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The Effectiveness of Humanities Courses in Producing Well-Balanced Engineering Graduates: A Study on Engineering Universities in Bangladesh

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ABSTRACT

The study strives to generate deep insights regarding the effectiveness of humanities courses that have been integrated into the academic curricula of engineering programs. The opinions of students and teachers surveyed from two leading engineering universities in Bangladesh. The results reflected that humanities aspects have been integrated into the engineering curricula to a limited extent. The t-test results indicated that there are significant variations in the opinion given by the two groups regarding the improvement of students' soft skills, socio-economic-environmental responsibilities, and mental-thinking process. Students identified that the inability of some teachers to grow interest in the course and relate course contents to the real-life world is hindering desired benefits. Similarly, teachers identified factors such as lack of student interest, inadequate logistics and administrative support, short-sighted curricula, over course load, and low status from the engineering departments are hindering the effectiveness of humanities courses to produce well-rounded engineering graduates. Thus, concerned authorities need to realize the fact that humanities courses are an essential part of a well-rounded education for engineering programs.

1. Introduction

Training well-rounded engineers with strong cultural and social understanding besides technical knowledge has been a topic of interest in academic and industrial circles since the 1940s. In the developed world (e.g., USA, Canada, UK, Australia, and China) the accreditation board has made it compulsory to integrate humanities and social science courses to train well-rounded engineers who will be flexible and adaptable to dynamic social changes. By the same token, engineering universities in Bangladesh have integrated humanities and social science courses at the undergraduate level so that engineering students can develop a strong cultural, philosophical, and ethical sense and become good citizens of the nation.

But the humanities courses are sometimes regarded as sideline courses to engineering education. Josa & Aguado identified several factors that hinder humanities and social science courses from integrating into the engineering curriculum [1]. They are: "(1) resistance to change, (2) external influences on the curricula, (3) lack of guidelines, and (4) misconceptions about social sciences". In Canada, 'the Committee on Future Development of the Engineering Profession' in their report stated that

"engineering graduates …are generally very poorly informed as to the social, ethical, and legal implications of

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engineering practice. Current engineering curricula usually omit these topics in favor of increased technical course content… It is considered vital to the well-being of the profession that its future members be formally acquainted, during their undergraduate days, with the responsibilities which they must accept in their future practice - responsibilities to society, to employers or clients, to other professionals, and themselves, and to all ethical and legal requirements of such practice" [1].

Robert Ruprecht viewed that "Humanities courses seem to be soft in the eyes of scientists and engineers and thus these can only serve their purpose in technical education if they are integrated with the curriculum as branches with all the weight that other subjects have" [2]. Similarly, Barron, et al. stressed that humanities or social science courses need to be fully integrated into engineering curricula to encourage engineering students [3]. In this respect, Lang et al. stated that "engineering education at universities has not changed appreciably for decades, even though the need for curriculum reform has been acknowledged" [4]. Thus, the present study aims to generate deep insights regarding the effectiveness of humanities courses that are integrated into the academic curriculum of engineering programs in Bangladesh.

2. Review of literature

2.1 Industry Expectations

Humanities and social science courses include a heterogeneous mix of academic disciplines (social sciences and humanities) that "help provide answers and reflect on various dimensions of society and human behavior" [1]. Humanities studies have been viewed by Reiter as "a way to lean back, a way to openness, a way to accepting our smallness and a way to courage in a technical curriculum because they look at the same things from different viewpoints" [5]. Engineers are expected to be experts in their field of interest but at the same time, they need to respond to the changing needs of industries. The industry now needs engineers having the ability to think in the abstract, efficiency to innovate, competency to work in multicultural environments, the capability to understand the business context of engineering, and an ability to adapt to changing conditions [6]. Despite having technical skills, the industry also requires engineers with interdisciplinary, communication, negotiation, time-management, and leadership skills [7]. True emphasis on Humanities study can strengthen the abilities of engineers to meet the dynamic needs of contemporary industries.

Reiter noted that humanities studies "strengthen our global view, broaden our intellectual foundation, teach us to communicate clearly, help us to develop creative and critical thinking skills, teach us to be problem solvers, create engaged citizens and thinkers, reinforce cultural and ethical responsibilities and values, help us to understand the impact that science, technology, and medicine have had on society, and create well-rounded academics, students and thinkers" [5]. The author explains, "Science, Technology, Engineering Mathematics (STEM) aim to foster inquiring minds, logical reasoning, and collaboration skills…STEM focuses on perceived education quality shortcomings in these fields, to increase the supply of qualified high-tech workers" [5]. But to create enthusiasm and inspire lifelong learning, the instructor, must strive to provide students with "a well-rounded education that gives them the tools to succeed in tomorrow's society" underscored the need for studying world culture for engineering students to develop a global perspective [5]. Similarly, Reiter stressed the need to provide students of Science, Technology, Engineering, and Mathematics (STEM) information related to the Humanities—through Literature, Philosophy, Management, Economics, Sociology, and History— to navigate ever-changing and unpredictable human behaviour and its reactions [5]. Reiter also noted that "Studies in the Humanities can help students understand both the world and the minds of other individuals by focusing on inquiry-based methods to study world culture" [5].

2.2 Academia Expectations

Many academia stressed the need for training engineering students on socio-economic and ethical issues that engineers often face in the dynamic workplace [8]–[10]. Josa and Aguado [1] emphasized incorporating both hard skills and soft social skills for engineers who want to design socially sustainable activities. Basu emphasized the potential for teaching knowledge and skills that go beyond the students' discipline so that they can develop an interest in other disciplines, integrate and examine problems from different perspectives, and learn to develop innovative solutions to complex social problems [11]. Many authors believed that humanities studies in the engineering curriculum can significantly improve graduates' employability, problem-solving, communication, and teamwork skills [12]–[14]. Others argued that humanities and social sciences are imperative to develop graduates' communication, critical thinking, and complex problem-solving skills [15]–[17].

Undoubtedly, the contribution of social science and humanities to STEM has been widely acknowledged in academic and industrial circles and the issue has spurred debates among them. These debates, however discovered many areas in which social science and humanities can be integrated to STEM to get maximum benefits: policymaking processes [1]; developing sustainable technology and infrastructure [18]; analyzing perspectives of different levels (individual to a policy level) regarding the adaptations to such technologies [19]–[22]; examining ethical issues embedded in research processes [23] ; considering responsible research and innovation systems in STEM to tackle social challenges [24], [25]; research on the energy-social science and humanities, [26]–[29], climate change- social science and humanities [30], [31], or nanotechnology- social science and humanities intersections [32]. Some authors acknowledged the failure of some STEM programs to face the challenges that are emerging in modern societies and thus, they argued for embedding social science and humanities courses into the engineering curriculum in more engaging ways [33], [34].

2.3 Research Gaps

From the above review of literature, it is clear that undoubtedly the need for an interdisciplinary approach (particularly inclusion of humanities and social science) to the engineering curriculum has been stressed by industrial and academic circles thus, it seems that social science and humanities courses have been introduced in the engineering curriculum as a result of the external pressure. Thus, there is always the question of its effectiveness in fulfilling expectations.

3. Aims and Objectives

The study aims to generate deep insights regarding the effectiveness of humanity courses that are integrated into the academic curriculum of engineering programs in Bangladesh. The specific objectives are:

1. to examine the present status of humanities courses in the academic curricula of engineering programs;
2. to measure the effectiveness of the current humanities courses offered by engineering programs;
3. to identify problems in the existing ways of doing; and
4. to provide suggestive measures to make humanities courses effective for engineering students.

4. Methodology

The study has used multiple case study techniques to address the research objectives. Both primary and secondary sources of data have been used, however, primary sources play a pivotal role. The primary data are collected from the students and teachers of two leading engineering universities in Bangladesh. Semi-structured questionnaire survey with the teachers and students has been conducted to collect the primary data. A total of 20 faculty members (teachers) and 372 students covering various subject fields has been selected using the following sampling techniques. The following formula has been used to determine the required sample size n with the known population:

$n = N*X / (X + N – 1)$, where, "$X = Z_{\alpha/2}^2 *p*(1-p) / e^2$, and $Z_{\alpha/2}$ is the critical value of the Normal distribution at α/2 (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), e is the margin of error, p is the sample proportion, and N is the population size. Note that a Finite Population Correction has been applied to the sample size formula" [35].

In the present study, the total number of students of the selected universities is 10,890. Rajshahi University of Engineering & Technology (RUET): 5650 students and Khulna University of Engineering & Technology (KUET): 5240 students. Assuming the conservative sample proportion rate is 50%, the sample size n is found to be 372. The sample size was again distributed between the two universities in the following manner.

Table 1. Sample distribution

Name of University	Number of Students	Percentage of Population	Number of Respondents (n=372)
RUET	5,650	52	193
KUET	5,240	48	179
Total	10,890	100	372

Source: Calculated based on university website data

The following table shows the department-wise distribution of respondents from the selected universities:

Table 2. Department-wise sample distribution

Name of the Department	Name of University		Total	(%)
	RUET	KUET		
Computer Science & Engineering	43	19	62	16.7
Mechanical Engineering	49	25	74	19.9
Material Science & Engineering	10	8	18	4.8
Civil Engineering	31	15	46	12.4
Architecture	13	4	17	4.6
Electrical & Computer Engineering	9	9	18	4.8
Lather Technology	0	19	19	5.1

Name of the Department	Name of University		Total	(%)
Building & Construction Management Engg.	5	5	10	2.7
Urban & Regional Planning	6	3	9	2.4
Electrical & Telecommunication Engineering	11	17	28	7.5
Textile Engineering	0	14	14	3.8
Electrical & Electronics Engineering	16	41	57	15.3
Total	193	179	372	100

Source: Calculated based on questionnaire survey data

The study is qualitative; however, quantitative data has also been used where appropriate to support qualitative data. Potential ethical consideration has been made while conducting the study to reduce the harm to the participants and to reduce personal bias.

5. Results and Discussions

5.1 Present status of the humanities courses in the academic curriculum of engineering Programs

In Bangladesh, all five public engineering universities as well as engineering faculties of different public and private universities are offering verities of courses under the Department of Humanities. The courses under the humanities department taught to engineering students include but are not limited to Economics, Sociology, Introduction to Management, Operations Management, Project Management, Accounting, Technical English, Communicative English, Industrial Laws, Political Science, Government, Psychology, Philosophy, Logic, Public Finance, Bangladesh Studies, Engineering Ethics etc.

It is worthwhile to mention that all the courses mentioned above are not offered by a single engineering department but rather each engineering department customizes and offers humanities courses according to their needs. For example, the Electrical and Electronic Engineering (EEE) department offers Technical English, Technical English Lab, Economics and Accounting, Projects and Operations Management, Bengali literature and History of Independence. The Computer Science and Engineering (CSE) department offers students to complete the following humanities courses: Technical English, Technical English Lab, Management and Accounting, and Economics & Sociology. The Mechanical Engineering (ME) department offers Technical English, Technical English Lab, Accounting and Industrial Law, Economics and Sociology. The Civil Engineering (CE) department offers humanities courses like Bangladesh Studies, Sociology and Government, Accounting and Economics, Technical English, and Technical English Lab. There is a specific guideline in each engineering department's brochures about what percentage of their total courses will be offered in humanities courses. Presently Bangladesh Accreditation Council (BAC) has provided guidelines for outcome-based education, in which they specify the type of courses and percentage of total credit hours. Although the percentage is negligible, it ranges from 5 to 12 percent of the total credit offered depending on the need of the respective engineering department.

5.2 Effectiveness of the Humanities Courses

This section attempted to assess how far the teaching-learning process of humanities courses is effective in attempting to produce all-rounded students. The research questions that guided this process can be summarized as follows:

1. How do students perceive the teaching-learning of humanities courses?
2. How do concerned teachers perceive the teaching-learning of humanities courses they teach?
3. Is there any significant gap?

5.2.1 Perception of Soft Skills

Respondents were asked to what extent humanities courses improve students' soft skills. Respondents were given the freedom to give weight from 1 to 5, where 1 for strongly disagree and 5 for strongly agree. As shown in Table 3, the majority of the students agreed that the humanities course helped them to improve their skills to communicate with non-engineers, which means skills they use every day when they communicate and interact with other people, (ranked 1), economics and project management skills (ranked 2), skills to make a decision (ranked 3), skills to collaborate (ranked 4), and employability (ranked 5). These factors score more than the averages mean (3.7) of the 11 factors tested. However, students disagreed that the following soft skills (Solutions to the complex problem that the world is currently facing, teamwork skills, critical thinking skills, time-management skills, and diagnostic skills) improve much from studying humanities course. These factors score less than the averages mean (3.7) of the 11 factors tested.

Regarding the improvement of students' soft skills, majority of the teacher agreed or strongly agreed that upon studying humanities courses students will be able to acquire those skills. The averages mean of the 11 factors was 4.48 although some factors (time-management skills, diagnostic skills, collaboration skills, and employability) were less than the average mean of the 11 factors.

Table 3. Improvement of soft skills

Items related to Soft-Skills	Students' Perspective		Teachers' Perspective	
	Mean	Ranked Mean	Mean	Ranked Mean
1. Solutions to the contemporary problem	3.45	11	4.50	6
2. Teamwork skills	3.66	7	4.60	4
3. Encouraging critical thinking skills	3.63	8	4.55	5
4. Communicate with non-engineers	4.02	1	4.75	2
5. Time-management skills	3.51	9	4.45	7
6. Interpersonal skills	3.73	6	4.60	4
7. Improve diagnostic skills	3.49	10	4.05	8
8. Improve decision-making skills	3.77	3	4.65	3
9. Collaboration skills	3.75	4	4.45	7
10 Economics and project management skills	3.94	2	4.80	1
11 Employability	3.74	5	3.90	9
Averages of Mean	3.70		4.48	

Source: Calculated based on questionnaire survey data

5.2.2 Independent samples test

As the response given by teachers varies with the response given by the students, the study conducted an independent samples test (t-test) to see if the variance is statistically significant. Hence, the null hypothesis is, H_0: There is no difference between the two groups (teacher and student) opinions regarding the improvement of students' soft skills.

Table 4. Independent samples test

		Levene's Test		t-test for Equality of Means						
									95% Confidence Interval	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error	Lower	Upper
Soft Skills	Equal variances assumed	1.97	0.18	7.33	21.00	0.00	0.75	0.10	0.53	0.96
	Equal variances not assumed			7.48	18.47	0.00	0.75	0.10	0.54	0.96

Source: Calculated based on questionnaire survey data

Table 4 summarizes the results of the independent samples test: (i) Levene's test for equality of variances and (ii) the t-test for equality of means. Table 4 also contains two sets of analysis, the first set assumes equal variances in the two groups and the second set assumes unequal variances. Levene's test helps us to decide whether we should use equal variances or unequal variances in the two groups to analyze the equality of the means. Levene's test for equality of variances tests the null hypothesis assuming the two groups have equal variances. Table 4 indicates that the p-value (0.18) associated with Levene's test is greater than the level of significance (0.05) which indicates that the testing groups (teacher and student) have equal mean variances and the null hypothesis is true. Thus, the statistic associated with equal variances assumed has been used for analyzing the t-test result. The t-test result shows a t-value of 7.33 with 21.00 degrees of freedom. The corresponding two-tailed p-value is 0.00, which is less than the level of significance (0.05). Therefore, the null hypothesis is rejected at a 5% significance level, which means that there is a significant difference between the two groups (teacher and student) opinions regarding the improvement of students' soft skills.

5.3 Humanities courses and socio-economic-environmental responsibilities

Respondents were asked to what extent humanities courses help them to grow responsibilities toward the socio-economic-environmental factors. As shown in Table 5 below the majority of the students agreed that the humanity courses help them to improve responsibilities toward clients (ranked 1), responsibilities toward legal requirements (ranked 2), responsibilities toward employers and other professionals (ranked 3), and responsibilities to be ethical (ranked 4). These factors score more than the averages of the mean of the 7 factors. However, responsibilities toward society and the environment score lower than the average mean of the 7 factors. Regarding this majority of the teachers agreed or strongly agreed that upon studying humanities courses students learn to be responsible for socio-economic-environmental factors. The average mean of the 7 factors was 4.52 although some factors (environment, employers, and legal requirements) were less than the average mean (4.52) of the 7 factors.

Table 5. Growing responsibilities

	Items related to Responsibilities	Mean	Ranked Mean	Mean	Ranked Mean
1.	Responsibilities to the society	3.82	5	4.70	2
2.	Responsibilities to the environment	3.57	6	4.30	6
3.	Responsibilities to employers	3.90	3	4.30	6
4.	Responsibilities to clients	3.95	1	4.60	3
5.	Responsibilities to other professionals	3.90	3	4.55	4
6.	Responsibilities to be ethical	3.84	4	4.75	1
7.	Responsibilities to legal requirements	3.94	2	4.45	5
	Averages of Mean	3.84		4.52	

Source: Calculated based on questionnaire survey data

5.3.1 Independent samples test

H_0: There is no difference between the two groups (teacher and student) opinions regarding the improvement of students' socio, economic and environmental responsibilities.

Table 6. Independent samples t-test

		Levene's Test		t-test for Equality of Means						
									95% Confidence Interval	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error	Lower	Upper
Responsibility	Equal variances assumed	1.6	0.23	8.04	12.0	0.00	0.68	0.08	0.49	0.86
	Equal variances not assumed			8.04	10.9	0.00	0.68	0.08	0.49	0.86

Source: Calculated based on questionnaire survey data

Table 6 shows a t-value of 8.04 with 12.00 degrees of freedom. The corresponding two-tailed p-value is 0.00, which is less than the level of significance (0.05). Therefore, the null hypothesis is rejected at a 5% significance level, which means that there is a significant difference between the two groups (teacher and student) opinions regarding the improvement of students' socio-economic-environmental responsibilities. There is therefore an expectation gap between the two groups–students and teachers.

5.4 Humanity courses and mental-thinking process

Respondents were asked to what extent humanities courses improve students' mental thinking processes. As shown in Table 7 below the majority of the students agreed that the humanities course helped them to improve global understanding (ranked 1), self-awareness (ranked 2), cultural sensitivity (ranked 3), lifelong learning (ranked 4), and understanding of both the world and the minds of other individuals by focusing on inquiry-based methods to study world culture (ranked 5). These factors score more than the average mean (3.69) of the 8 factors. However, self-motivation, emotional awareness and ability to function in a multitude of social situations score lower than the average mean (3.69) of the 8 factors. Regarding this issue majority of the teachers agreed or strongly agreed that upon studying humanities courses students can improve their self-awareness, global understanding, lifelong learning, self-motivation, and ability to function in a multitude of social situations. The average mean of the 8 factors was 4.49 although some factors such as cultural sensitivity, emotional awareness, and understanding of both the world and the minds of other individuals by focusing on inquiry-based methods to study world culture were less than the average mean (4.49) of the 8 factors.

Table 7. Improving mental-thinking process

	Items	Mean	Ranked Mean	Mean	Ranked Mean
1.	Self-awareness	3.83	2	4.55	2
2.	Cultural sensitivity	3.80	3	4.45	4
3.	Global understanding	3.95	1	4.50	3
4.	Lifelong learning	3.77	4	4.60	1
5.	Self-motivation	3.50	7	4.50	3
6.	Emotional awareness	3.32	8	4.40	5
7.	Ability to function in a multitude of social situations	3.66	6	4.55	2
8.	Understanding both the world and the minds of other individuals	3.71	5	4.35	6
	Averages of Mean	3.69		4.49	

Source: Calculated based on questionnaire survey data

5.4.1 Independent Samples Test

H_0: There is no difference between the two groups (teacher and student) opinions regarding the improvement of students' mental-thinking process.

Table 8. Independent samples t-test

		Levene's Test		t-test for Equality of Means						
									95% Confidence Interval	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error	Lower	Upper
Mental-Thinking Process	Equal variances assumed	3.39	0.09	10.38	14.0	0.00	0.80	0.08	0.63	0.96
	Equal variances not assumed			10.38	9.37	0.00	0.80	0.08	0.62	0.97

Source: Calculated based on questionnaire survey data

Table 8 shows a t-value of 10.38 with 14.00 degrees of freedom. The corresponding two-tailed p-value is 0.00, which is less than the level of significance (0.05). Therefore, the null hypothesis is rejected at a 5% significance level, which means that there is a significant difference between the two groups (teacher and student) opinions regarding the improvement of students' mental-thinking process.

6. Factors Hindering the Effectiveness of Humanities Courses

6.1 Students' Perception

To identify factors that are hindering getting actual benefits from the humanities courses, engineering students were asked to give weight to several factors related to teaching, students, and logistics. These factors (shown in Tables 9 to 11) were identified through an extensive literature review.

Firstly, students were asked about teaching-related factors hindering effectiveness. As shown in Table 9 below the majority of the respondents agreed that traditional teaching (ranked 1), expression of the teacher (ranked 2), and the inability of the teacher to relate the topic to the real-life world (ranked 3) are hindering the effectiveness of the humanities courses. These factors score more than the average mean (3.26) of the 6 sub-factors. However, language problems, lack of effort of the teacher, and the inability of the teacher to grow importance score lower than the average mean (3.26) of the 6 factors.

Table 9. Teaching-related factors hindering the effectiveness

Factors	Mean	Ranked Mean	Std. Deviation
1. Teaching quality/traditional teaching	3.67	1	1.21
2. Expression of the teacher	3.57	2	1.19
3. Language problem (locality)	2.76	6	1.31
4. Lack of effort of the teacher	3.04	5	1.43
5. The inability of the teacher to grow the importance	3.25	4	1.27
6. The inability of the teacher to relate the topic to the real-life world	3.29	3	1.40
Averages of Mean	3.26		

Source: Calculated based on questionnaire survey data

Secondly, students were asked about students-related factors hindering effectiveness. As shown in Table 10, the majority of the respondents agreed that high pressure from engineering courses is hindering the effectiveness of humanities courses. These factors score more than the average mean (3.77) of the 3 sub-factors. However, negative attitudes toward humanities courses and lack of willingness/interest scores were lower than the average mean (3.77) of the 3 sub-factors.

Table 10. Student-related factors hindering the effectiveness

Factors	Mean	Ranked Mean	Std. Deviation
1. High pressure from engineering courses	4.33	1	1.01
2. Negative attitude towards Hum courses	3.44	3	1.28
3. Lack of interest/willingness	3.53	2	1.32
Averages of Mean	3.77		

Source: Calculated based on questionnaire survey data

Finally, students were asked about infrastructure/ logistics-related factors hindering effectiveness. As shown in Table 11, the majority of the respondents agreed that lack of industrial visits and lack of funding for such visits hinder the effectiveness of humanities courses. These factors score more than the average mean (3.67) of the 6 sub-factors. However, the classroom environment, classroom technology, lab facilities, and inadequate reading materials in the library (humanities and social science courses) score lower than the average mean (3.67) of the 6 sub-factors.

Table 11. Infrastructure/logistics related factors hindering the effectiveness

Factors	Mean	Ranked Mean	Std. Deviation
Class room environment	3.31	5	1.25
Class room technology	3.38	4	1.35
Lab facilities	3.52	3	1.34
Inadequate reading materials in the library (humanities and social science courses)	3.54	2	1.21
Field work/industrial visit	4.13	1	1.18

Factors	Mean	Ranked Mean	Std. Deviation
Funding for such visits	4.13	1	1.19
Averages of Mean	3.67		

Source: Calculated based on questionnaire survey data

6.2 Teachers' Perception

To identify problems that are hindering engineering graduates from getting actual benefits from the humanities courses, concerned teachers were asked to give weight to several factors related to students, logistics, administration, curriculum, status, job duty, and research facilities (shown in Tables 12 to 19). Firstly, teachers were asked about student-related factors hindering effectiveness. As shown in Table 12, the majority of the respondents agreed that the lack of interest/willingness of the students is hindering the effectiveness of the humanities courses. This factor scores more than the average mean (3.50) of the 2 sub-factors. However, the quality of students' scores is lower than the average mean (3.5) of the 2 factors, which means students' quality does not affect effectiveness.

Table 12. Student-related factors hindering the effectiveness

	Factors	Mean	Ranked Mean	Std. Deviation
1.	Low-quality students	2.45	2	1.47
2.	Lack of interest/willingness	4.55	1	0.51
	Averages of Mean	3.50		

Source: Calculated based on questionnaire survey data

Secondly, teachers were asked about logistics-related factors hindering effectiveness. As shown in Table 13 below the majority of the respondents agreed that lack of office facilities and improper classroom technology is affecting the effectiveness of the humanities courses. This factor scores more than the average mean (4.05) of the 5 sub-factors. However, the classroom environment, lab facilities, and office equipment scores lower than the average mean (4.05) of the 5 factors, which means these factors do not affect effectiveness much.

Table 13. Logistics-related factors hindering the effectiveness

	Factors	Mean	Ranked Mean	Std. Deviation
1.	Class room environment	3.65	5	1.27
2.	Class room technology	4.10	2	1.02
3.	Office facilities	4.60	1	0.60
4.	Lab facilities	3.90	4	0.97
5.	Lack of office equipment	4.00	3	1.21
	Averages of Mean	4.05		

Source: Calculated based on questionnaire survey data

Thirdly, teachers were asked about curriculum-related factors hindering effectiveness. As shown in Table 14, the majority of the respondents agreed that a short-sighted syllabus and no significant changes in the curriculum regarding the humanities courses are affecting effectiveness. This factor scores more than the average mean (4.50) of the 3 sub-factors. In addition, inadequate course credit for the humanities (mean of 3.90) is also affecting effectiveness however they score lower than the average mean (4.50) of the 3 factors.

Table 14. Curriculum-related factors hindering the effectiveness

	Factors	Mean	Ranked Mean	Std. Deviation
1.	Inadequate course credit	4.30	2	1.26
2.	Short-sighted syllabus	4.60	1	0.99
3.	No significant changes in the curriculum	4.60	1	0.82
	Averages of Mean	4.50		

Source: Calculated based on questionnaire survey data

Fourthly, teachers were asked about status-related factors hindering effectiveness. As shown in Table 15, the majority of the respondents agreed that low value from colleagues in engineering departments and low value from administrative or office staff are affecting effectiveness. This factor scores more than the average mean (3.86) of the 4 sub-factors. In addition, low social status (inside university, mean 3.90), and low social status (outside university, mean 2.65) are also affecting effectiveness however they score lower than the average mean (3.86) of the 4 factors.

Table 15. Status-related factors hindering the effectiveness

	Factors	Mean	Ranked Mean	Std. Deviation
1.	Low value from colleagues in engineering departments	4.60	1	0.75
2.	Low value from administrative or office staff	4.30	2	0.73
3.	Low social status (inside university)	3.90	3	0.97
4.	Low social status (outside the university)	2.65	4	1.18
	Averages of Mean	3.86		

Source: Calculated based on questionnaire survey data

Finally, teachers were asked about job duty-related factors hindering effectiveness. As shown in Table 16, the majority of the respondents agreed that overburden/course load is affecting effectiveness. This factor scores more than the average mean (4.17) of the 3 sub-factors. In addition, administrative duty (mean 4.00) and other workloads (examining script, preparing questions, syllabus update, outcome-based curriculum, paper review, research work, etc.) are also affecting effectiveness however this score is lower than the average mean (4.17) of the 3 factors.

Table 16. Job duty-related factors hindering the effectiveness

Factors	Mean	Ranked Mean	Std. Deviation
1. Overburden/course load	4.50	1	1.00
2. Administrative duty	4.00	2	1.30
3. Other workloads	4.00	2	1.38
Averages of Mean	4.17		

Source: Calculated based on questionnaire survey data

7. Making Humanities Courses Effective

The following sub-section deals with how to make humanities courses effective for engineering students. Suggestive measures were sought from both the students and the teachers concerned. As shown in Table 17, the majority of the students agreed or strongly agreed on the following factors that need to be ensured. They are humanities course materials that need to be brought into the engineering content in more engaging ways (ranked 1), problem-based learning, team-based learning environments, and multidisciplinary classes in teaching such skills (ranked 2), job design (ranked 3), training (ranked 4), and adequate resources (ranked 5). These factors score more than the average mean (4.09) of the 9 factors tested. Students also agreed on the fact that cultural (mean 3.79) and structural (mean 3.94) change, well recognized by the concerned authority (mean 3.98), and student-friendly regulations (mean 3.99) are also important to make humanities courses effective. These factors however score less than the average mean (4.09) of the 9 factors tested. Similarly, the majority of the teachers agreed or strongly agreed on the following factors that need to be ensured. They are cultural change (ranked 1), well-recognized by the concerned authority (ranked 2), adequate resources (ranked 3), structural change (ranked 4), and proper training related to teaching-learning (ranked 5). These factors score more than the averages mean (4.64) of the 9 factors tested. The teachers also agreed or strongly agreed on the fact that proper job design to reduce job overload and job burnout, teacher-friendly regulations, problem-based learning, team-based learning environments and multidisciplinary classes in teaching such skills and humanities course materials need to be brought into the engineering content in more engaging ways are also important to make humanities courses effective. These factors however score less than the average mean (4.64) of the 9 factors tested.

Table 17. Making Humanities Courses Effective

	Students' Perspective		Teachers' Perspective	
Factors	Mean	Ranked Mean	Mean	Ranked Mean
1. Cultural change	3.79	9	4.90	1
2. Structural change	3.94	8	4.70	4
3. Recognition	3.98	7	4.85	2
4. Resources	4.13	5	4.80	3
5. Training	4.17	4	4.65	5
6. Job design	4.19	3	4.45	7
7. Regulations	3.99	6	4.40	8
8. Humanities course materials need to be brought into the engineering content in more engaging ways	4.31	1	4.60	6
9. Problem-based and team-based learning environments	4.30	2	4.45	7
Averages of Mean	4.09		4.64	

Source: Calculated based on questionnaire survey data

7.1 Independent Samples Test

H_0: There is no difference between the two groups (teacher and student) opinions regarding the effectiveness of humanities courses for engineering students.

Table 18. Independent samples t-test

		Levene's Test		t-test for Equality of Means						
									95% Confidence Interval	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error	Lower	Upper
Ways to Make Humanities	Equal variances assumed	0.01	0.91	6.5	16.0	0.00	0.56	0.08	0.38	0.74

Courses Effective	Equal variances not assumed			6.5	15.9	0.00	0.56	0.08	0.38	0.74

Source: Calculated based on questionnaire survey data

Table 18 shows a t-value of 6.55 with 16.00 degrees of freedom. The corresponding two-tailed p-value is 0.00, which is less than the level of significance (0.05). Therefore, the null hypothesis is rejected at a 5% significance level, which means that there is a significant difference between the two groups (teacher and student) opinions regarding the effectiveness of humanities courses for engineering students.

8. Conclusion

The present study strives to generate deep insights regarding the effectiveness of humanities courses that are integrated into the academic curricula of engineering programs aims to produce well-balanced engineering students. Extensive literature both from the academic and industry point of views were reviewed to understand the importance and benefits of integrating humanities courses into the engineering curricula. The literature reviews also helped to identify factors that impede the teaching-learning of humanities courses for engineering students. Two groups of respondents (student and teacher) were selected to conduct a questionnaire survey. The study results show that humanities aspects have been integrated into the engineering curricula to a limited extent. The results of the t-test indicate that there are significant variations in the opinion given by the two groups regarding the improvement of students' soft skills, socio-economic-environmental responsibilities, and mental-thinking process. This means that there is a gap in the teachers' expectations regarding the benefits of the courses and students' perception of the benefits they received from the humanities courses. Students opined that the inability of some teachers to grow interested in the course and relate the topic to the real-life world, lack of field visits, and classroom environment are hindering the benefits. As Bangladesh has the vision to become a developed country, it is high time to realize that humanities courses are an essential part of a well-rounded education for engineering programs.

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