

# Empirical study of engineering students' satisfaction with modern educational technology

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**ABSTRACT:** The purpose of the study outlined in this article was to examine students' satisfaction with modern educational technology in Chongqing Three Gorges University (CTGU). Students were asked to rank services offered by CTGU and to complete a questionnaire to measure their attitude to technology that aids teaching, extracurricular learning technologies and on-line resources. Mixed research methods (questionnaire and interviews) were applied for collecting the primary data, as were descriptive statistics using frequency distributions by which to analyse the selected data. Results indicated that students mostly are satisfied with extracurricular learning technologies, while four important sub-factors contributing to the students' engineering learning are: course Web site (86.2%), interactive whiteboards (85%), social media (85%) and e-library databases (82%). Finally, it is recommended that teachers adopt Web-based solutions for their students, an innovative teaching style and establish informational communication mechanisms.

## INTRODUCTION

Technology is ubiquitous in daily life, from bar codes at stores to multimedia in classrooms. Nowadays, teachers can adopt a variety of technologies in their teaching, including computers, multimedia, laptops and projectors. Various educational technology is now used at all academic levels, to increase the flexibility of classroom teaching and, hence, increase educational quality. But teaching is not limited to the classroom, as it includes the Internet, e-libraries and social media [1].

Though teaching is of primary importance in classroom teaching, it is worthwhile to investigate students' perception of, and application of, educational technology. Monaghan has stated that educational technology should be classified into three categories, viz. instructional, social media and experiential. Based on Monaghan's research, the content of this article is an evaluation of university students' satisfaction with educational technology from three perspectives, viz. technology that aids teaching, extracurricular learning and on-line resources [2].

## RESEARCH AIMS AND QUESTIONS

The aim of this study was to clarify how educational technology affects students' academic achievement and to determine the degree of importance of the various factors. The research aim and questions are presented in Table 1.

Table 1: Research aim and questions.

Research aim	Research questions
To identify college students' satisfaction of modern educational technology as it affects learning	Question 1: Are college students satisfied with technology that aids teaching for engineering courses?
	Question 2: Are college students satisfied with technology that aids extracurricular learning for engineering courses?
	Question 3: Are college students satisfied with on-line resources for engineering courses?
	Question 4: Among the above three factors, which is the most important for students' learning?

## RESEARCH METHODOLOGY

In this research, both questionnaires and interviews were adopted to determine the most important factors assisting Chongqing Three Gorges University (CTGU) students' learning (see Table 2, Research method).

*Research sample:* the research population were undergraduates studying engineering at CTGU. There were 96 students *in toto*, with 24 freshman, sophomore, junior and senior students each. The sample was selected at random.

These respondents included 80 engineering students majoring in safety engineering, architectural engineering, environmental science, electrical and information engineering, and mechatronics. To guarantee the validity and generality of the research, both male and female students were invited to participate [3]. After the questionnaire survey, 10 representative students were selected for focus-group interviews, enabling students to express their own attitude toward educational technology and to make suggestions for improvements.

*Research instruments:* the main instrument for this research was a two-page survey questionnaire, which contains 11 questions. These include open, closed and multiple choice questions and can be finished in 10 to 15 minutes. The questionnaire has two parts. Part one is a general information survey and includes questions about age, gender, grades and department. Part two surveys the student's attitude toward modern educational technology. Part two also covers three categories, viz. technology that aids teaching, extracurricular learning technologies and on-line resources.

The second instrument was the scripted interview, designed to gauge the respondents' attitude toward educational technology. For example, responses to the question, *What is your opinion of the technology that aids teaching?*, were used to develop a more in-depth understanding of the questionnaire answers.

Table 2: Research method.

Research method	Sample	Purpose	Data analysis
Questionnaire survey	80 CTGU undergraduates	Identify students' satisfaction with current educational technology	Microsoft Excel, frequency statistics
Interviews	10 representative students from 80 respondents	Examine participants' attitudes toward the technologies and identify potential improvements.	Transcripts, content analysis

## RESULTS AND FINDINGS

The participants of this study were all college students studying engineering majors at CTGU. Students from architectural engineering, electrical and information engineering accounted for 50%, and male students 75% of the total. During the survey, 96 questionnaires were handed out, 87 were returned, 80 were valid. Thus, the completion rate was 83%.

### Results of the questionnaire

This part presents the questionnaire results of the students' satisfaction of items: technology that aids teaching, extracurricular learning technologies and on-line resources (see Table 3).

*Technology that aids teaching:* the level of satisfaction was determined using a five-point Likert-scale. The following three aspects were evaluated, viz. computer aids, multimedia integration and interactive whiteboards.

Table 3: Students' satisfaction of technology that aids teaching.

Technology that aids teaching \ Choice		Strongly satisfied	Slightly satisfied	Medium	Slightly dissatisfied	Strongly dissatisfied
Computer aids	Frequency	35	29	6	4	6
	Percentage	43.8	36.2	7.5	5.0	7.5
	Cumulative percent	43.8	80.0	87.5	92.5	100.0
Multimedia integration	Frequency	32	29	5	6	8
	Percentage	40.0	36.2	6.3	7.5	10.0
	Cumulative percent	40.0	76.2	82.5	90.0	100.0
Interactive whiteboards	Frequency	40	28	2	7	3
	Percentage	50.0	35.0	2.5	8.7	3.8
	Cumulative percent	50.0	85.0	87.5	96.2	100.0

The outcome of the first question indicated that 80% of the respondents were satisfied with computer-aided technology, among which 43.8% are strongly satisfied. Six participants perceived it as not useful at all. The data also show that only 76.2% were satisfied with the multimedia integration technology and 10% considered it not useful.

The data showed that 85% of the respondents were satisfied with the adoption of interactive whiteboards, which is the newest classroom teaching techniques. Fifty percent were strongly satisfied with interactive whiteboards and just 3.8% perceived them as not useful. Based on these data, the three items can be sequenced according to the respondents' attitude, i.e. interactive whiteboards with 85% strongly or slightly satisfied, computer aids with 80%, and multimedia integration with 76.2%.

The data also reveal that the roles of traditional technology that aids teaching, such as computers and multimedia have been replaced by modern interactive technologies. Students emphasise interactive communications and timely feedback, between teachers and students [4]. This may be a new trend for research in technology that aids teaching.

*Extracurricular learning technologies:* this part mainly concerns the role of extracurricular learning technologies for students' learning, and is evaluated from three aspects viz. the course Web site, e-library database and simulation software. The results are shown in Table 4.

Table 4: Students' satisfaction with extracurricular learning technologies.

Choice		Strongly satisfied	Slightly satisfied	Medium	Slightly dissatisfied	Strongly dissatisfied
Extracurricular learning technologies	Frequency	37	32	5	4	2
	Percentage	46.2	40.0	6.3	5.0	2.5
	Cumulative percent	46.2	86.2	92.5	97.5	100.0
Course Web site	Frequency	32	34	10	4	0
	Percentage	40.0	42.5	12.5	5.0	0
	Cumulative percent	40.0	82.5	95.0	100.0	100.0
E-library database	Frequency	30	32	8	2	8
	Percentage	37.5	40.0	10.0	2.5	10.0
	Cumulative percent	37.5	77.5	87.5	90.0	100.0
Simulation software	Frequency	35	28	3	4	10
	Percentage	43.8	35.0	3.7	5.0	12.5
	Cumulative percent	43.8	78.8	82.5	87.5	100.0
Social media	Frequency	38	30	1	6	5
	Percentage	47.5	37.5	1.2	7.5	6.3
	Cumulative percent	47.5	85.0	86.2	93.7	100.0

The data show that the course Web site has played an increasingly important role for after-class learning, with more than 86% satisfied. In addition, e-library databases, such as CNKI (China National Knowledge Infrastructure) are also important in supplementing knowledge. In fact, 82.5% have a positive attitude to the e-library database and no-one records a negative attitude. However, simulation software, which is important for engineering students, has a satisfaction rating of only 77.5%.

*On-line resources:* this was analysed from two aspects, i.e. open courses and social media.

Table 5: Students' satisfaction with on-line resources.

Choice		Strongly satisfied	Slightly satisfied	Medium	Slightly dissatisfied	Strongly dissatisfied
On-line resources	Frequency	35	28	3	4	10
	Percentage	43.8	35.0	3.7	5.0	12.5
	Cumulative percent	43.8	78.8	82.5	87.5	100.0
Open courses	Frequency	38	30	1	6	5
	Percentage	47.5	37.5	1.2	7.5	6.3
	Cumulative percent	47.5	85.0	86.2	93.7	100.0
Social media	Frequency	35	28	3	4	10
	Percentage	43.8	35.0	3.7	5.0	12.5
	Cumulative percent	43.8	78.8	82.5	87.5	100.0

Social media is viewed as important for learning by 85% of participants; while 78.8% consider open courses as important. Table 5 shows that students are inclined to use on-line resources for acquiring and digesting knowledge. In fact, both social media and open courses are the newest platforms of the Internet age [5]. Thus, these data show the rise of the new Internet technology.

Based upon the above results, the quantitative research has indicated that the most important four sub-factors contributing to the students' engineering learning are: course Web site (86.2%), interactive whiteboards (85%), social media (85%) and e-library databases (82%).

## Results of the Interviews

Ten representative respondents were chosen to participate in focus-group interviews to investigate the underlying reasons for their questionnaire choices, as well as to seek measures for improving educational technology. First, among the three main items, nine out of the 10 interviewees were strongly satisfied with extracurricular learning technologies, and eight perceived on-line resources as quite important for engineering learning. This is consistent with the quantitative research, which shows that 82% and 82.5% are satisfied respectively with extracurricular learning and on-line resources. This rates higher than satisfaction with technology that aids teaching. This result was followed up in the interviews. The majority of the interviewees considered it was necessary to acquire engineering management knowledge outside the classroom [6]. As one respondent stated, *...engineering is both a science and an art, mastering it not only needs classroom learning but also social practice*. Thus, technology that assists the acquisition of recent engineering knowledge is becoming more important.

Among the nine sub-factors influencing students' learning, the 10 agreed that the course Web site is necessary supplementation for classroom teaching material and, in particular, for gaining systematic engineering course information; nine considered interactive whiteboards effective for timely communication and teacher-student interaction [7].

Eight of the 10 considered it advisable to make full use of social media and searching technologies, which can provide the latest engineering information, and also promote timely communication between students and teachers. One of the 10 added that modern university students should not only master necessary knowledge for future work, but also master how to learn. Obviously, Internet technology facilitates this. Therefore, the impact of Internet technology on college education cannot be neglected. Six out of 10 also consider that traditional computer-aided and multimedia technology is important for learning and one stated the reason that *...they make classroom teaching flexible, as well as more diverse*.

As to the measures for improving the technology used for college education, all the 10 interviewees emphasised that it is necessary to invest in the latest technology when refreshing teaching material and, as well, adopt an innovative teaching style. Nine also mentioned the important role of the tutor when using the technology. Thus, on-the-job training should be conducted for teachers.

Finally, with the rapid development of the mobile Internet and social media, more students (nine out of 10) rely on external social resources. Thus, it is urgent for university teachers to innovate their teaching with Internet and communications technology [8].

## CONCLUSIONS AND IMPLICATIONS

Mixed research methods were used to evaluate students' satisfaction with the educational technology adopted by CGTU. The research instruments included a self-administered questionnaire and focus-group interviews. The quantitative research identified college students' perception of the impact of educational technology on their learning efficiency, and the qualitative research was used to justify the outcome through interviews.

The outcome of the survey revealed that, on average, 80.4% of the respondents were satisfied with the application of technology that aids teaching, 82% were satisfied with extracurricular learning technologies and 81.9% were satisfied with on-line resources. Among the three main items, the course Web site has contributed most to students' satisfaction, with a rating of 86.2%. This is followed by interactive whiteboards (rating of 85%), social media (85%) and e-library databases (82%). The results were consistent with the outcome of the interviews. Results reveal that, unlike previous students, current engineering students rely more on the Internet and communications technology for acquiring knowledge. In fact, as a practical subject, it requires both the teachers and students to pay close attention to engineering management development, and make full use of the traditional e-library databases, as well as Internet digital data.

The outcome of this research has important educational implications. First, it is necessary for universities to invest more in the establishment of information platforms to acquire the latest engineering knowledge. It is necessary for college teachers to implement solutions for their students using the Web.

Second, college engineering administrators should pursue the combination of educational technology and teaching practice. They should focus on the application of new technology and methods rather than increasing the complexity of the knowledge. Adopting mixed teaching methods, as well as educational technology, should become the trend for college education.

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