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School Facilities as a Potential Predictor of Engineering Education Quality: Mediating Role of Teaching Proficiency and Professional Development

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Abstract:
Besides the importance of educational institutes there is still need to do some work in Indonesian educational institutes to improve their quality of education. Even Indonesian educational institutes try to improve their quality of education but there is still need to identify the reason why these universities are not included among the top ranking universities in the world. So, this study explores the influence of school resource on educational quality. The purpose of the current study was to examine the influence of school facilities on engineering education quality while mediating by teaching proficiency and professional development in Indonesian educational institute. The study was descriptive and quantitative in its nature. The questionnaire method was used for data collection. The respondents of this study were teachers of universities in Indonesia. Data collected from 384 university teachers. The unit of analysis of the study was individual and study was cross sectional in nature only one time data were collected from teachers. Further, the simple random sampling technique was used for data collection. In this study, the data were analyzed by using SMART PLS. The finding of the study shows that there was significant and positive relationship among all variables such as engineering education quality, school facilities, teaching proficiency and professional development.

Keywords: *School facilities, teaching proficiency, professional development, engineering education quality*

I. INTRODUCTION

Indonesia is now facing different challenges regarding the education system because the policy makers have to ensure the need fulfillment of approximately 375+ ethnicities, 700 languages and six minorities with one major religion Islam(Ananta, Arifin, Hasbullah, Handayani, & Pramono, 2013; Indonesian Central Agency on Statistics, 2010). Currently, Indonesia possess world's fourth largest education system. Higher education institutions have made major developments over the period of time. Most of them are not too much old rather they made valuable and remarkable progress in this regard(Logli, 2016). Besides the great developments have been made with regard to improve the education quality of Indonesian institutions relatively there still exists some problems as well (Welch, 2012). No Indonesian university is ranked among top universities in the world which stands as a key question regarding the quality of education in Indonesia(OECD/Asian Development Bank, 2015).

The Indonesian education system has developed over the years which can be divided into pre-independence and post-independence. A major development was made in 2012-13 when 35 community colleges were established across the

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Indonesia and the government of Indonesia also aimed to establish 500 more community colleges in next five years as well. The purpose the community colleges is to provide with up to 2 years of vocational education to the students especially in the areas of manufacturing, nursing, automotive technologies etc. Furthermore, for their quality assurance they were supported by the different universities. Such as Bogor Agricultural University provided assistance in establishing the four community colleges(Clark, 2014).

Quality of education and services is the emerging issues the higher education of Indonesia. In this regard it has been stated that quality internet is not available in most of the higher education institutions. Besides this other challenge have also been highlighted in the education sector. In the distance education there are several factors highlighted which dampened the education quality such as technological limitations, virtual teaching platforms, training of both the students and teachers regarding the use of technology for education purpose. Besides this other challenge also exist which undermined the quality of education namely; qualified teachers, productive coordination of institutions which do offer the distance education and resources availability. From resources point of view financial problems are also being faced by the Indonesian education sector. In this regard it has been pointed out that government has reduced the funding allocation for the education over the years which has pushed the universities to increase the fee and thus on average an Indonesian household have to spend almost 1/3rd of its yearly expenses on the higher education(OECD/Asian Development Bank, 2015).

Having in mind the challenges and problems pointed out the literature the current study has focused on the resources availability with the higher education institutions and their impact on the education quality of these institutions. The focus of the study is on the education because it is playing a key role in the country development and regarded as a core component in the society. In this regard it has been argued that education is one of the key factor which can scale up the life standards. The core focus of the study is the engineering education quality. Regarding the education quality it has been argued that it can potentially influence the overall economic growth of a nation over the period of time (Hanushek & Woessmann, 2010). At this point it is worthy to mention the remarks of the Porter (2008) regarding the education quality, he argued that government must provide the nation with quality education with the primary objective to get the improved and productive human resource. Further he also stated that individuals with the knowledge are regarded as beneficial and serve as a competitive advantage for their respective countries.

The growth of Indonesian education sector over the years has been remarkable. The government is trying to provide the education to the public at convenience and making sure that everyone gets the education. However, in the concern to ensure the education provision something has been left behind which is quality of education in different aspects. Previously studies have argued that over the years in provision of the education certain factors such as assurance of sufficient staff, research and facilities have left behind (OECD/Asian Development Bank, 2015; Welch, 2011). Furthermore, it has also been stated that qualified teaching personal, quality research, equipment ask for a budget which is not available and it resultantly have created a gap to fulfill the demand. The aforementioned factors are rare to find in the universities (Soedijarto, 2009). In addition Moeliodihardjo, Soemardi, Brodjonegoro, and Hatakenaka (2012) argued that 70% of the higher education institutions' budget is spent on the personal costs which ultimately undermine the all other educational needs.At micro level the universities hire their own graduates which is purely biased choice in comparison to the competent one which further undermines the performance of teaching and finally lead towards the low engineering education quality (Logli, 2015).

The teaching quality get affected by the resources available which further do influence the quality of education. In this regard it has been argued that when the teachers are provided with the necessary resources and they can manage them well they will be more engaged in teaching and provide good education to their students. The resources available ensures that everything is available for the students learning, the necessary teaching material is available, there is no lack of physical infrastructures, there is sufficient human resource available etc. the absence of these factors lead towards the ineffective teaching. Alike it has also been added that when the colleges are not equipped with such facilities the teachers will not be able to do their job effectively which will ultimately result in inferior teaching quality and leave the teachers vulnerable(Pootrakul, 2014). The resources term in this study is broad which do include the range of factors.So bearing in mind the aforementioned factors the purpose of the present study is to explore the influence of resources over the quality of education. Therefore, the study will address the following research questions:

1. Do basic facilities, environment, and service influence the quality of education in engineering context?
2. Do the didactic resources influence the quality of education in engineering context?

Besides the resources impact on the quality of education, the present study has considered the role of teaching quality in the engineering education quality.Previously it has been argued

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that qualified teachers are required to improve the education quality regardless of discipline of study. So the lack of teaching quality can be improved by the providing adequate training to the teachers and other staff as well. Only the resources are not necessary for the quality education. Teaching quality in Indonesia is not satisfactory so it can meet with the demands of the changing world. There is lack of professional development found in Indonesia. It can be judged from the following fact that in 2017 only some 52 lecturers received grant to study abroad and 817 lecturers received the same grant to study within country. Similarly the research ratio of the faculty is 1071 per one million paper and it stands low in comparison to Malaysia and Singapore.The majority of the faculty of the education sector is not qualified up to the scale they should be. It is obvious from the figure that majority of the faculty is composed of having the master's degree which is quite alarming for the universities to provide the quality education. In addition to this Indonesia is about to face the shortage of almost 6000 lecturers in upcoming years. Following figure 1 is showing the education levels of the faculty present in the Indonesian schools.

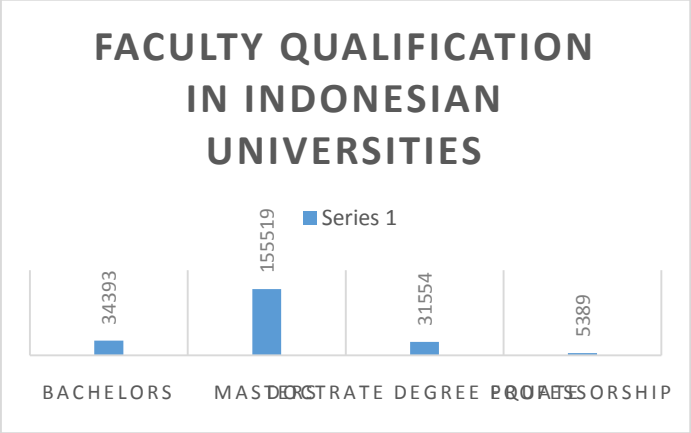

Figure 1

Source: Global Business Guide Indonesia (2018)

Therefore, the focus of the present study is also on the teaching quality which ultimately accounts for the education quality as well. In this regard following research questions will be entertained by the present study:

1. Do the teaching proficiency influence the education quality in engineering context?
2. Do the professional development influence the education quality in engineering context?
3. Do teaching proficiency and professional development mediate the relationship between basic, environment and service facilities and engineering education quality?
4. Do teaching proficiency and professional development mediate the relationship between didactic resources and engineering education quality?

The present study is aimed to investigate the influence of resources availability on engineering quality education. The study is significant in a sense that it will provide guideline to the policy makers while deciding about the funding to be allocated to the higher education. Furthermore the study will also provide evidence regarding how the education quality can be improved. In addition it will serve as a potential guideline regarding the need and importance for the resources required for the quality education especially in engineering context. The next section of the present study will elaborate the literature review, methods adopted, findings and future direction for further study.

II. Literature Review

Engineering Education Quality

When it comes to assess the development of a particular country lot of indicators comes in mind. Education also falls under the broad categories of the indicators used to assess the development of a particular country or nation. Having understood the importance of education majority of the organizations regardless of sector pay appropriate attention towards the education. General speaking education denotes to gain the knowledge however, researchers have defined it in various ways. Aristotle defines education as "The root of education is bitter, but the fruit is sweet"(Moorcroft, 2005). John Dewy has defined that the education is getting ready for the life rather it is a life itself. Whereas the education has been regarded as most influential tool which can be utilized to alter the world (Education for All, 2009). On the conclusive remarks it is stated that education goes beyond read, write and arithmetic. For survival in the market various skills are required namely; socialization, communication, collaboration, critical thinking and resolving the issues. These skills are regarded as important and asked by the people. Further these skills help to behave in a better way. In addition to these skills which are at personal level, there are some other skills as well, which are the core of the professional life are such as technical and occupational skills which help to survive in market(World Bank Group Education Strategy, 2002).

Quality education is the point of concern for the present study which can be defined in different ways. The term quality almost have same meaning for the education as it do have for the manufacturing and services sector. Its multifaceted concept which cannot be pen down in a single line or assesses by a single indicator of some specific domain rather it is quiet broad term.Education quality has been associated with different factors such as conformity with the specs, value,

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avoidance of defects and useable etc. Cheng and Tam (1997) defined "education quality" in a multi-dimensional fashion as "the character of the set of elements in the input, process, and output of the education system that provide service that completely satisfy both internal and external strategic constituencies by meeting their explicit and implicit expectations." From the above mentioned definitions and terms associated with the education quality it is obvious that it can be measured by using different criteria. Input and process both are the broad key areas to assess the education quality. In this regard it is worthy to mention the points put forward by Saiti (2012) such as quality in context of education is closely linked with the accountability and how the system is being appraised to control it.

In this regard Pootrakul (2014), argued that when quality is focused and assured it do impact the strategy of school and it makes more sense in presence of competitive environment. Further, author also added that it is crucial instrument which can change the school strategy. Therefore, it is stated that school level quality assurance also applies in context of colleges which can also change their strategy and is one of the most important factor as well when it comes to satisfy the stakeholders.

School facilities

It is general phenomenon that schools with superior facilities do provide with best educational results as compared to schools with nominal school facilities. However the empirical evidence in this regard is also different according to some studied it exists and according to some it is not. Thus it provides the solid base to study this phenomenon. As per the literature the facilities can be categorized into two categories namely; basic, environment and services (building, water supply, and electricity etc.) whereas the second type of facilities is the didactic resources namely; laboratories, sports complex, library and information and communication technologies(Kassis, Graf, Keller, Ding, & Rohlfs, 2019; Olsen & Huang, 2019; Pootrakul, 2014).

Basic facilities are very much broad in a sense that they include the very small and needed facilities. These facilities help the students very vastly. They range from the necessities such as lights, air quality in classroom, rooms are noiseless or not, they are acoustical controlled or not, building condition if satisfactory or not, are there enough labs for students etc.Going on further Tableman and Herron (2004)argued that when the school have all the facilities which are also supportive to the students, teachers and learning environment will ultimately improve the teaching proficiency which finally lead towards the improved education quality.When the teachers do have the adequate facilities to be used while they are teaching it will impact positively on their teaching which do improves the quality of education(Bubić & Ljubetić, 2016).

From the building point of view it has been stated that it do influence the students' performance. Earlier Fritz (2007)studied the influence of new and old school facilities and concluded that there was a significant difference in students' performance before and after going to the new building. From the engineering education perspective when the teachers are provided with the science labs and computer labs they tend to be more optimistic regarding their education delivery methods. They tend to use all the means optimally available to deliver the content to the students which finally lead towards the teachers' satisfaction and improved quality of education.Whereas the poor learning environment demotivates the teachers as they are unable to deliver the content they wanted to which undermines the overall quality of education.

Previously studies have reported that the school facilities do influence the teaching. Importantly Buckley, Schneider, and Shang (2004b)conducted a study in Chicago and Washington D.C, USA. They collected data from large number of teachers. The findings of their study enlighten that teachers preferred to stay at the schools were the environment and the facilities were good. It means that the teachers choose the schools with superior facilities as they facilitate their teachings. In addition they also reported that approximately 33% and 50%+ teachers of Chicago and Washington respectively were dissatisfied with their school facilities. Interestingly the environment were found to be most highlighted issues in those schools were teachers were not satisfied as it do influence their working. Furthermore, the noise and air control systems were also reported to be affecting the teachers' teaching in that schools due to which they reported to be dissatisfied. The teachers reported that they can't bear such kind of facilities and they attempted to switch the school as well or likely to do in near future. Similar to this, Bishop (2009) conducted a study on the school facilities by considering only few variables namely; ventilation and climate control systems they reported that the schools with such god facilities have a positive impact on the behavior of the teachers and school staff as well.

Besides these studies there are other studies are available as well which do report that the school facilities do influence the teaching quality for sure. Notably, Leung, Chan, and Wang (2006)conducted a study to explore the impact of facility management on the behavior of the teachers regarding their work. Their study revealed that the teachers and staff found to be more effective and efficient when they were provided with the sufficient and relaxing facilities in comparison to non-provision of such facilities.Buckley, Schneider, and Shang (2004a), pointed out that the school facilities cannot be

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ignored as they do have a significant relationship with the teaching quality. From the above mentioned literature review it is concluded that the basic facilitiesof the schools do influence the teaching quality. If the teachers are provided with the sufficient resources they tend to be more productive and more positive regarding their job(Hernandez, 2019).

Didactic Resources

Previously various studies have reported that when it comes to a teacher his or her satisfaction, commitment and behavior gets affected by the social dynamics. Which ultimately affects the student's accomplishment (Anderson, 1982; Hoy, Tarter, & Bliss, 1990; Ibrahim & Al-Taneiji, 2019; Subbarayalu & Al Kuwaiti, 2019; Tarter, 1995). So it is argued that when the teachers' behaviors get affected by the resources provided to them or they do not get the sufficient resources, their feeling of helpless will ultimately affect the education quality in context of student achievement.From the resources availability and its impact on the education it is important to mention the findings of Hamzah, Mohamad, and Ghorbani (2008)as in their study they found some high performing schools with quality education and resource availability was one of the main reason for optimal performance. They reported that most importantly the resources were made available so that the students can benefit more from them, learn and education standard of the students gets improved.

H1:*Basic facilities, environment and services significantly influence the teaching proficiency.*

H2: *Basic facilities, environment and services significantly influence the teaching professional development.*

Teaching Quality and Engineering Education Quality

Teaching quality is not a new phenomenon which is being studied in the domain of education. It has been previously studied from different perspectives. In this regard argued that Jamil (2014) argued that teachers are recognized as a most vital factor or agent which do positively contributes towards the improved education quality more importantly when it is talked about the student learning phenomenon.So to improve the education quality it is necessary that some consideration should be paid to the teachers as well. Regarding the importance of professional development of the teachers Jamil (2014) argued that it should be focused extensively as when the teachers are trained and provided with certain upgraded skills set their performance will increase which will ultimately scale up the quality of education and also influence the student development in positive way. That's why the teaching quality has become a vital issue in domain of education.

When it comes to assess the education quality the first factor which comes in mind is the mental readiness of learner then teacher. Whereas the present study has focused on the teachers regarding the assessment of education quality. Teaching quality is they key determinant of the education quality as it directly do influence and have direct link with the learners in both the school and university scenarios. In this regard it is important to mention the findings of McKinsey & Company (2007), according to which the major driver for the students learning is the quality of teacher at school. They surveyed different schools and reported that the students which were studying under high performing teachers will advance three times more in comparison to the students which were studying under low performing teachers. In addition to this they also reported that schools having high performance accomplish this by recruitment of qualified teachers, they persistently develop their teachers skills and abilities and provide them with the opportunity to go for development workshops. Finally they conduct training sessions regularly at their schools for the teacher development. Some other studies have also found that the quality of teaching is ultimate predictor for the quality education such asDarling-Hammond (2000)in a study reported that in presence of a good quality instructor student's accomplishment tends to improve significantly. Alike Heck (2009) also pointed that the effectiveness of instructor positively affect the performance of a student with regard to reading and mathematics. Similar to previously mentioned studies De Paola (2009)conducted a study in Italian universities and reported that there is significant positive relationship between teacher quality and students performance.

Based on the above-mentioned studies it is stated that when a teacher is proficient in his or her teaching it will ultimately improve the education quality. The professional development of a teacher also signifies his or her teaching performance which finally affect the quality education. It has been argued that the teachers' well-being and professional development serves as a significant predictor for the quality education. It is widely accepted that when the professional development of teachers exert positive influence on their personal satisfaction and improves the overall education delivery(Jamil, 2014). Previously various studies have mentioned and reported that positive impacts of the teachers' professionalism on the students and education as well(Lake & Holt, 2019; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

Notable Harwell (2003) stated that the teacher should be competent and qualified for the better development of the students' abilities and provide them knowledge and new set of skills as well. With regard to teacher professionalism it has been proved that it do influence and contribute towards the student accomplishment. Further it has also been reported that

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there is a relationship between professionalism and teaching quality and its overall performance(Desimone, 2009; Wei, Andree, & Darling-Hammond, 2009). Besides this how the teacher deals the classroom his or her practices in class room and teaching style also gained much important over the years. It is also acknowledged that how the teachers are teaching and their class room dealings do influence and enhance the learning of students. Consequently, it adds to the overall improved education quality and positive learning (Hattie, 2012; Hayes, Mills, Christie, & Lingard, 2006).At this point it is worthy to mention that teachers is the most important factor which do contribute and affects the accomplishment of students(Hanushek & Woessmann, 2010). The presence of highly qualified professional teachers tend to influence the students positively and lead them towards the positive learning outcomes which can't be done in presence of low qualified teacher.

Based on the above-mentioned literature it can be concluded that teacher proficiency influences the students positively. When the teachers are provided with the appropriate training and development opportunities they get satisfied with their jobs which in turn improves their overall teaching performance. Being an important aspect of the education they serves as a tool for the improved education. Similar scenarios are also applicable to the engineering discipline. When the teachers are provided with the sufficient training regarding the equipment and new teaching methodologies then tend be more satisfied with their profession which in turn improves the overall education system. The better education provided to the students results their outclass performance in tests and exams. So it is hypothesized that:

H3: *Teaching proficiency is significantly associated with the engineering education quality.*

H4:*Teacher's professional development is significantly associated with the engineering education quality.*

H5a:*Teaching proficiency is a significant mediator between relationship of basic facilities, environment and services and engineering education quality.*

H5a: *Teaching professional development is a significant mediator between relationship of basic facilities, environment and services and engineering education quality.*

H6a: *Teaching proficiency is a significant mediator between relationship of didactic resources and engineering education quality.*

H6a: *Teaching professional development is a significant mediator between relationship of didactic resources and engineering education quality.*

Following figure 2 is showing the research framework for the present study:

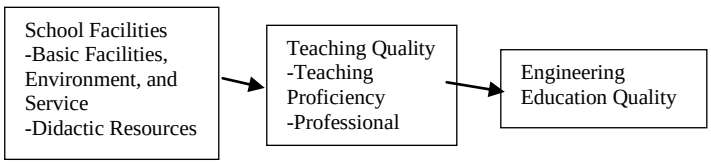

Figure 2

III. METHODOLOGY

Engineering education has become a significant study discipline over the years and is being offered in diverse fields. Besides this the quality of education has become a serious concern for the universities and all the stakeholders associated with it. Having understood the importance of engineering education and its quality the study has tried to explore the impact of school facilities and engineering education quality. In this regard basic school facilities and didactic resources have been considered as key determinant for the quality education which further lead towards the improved education quality. The nature of study is quantitative and descriptive. Being a cross sectional study data has been collected for one time only.

Population of the study was the teachers teaching in the Indonesian universities. As per the previously mentioned statisticsthere are 226855 teachers in Indonesian universities(Global Business Guide Indonesia, 2018). The next step was to select the appropriate sample size for the present study as it is not possible to collect data from the whole population. For sample size selection Krejcie and Morgan (1970) table has been used as the exact figure of the population is known. As per the table sample size for the present study is 384 respondents.

Data has been collected by using the questionnaires. Data were collected doing personal visits in the universities and also by hiring the surveyors. The questionnaire contained questions regarding two types of variables namely; demography and variables. Initially a meeting was held with the deans of the respective engineering schools to gain the permission for data collection. After obtaining the permission for the data collection and after gaining the acceptance to participate in the study the questionnaires were than distributed.

The measures for all the variables were adapted from the previous studies. Teacher professional development was measured by using five items measure. Teachingproficiency was measured by using 11 items measure(Lowe, 1990). Furthermore, five items were used to measure the basic school facilities (Leu, 2004)and six items were used to measure the didactic resources.Education quality was also measured by using five items scale(Mumtaz, 2000). All the scales were adapted from the previous studies. Smart-PLS was used for data analysis. It is used when the purpose is to testthe theory

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or predict variable. The purpose of the study is to predict the education quality from the school resources perspective thus PLS-SEM seems to be appropriate tool for testing. Furthermore, confirmatory factor analysis has been perfumed to assess the measurement model of the present study. The next section will elaborate the study results in detail.

IV. FINDINGS

Table 1
Confirmatory Factor Analysis

Constructs	Items	Loadings	Alpha	CR	AVE
Basic Facilities, Environment and Services	BF ES1	0.83	0.827	0.886	0.662
	BF ES2	0.838			
	BF ES3	0.71			
	BF ES4	0.867			
Didactic Resources	DR 1	0.819	0.827	0.876	0.551
	DR 2	0.841			
	DR 3	0.726			
	DR 4	0.409			
	DR 5	0.754			
	DR 6	0.817			
Engineering Education Quality	EQ 1	0.785	0.776	0.851	0.554
	EQ 2	0.827			
	EQ 3	0.838			
	EQ 4	0.827			
	EQ 5	0.289			
Teaching Proficiency	TP1	0.711	0.846	0.886	0.566
	TP2	0.685			
	TP4	0.749			
	TP5	0.772			
	TP6	0.802			
	TP7	0.789			
Teacher Professional Development	TP D1	0.88	0.887	0.917	0.691
	TP D2	0.809			
	TP D3	0.888			
	TP D4	0.856			
	TP D5	0.71			

Before proceeding to the inferential statistics it is necessary to assess the validity and reliability of the scale. In such case the present study has assessed the measurement model by using the confirmatory factor analysis which provides the reliability and validity of the instrument used in the study. Confirmatory factor analysis provides information regarding three parameters namely; composite reliability, average variance extract and factor loadings.

First of all the reliability value for each individual scale are provided in the above table 1. The reliability values for the variables namely; basic facilities, environment and services, didactic resources, engineering education quality, teaching proficiency and teacher professional development are 0.827, 0.827, 0.776, 0.846 and 0.887 respectively. The values for the Cronbach's alpha must be greater than 0.7. As per the findings reported in table 1 all the values are greater than 0.7 which affirms that scale is reliable and also confirms the internal consistency of the scale as well.

Secondly table 1 is also showing the values of the composite reliability for the variables. The values of CR for the variables namely; basic facilities, environment and services, didactic resources, engineering education quality, teaching proficiency and teacher professional development are0.86, 0.876, 0.851, 0.886 and 0.917 respectively. As per the criterion the value for CR must be greater than 0.8 and as per the table 1 findings all the values for CR are greater than 0.8 which affirms the composite reliability of the scale.

Thirdly table 1 is also showing the values for the average variance extract which is the last criterion for the convergent validity. The value of AVE for the variables namely; basic facilities, environment and services, didactic resources, engineering education quality, teaching proficiency and teacher professional development are0.662, 0.551, 0.554, 0.566 and 0.691 respectively. As per the parameter the values for AVE should be greater than 0.5 and as per the findings highlighted in table 1 all the values for AVE are greater than 0.5 which affirms the convergent validity.

Discriminant Validity

Table 2
Fornell-Larcker Criterion

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	BFES	DR	EQ	TP	TPD
BFES	0.813				
DR	0.453	0.743			
EQ	0.555	0.561	0.744		
TP	0.608	0.577	0.672	0.752	
TPD	0.54	0.569	0.729	0.628	0.831

After the convergent validity is established the next step is to assess the discriminant validity of the scale which also comes from the confirmatory factor analysis as well. In this regard there are different techniques being used. Table 2 is showing the values for the Fornell-Larcker criterion values. As per the parameter of this technique the values of the correlation of a variable must be greater than its correlation with other variables. The findings in table 1 are showing and satisfying the parameters of the Fornell-Larcker Criterion. Thus, discriminant validity is established.

Table 3
Cross Loadings

	BFES	DR	EQ	TP	TPD
BFES1	0.830	0.334	0.444	0.454	0.413
BFES2	0.838	0.372	0.415	0.505	0.374
BFES3	0.710	0.362	0.409	0.445	0.474
BFES4	0.867	0.398	0.523	0.562	0.485
DR1	0.404	0.819	0.519	0.532	0.541
DR2	0.349	0.841	0.371	0.401	0.406
DR3	0.367	0.726	0.411	0.429	0.389
DR4	0.224	0.409	0.322	0.284	0.245
DR5	0.327	0.754	0.48	0.49	0.486
DR6	0.305	0.817	0.339	0.362	0.379
EQ1	0.415	0.47	0.785	0.54	0.569
EQ2	0.411	0.444	0.827	0.589	0.585
EQ3	0.507	0.478	0.838	0.54	0.641
EQ4	0.487	0.468	0.827	0.549	0.6
EQ5	0.144	0.1	0.289	0.138	0.185
TP1	0.452	0.364	0.491	0.711	0.464
TP2	0.422	0.363	0.483	0.685	0.442
TP4	0.443	0.466	0.52	0.749	0.504
TP5	0.461	0.433	0.552	0.772	0.517
TP6	0.492	0.488	0.489	0.802	0.449
TP7	0.474	0.483	0.496	0.789	0.457
TPD1	0.465	0.512	0.6	0.471	0.880
TPD2	0.454	0.445	0.591	0.597	0.809
TPD3	0.459	0.505	0.672	0.527	0.888
TPD4	0.471	0.521	0.674	0.513	0.856
TPD5	0.393	0.361	0.465	0.518	0.710

Table 3 is showing the values for the cross loadings. As per the parameter the values of cross loadings for a particular variable must be greater than the other variables in the same column. Findings reported in table 3 are fulfilling the conditions for the cross loadings to be valid, therefore it further strengthen the presence of discriminant validity.

Table 4
HTMT

	BFES	DR	EQ	TP	TPD
BFES					
DR	0.543				
EQ	0.672	0.670			
TP	0.724	0.678	0.801		
TPD	0.628	0.646	0.850	0.731	

Finally the study has also used the latest technique which is Heterotrait-Monotrait Correlation Ratio. According to this technique the values for the correlation between all the variables should be less than 0.85. It is obvious from the table that the values of correlation between all the variables are less than 0.85. Therefore, it is stated that results established the discriminant validity with respect to old and new techniques as well.

Table 5
Structural Equation Modeling

	Beta	SD	t value	p value	Decision
BFES -> TP	0.436	0.028	15.318	p<0.05	Supported
BFES -> TPD	0.356	0.029	12.331	p<0.05	Supported
DR -> TP	0.380	0.030	12.565	p<0.05	Supported
DR -> TPD	0.408	0.032	12.739	p<0.05	Supported
TP -> EQ	0.353	0.030	11.825	p<0.05	Supported
TPD -> EQ	0.507	0.032	15.992	p<0.05	Supported

Structural equation modeling has been used to test the underlying hypothesis of the present study. Table 5 is showing the relationships between the variables. Basic facilities, environment and service found to have a positive relationship with teaching proficiency and professional development valued at 0.436 and 0.56 respectively. The relationship is significant and thus supported the hypothesis. Based on this finding it can be established that when the teachers are provided with the necessary facilities at school or college they

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will be more motivated towards the teaching. When teachers are trained with the time it ultimately develops them and their teaching skills. Further it is also established that when the teachers are provided with the necessary facilities at schools, it ultimately assist them to teach better as they are provided with everything they are in need of.

Results are also showing a positive impact ofdidactic resources on teaching proficiency and teacher professional development. Both of the relationships are valued at 0.380 and 0.408 respectively. Didactic resources found to have a strong positive impact on teaching professional development as compared to the teaching proficiency.The results establish thatwhen the teachers are provided with the better infrastructure facilities they tend to be more proficient. When the appropriate infrastructure is in place then everything will go in good side. Finally the results reported a positive impact of both the teaching proficiencyand professional development on the engineering education quality. The both relationships are valued at 0.353 and 0.507 respectively. This highlights that when the teachers are satisfied with their profession they tend to be more enthusiastic regarding their profession which will ultimately improve the education quality. All the relationships are significant and thus all the hypothesis are supported.

Table 6
Specific Indirect Effects

	Beta	SD	t value	p value	Decision
BFES -> TP -> EQ	0.154	0.017	9.273	p<0.05	Supported
DR -> TP -> EQ	0.134	0.017	8.100	p<0.05	Supported
BFES -> TPD -> EQ	0.180	0.020	9.225	p<0.05	Supported
DR -> TPD -> EQ	0.207	0.021	10.02	p<0.05	Supported

Table 6 is showing the mediation results for the relationships. Teaching proficiency found to be a positive and significant mediator between the basic facilities, environment and services and engineering education quality. Furthermore it also found to be a significant mediator between association of didactic resources and education quality. It can be stated that when the teachers are satisfied with their school environment and they are provided with the necessary things they will feel it easy to deliver the content they wanted to. It will finally improve the education quality.

Finally the results also showed that professional development is also a significant mediator between the relationship of basic facilities, environment and services and engineering education quality. Furthermore it also found to be a significant mediator between association of didactic resources and education quality. It is established that when the teachers are provided with the resources they are required to teach effectively they will groom professionally. In addition to this when the teachers are provided with the training and opportunity to go for the workshops for their professionaldevelopmentthey will be become more quality oriented and will ultimatelyimprove the quality of education they are providing to the students.

Discussion

The objective of the current study is to examine the impact of school facilities on engineering education quality while mediating by teacher's proficiency and professional development. The school facilities affect the teacher's performance when teachers are provided with health trainings and development opportunities, and the quality of teachers can be improved. Similarly, the best teachers can perform better in educational institutes and the quality of student also improved. Hence, when educational institutes provide better facilities the teachers ability is going towards the betterment and the quality of education also go towards improvement. Therefore, the findings of this study supported the 1st and 2ndhypotheses that are the school facilities have significant and positive relationship with teacher's quality. The Basic facilities, environment and services significantly and positively influence the teaching proficiency and basic facilities, environment and services significantly influence the teaching professional development. The schools with the best facilities try to provide the best teachers and best training facilities to their teachers to improve the teacher's quality in sense of their teachers proficiency and teachers development. Previous studies also support the 1st and 2nd hypotheses (Anderson, 1982; Hoy et al., 1990; Ibrahim & Al-Taneiji, 2019; Subbarayalu & Al Kuwaiti, 2019; Tarter, 1995). The teacher's quality affects the educational quality because it is the source of improving the education system and they are one of the important sources to induce knowledge in students mind. Moreover, the results of the study also supported the 3rd and 4th hypotheses, its shows that teaching proficiency and teacher's professional development has significant and positive relationship with engineering education quality. Previous results also provide support to above mention discussion related to 3rd and 4th hypothesis(Darling-Hammond, 2000; Jamil, 2014). Furthermore, school facilities one of the best source to encourage the quality of education but unless until school does not have better teachers there educational quality cannot produce better results. Similarly, the 5th and 6th hypotheses also supported by the previous researches it shows that teaching proficiency and teachers teaching development mediates the relationship of school facilities and engineering education quality (Hanushek &

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Woessmann, 2010; Hattie, 2012; Hayes et al., 2006; Leung et al., 2006).

Limitations and Future Directions

Nothing can be done in this world without any deficiencies, this study also have some limitation and provide a loop for future studies. The educational institutes in Indonesia need intensive research work, so this work is beneficial for the policy makers of educational institutes to enhance their productivity and develop the students in a long run. The study is cross sectional in nature, further studies can be done in longitudinal bases collect data from more than one point of time. The data is collected from Indonesian universities in future data can be collected from other country universities that are included in top ranking universities to set the bench mark for Indonesian universities. The unity of analysis of this study is teachers of teaching universities but in future researcher can study the student's perspectives also for gaining in depth review of school facilities and teaching quality influence on engineering education quality. The mix method approach could provide clearer picture of the school facilities and teachers quality effect on education quality.

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