure or faculty support. The findings may also inform the provision of students' support services to facilitate their readiness for the new teaching approach. For example, the study uncovers that perceived easiness has a positive impact on students' readiness. Since perceived easiness can be facilitated through support and guidance, universities can establish peer mentoring programs or support networks where experienced students can guide and assist their peers in adapting the new approach. Additionally, counseling services can be offered to address potential concerns or anxieties students may have during the transition process. Additionally, counseling services can be offered to address potential concerns or anxieties students may have during the transition process, which may even prevent student dropouts [109].

Theoretically, the study contributes to the understanding of the factors that influence students' readiness towards adopting a new instructional approach (OBE) in the context of educational innovation. By identifying and examining these factors, the study may enhance our knowledge of the underlying mechanisms that shape students' preparedness to embrace new teaching approaches. This knowledge may inform the development of theoretical frameworks that better explain and predict student readiness in similar contexts. Secondly, the study fills gaps in the literature by exploring students' readiness and its associated factors specifically in OBE implementation in the engineering domain. While research on students' readiness has been conducted in areas such as online learning [13], [21], [24], [26], [27,28], M-learning [32], professional accounting education [29], entrepreneurship education [15], and self-directed learning [40], there is a relatively no study that focuses specifically on engineering students' readiness to adopt OBE approach. By examining readiness in this context, the study provides valuable insights into the unique challenges and opportunities faced by engineering students when adopting new teaching approaches. This fills a gap in the literature and extends our understanding of readiness beyond the broader educational context. Furthermore, the study challenges existing theories by highlighting the differential impact of existing factors across engineering domains. Existing theories on readiness may have been developed and tested primarily in non-engineering educational settings, and their applicability to engineering disciplines may be limited. For example, Rhaffor et al. [34], emphasized the impact of teachers commitment for a smooth transition to a new teaching approach. Similarly, Altun [41] and Mart [40] reported positive influence of teachers' commitments on students' self-efficacy and motivation. However, the result of this study indicates that there is no direct significant influence of teachers' commitment on students' readiness to implement OBE. This contradicting result may serve as a glimpse on how existing factors operate differently in the engineering domain, and thus, challenges researchers and theorists to expand and adjust their conceptual frameworks to encompass the unique context of engineering education.

6. Limitation and future study

First, limitation of the study was the significant number of male participants (80.8 %). This could have skewed (biased) the outcome in terms of how gender affects behavioral intention. We have to acknowledge the fact that, the number of female students in Eng. Ed of Bangladesh is comparatively lower than other education sectors [104,105]. Secondly, the scale used in measuring students' perceptions towards OBE implementation was applied for the first time in the context of the study. Though the measurement model was typically adequate, the fact that some items had insignificant loadings, which suggest that they were not pertinent for capturing the construct in the context. To determine the most relevant indicators of students' readiness factors in Eng. Ed of Bangladesh, future research may begin with including other factors form in depth qualitative research. Another limitation of this study is that, it only used students' self-reported survey data to assess their readiness for implementing OBE, which may be subjected to bias, that is, students may not be entirely truthful or may not accurately express their views towards the phenomena, leading to inaccurate or unreliable data. However, in order to minimize this, the invited participants only from those sections (classes) where implementation of OBE had started so that they should express their understanding towards the phenomena. Therefore, collecting qualitative data through structured or semi-structured interviews with some of the participants, may assist to triangulate the data which assists to validate the findings of this study. Future research may consider data triangulation techniques to acquire a deeper understanding of the variables influencing students' readiness for implementing OBE in Eng. Ed of Bangladesh. Another important limitation in this study is that, the selection of participants was made based on the engineering domains implementing OBE in the university at the moment of conducting this research. However, the selected domains (EEE, CSE, CEE, and MPE) are the major stems from which other emerging engineering fields evolved. They also represent the major engineering domains that are offered in almost all the engineering universities in the country. Nonetheless, inclusion of more engineering domains would provide a comprehensive understanding of the factors influencing students' readiness to OBE implementation in engineering education. Future research may explore students' readiness in other additional engineering domains, such as chemical engineering, aerospace engineering, biomedical engineering, software engineering

and more, to enhance the generalizability of the results.

Ethical approval consent

This study followed the procedure approved by the 48th meeting of the Committee for Advanced Studies and Research of the Islamic University of Technology University, Bangladesh country under the resolution 7, Dated on 13 July 2021. Informed consent was obtained from all participants prior to data collection.

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Md Shahadat Hossain Khan: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Conceptualization. **Nafiu Salele:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **Mahbub Hasan:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **Benadjih Oiriddine Abdou:** Writing – review & editing, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

SA	Students' Awareness
SA1	I am aware that Outcome Based Education (OBE) is being implemented in IUT.
SA2	I am aware of Program Outcomes (POs).
SA3	I am aware of Course Outcomes (COs).
SA4	I am aware of the methods applied to measure Program Educational Outcomes (PEOs).
SA5	I am aware of the methods used to measure Course Outcomes (COs).
SA6	I am aware of the learning domains **(Bloom's Taxonomy)** specified for each Course Outcome (CO).
SA7	I am aware that OBE involves assessment techniques to measure my performance.
SA8	I am aware that assessments such as tests, reports, assignments, and final exams are considered as direct measurements of my academic performance.
TC	**Teachers' commitment**
TC1	Teachers explain the Program Outcomes (POs) of the courses at the beginning of the semester.
TC2	Teachers explain the Course Outcomes (COs) of the courses at the beginning of the semester.
TC3	Teachers are committed to make Information on OBE available and accessible to everyone in IUT.
TC4	I believe that teachers are putting effort to improve their teaching methods to achieve Course Outcomes (COs)
TC5	I believe that teachers are working hard to ensure all students attain the Course Outcomes (COs).
TC6	Teachers clearly explain the evaluation and assessment procedure, including marks distribution that is linked with Course Outcomes (COs)
TC7	Teachers Course Outcomes, Cos for assessment activities (quizzes, assignments, presentations, projects, and exams).
PE	**Perceived Easiness**
PE1	It is easy for me to understand the course outline provided by the course teacher.
PE2	It is easy for me to understand the course plan supplied by the course teacher.
PE3	It is easy for me to acquire knowledge from those courses that follow OBE.
PE4	Implementing OBE-based courses makes it easy for me to explore additional information from other means of learning (videos, relevant texts, and discussion).
PE5	It is easy for me to follow teachers' teaching style (method).
PE6	I can easily handle the tools/instruments or technologies used during class sessions.
PE7	It is easy for me to participate in teamwork and present my opinion during the teaching and learning.
IS	**Institutional Support**
IS1	I am always supported by the course teacher in the teaching, learning, and assessment process.
IS2	I am being supported by an advisor who always cares about my concerns.
IS3	I am being supported by library staff to find the required materials for study.
IS4	In the Laboratory, relevant equipment is always provided to support our practical sessions.
IS5	Laboratory staffs are supportive in the sessional classes.

(*continued on next page*)

(*continued*)

SA	Students' Awareness
IS6	I am being supported by my department regarding my academic progress.
IS7	I believe my institution is doing its best to provide a favorable environment for study.
IS8	I believe my institution is supportive for implementing OBE.
IS9	I believe my institution is providing the necessary training to understand and implement OBE.
SM	**Students Readiness (Students Motivation)**
SM1	I am motivated when I can successfully complete the tasks distributed in a course.
SM2	I think I enjoy learning very much when courses are OBE-based.
SM3	Improving my knowledge and competence through OBE motivates me to learn more.
SM4	I am motivated when I realize the long-term benefit of the knowledge I learned through OBE.
SM5	I am motivated by OBE because it provides me with an opportunity to strengthen my relationship with my teacher.
SM6	I am motivated by OBE because it provides me with an opportunity to strengthen my relationship with my classmates.
SM7	I am motivated by OBE because it provides me with an opportunity to be actively involved in learning activities.
SM	**Students' Readiness (Self-efficacy)**
SE1	I feel confident in performing the basic activities guided by the OBE.
SE2	I feel confident in my knowledge and skills of how to engage in my learning activities by following OBE.
SE3	I feel confident in attending teaching sessions followed by the OBE.
SE4	I feel confident to ask questions to my teachers in OBE-focused classroom teaching.
SE5	I feel confident to seek help from my teachers when needed.
SE6	I feel confident to express my opinions to teachers respectfully.
SE7	I feel confident to work in groups in OBE-focused teaching and learning environment.

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