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Information Technology Tools Analysis in Quantitative Courses of IT-Management (Case Study: M.Sc. - Tehran University)

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Abstract

The purpose of this study was to determine the most suitable ICT-based education and define the most suitable e-content creation tools for quantitative courses in the IT-management Masters program. ICT-based tools and technologies are divided in to three categories: the creation of e-content, the offering of e-content, and access to e-content. In this study the first two categories are considered for on-campus education and virtual education (both synchronous and asynchronous).

In the comparisons, eight modes of delivery styles were verified using two methods; first they were compared two by two in an ordinal questionnaire measured by an Eigenvector technique. Next they were compared by a single-weighted method. The results were then agreed upon by experts using a personal approach in group decision making. The most effective ICT-based education was defined as on-campus education and the Collaborative Learning Environment with Virtual Reality (CLE-VR) received the highest level for virtual education because it highlighted the social presence, and then synchronous and asynchronous virtual education. Slides of Microsoft PowerPoint ranked in the upper-level for smart boards for on-campus education but they ranked in the same level for virtual education.

E-content creation tools were measured by an interval questionnaire using a semi-metric scale of [0-100] by the single-weighted method. The results of second section found that the most suitable tool for creating e-content are Microsoft Office PowerPoint.

Questionnaire analysis revealed a preference for social interaction in studying quantitative courses, creating, and customizing e-content as soon as possible.

Keywords: E-learning, Creating e-content, Group decision making, Information technology, University courses.

1. Introduction

These days, ICT-based tools are insufficiently used for education in universities, so the analysis on them causes to define suitable ways of using them such as introducing them to teachers in order to use ICT-base education more effectively. Computer-based instruction is not as useful as traditional methods despite it being found to be user friendly and being recommended to educational staff (Stephenson, Brown, Griffin, 2006). There are too types of educational tools and technologies that are the basis for other methods for offering course content, such as using PowerPoint slides, using Smart Boards in real and virtual environments, and various channels of multimedia (e.g. voice, text, image). Comparing these methods and defining suitable ones for every subject area would be beneficial in the education system.

The key to success is identifying the best-suited use of technology for the course type, therefore it needs through analysis and planning (Knight, 2005). Firstly it is essential to analyze the teaching and learning environment; this includes understanding the course material, the students, the teacher, and the team; secondly it is critical to look at the technical environment in which it is taught.

It is generally believed that ICT can empower teachers, promote change and foster the development of 21st century skills, but the support of these beliefs are still limited and ICTs are very rarely seen as central to the overall learning process. An enduring problem is putting technology before education. Specifically, the continuing difficulties of technology used in education is that educational planners and technology advocates came up with the technology first and then investigated the educational applications of it (Trucano, 2005).

While it is obvious that the application of various ICTs are the most important determinants of the effectiveness of such tools' in education, the choice of tools is quite varied and each tool has its own advantages and disadvantages. Policymakers and donor staff are often bombarded by information and studies from vendors on the suitability of their products or services, and there is a need for further, independent research on the appropriateness on specific tools with potential to help meet education-related MDGs (Millennium Development Goals). *(Alexander J. Romiszowski, 2004)*

Documents and text content are important parts of education in traditional and modern education approaches. Besides the advantages of the hardcopy format, in comparison with management styles and the review of computer-based and e-content, their transfer and distribution are slower. In addition, when a text is written on paper, it cannot easily be saved, edited and reviewed. One of virtual education's challenges is to provide E-content. Thus, in this paper E-content creation tools will be verified.

2. The History of E-learning throughout the World

Education over far distances was considered correspondence in 1800 A.D. Correspondence education was managed by schools or qualified institutes offering the program to students and teachers while in High School and University. As the United States of America started to provide education using summarized pamphlets, the term 'distance education' came about in 1892 and this form of education was dependent on mailings. The idea of this approach should be probed in the mid 20th century. Half-attendance education is considered to be the start of Internet-based education or virtual university and was a project of private universities in England. According to this project, university students were taught by television programs after which they were tested and acquired their certification. Along with setting up free consulting services and educational departments in the U.S.A in the 1960s, other successful steps was taken towards this method of education in the middle of the 20th century. There were various educational programs for people who could not attend central classes. Due to the considerable fame of radio and television, professors became intimate with new technologies to present distance education courses that were not dependent on mailing system. Finally, the first university education radio received authorization in 1921 and became the first base of the e-learning form. In the 1970s, due to wide access to computers in the U.S.A, unattended education became common. In the early 1980s one of the founders of virtual universities offered a unit of a course online. This important event was accomplished using modem-based access to a bulletin board system (BBS). Since then, virtual universities have improved extensively. In the 1980s, television broadcasting was reinvented with the arrival of satellite and cable program services and this event improved the e-learning industry. With the emergence of the internet, the first online Bachelor degree program courses were offered by the New Jersey Technology Institute in 1984, and this caused quick development of e-learning. Through the same educational channel, the U.S.A National University offered Engineering Bachelor degree programs and post Graduate courses, granting degrees to students starting in 1985.

In 1988, for the first time, powerful software named the "digital-professor" was developed, marking a revolutionary movement in electronic systems. This system offered voice chat in education affairs, a very practical tool for enhancing communication. The first online education program was offered by Monix University in 1989, which opened 100 virtual universities with 1500 courses in California. Since then educational institutes in the U.S.A have accessed and improved e-learning approaches around the world by revising and strengthening some of the methods in this system. In 1995, at first public the opinions considered websites that said they offered virtual education a flash in the pan. However, these days there are hundreds of education sites that offer more than 500 low expense courses over the universal internet and cover a variety of science subjects. As a statistical assessment, over one billion people around the world access the internet and one million of them joined prominent universities to continue their studies over the internet. Hence, we can claim that universal learning has been established internationally through the use of modern communication technology. This association has linked not only different scientific centers, but also professors and students of different majors to each other. Undoubtedly, virtual education will occupy the largest portion of the internet in the future.

3. The History of E-learning in Iran

Distance education does not have a strong background in Iran, with the exception of a few private universities, before the Islamic revolution, and Payamenoor University, which based their systems on a distance communication approach. At the end of the 1990s in Iran, virtual learning was established at Tehran University and was practiced from the first half-semester of that year. In the same year, the Science, Research, and Technology departments announced the establishment of an online university managed through the same ministry, but via a more private medium with no public financial support. Following the same trend, some universities also announced their establishment of e-learning education offering single university courses online (Majed Esmail, 2006). In recent years, the online university of the Islamic Azad University has become one of the most advanced and biggest virtual education centers in Iran.

4. Research Questions

1) What is the ranking of virtual education as compared to on-campus education? Also, what is the recognition of presentation of courses through PowerPoint slides, smart board, virtual environment, and video conferencing in teaching of quantitative courses in an IT-management Masters program?

2) What are the most suitable tools for creating e-content for quantitative courses in an IT-management Masters program?

5. ICT-Based Education and E-content Creation Categories

Every educational environment is tightly coupled with its teachers, students, and the content of the courses and the key to success is identifying the most appropriate utilization of technology for the course. Firstly, the educational environment should be analyzed, thus in this paper various ICT-based educations are examined. Next the understanding the course and its students are essential; Hence in this paper, experts' opinions are used to define suitable methods and technologies. Finally, technology aspects of educational environments should be considered. Professors must also supervise the development of e-content for each course as they are the ones offering the course content using various educational methodologies.

The concept model of research and ICT-based education categories and e-content creation tools are shown in Figures.1 and 2.

Insert Figure 1 and Figure 2 Here

6. Research Methodology

In this paper, two aspects of e-learning have been considered separately. First, the survey of ICT-based educational environments has been analyzed and then the factors affecting the ranking utility of e-content creation tools. Phases of this project involved a pilot study of professors from various universities in Iran. The universities Alzahra University, Tehran University, Shahid Beheshti University, Allameh University, Tarbiat Moadarres University, and Science Research Islamic Azad University were chosen ones for this study.

Professors of these universities have been teaching quantitative courses such as, Operational research, Expert and decision systems, Statistical analysis, Fuzzy and artificial intelligent. They all have Ph.D. degrees and are familiar with ICT tools in educational systems and were chosen as subject-matter experts in this paper. 9 people with these specifications contributed to this research.

First phase: Survey on the Importance of ICT-based Education

In this section, two methods have been used to measure the importance of various methods of ICT-based education. Then, by using combination patterns (Toloei, 2006) the importance of each are measured.

The two methods are:

1).Two by two comparison according to Eigenvector (Saati,1999): In this method, by using pair comparisons, the final matrix for each person is exploited and the convergent weights are calculated as follows:

(1)

Where D is the comparison matrix, e is unique vector, e^t is reverse vector and k is an integer counter.

2. Single-weighted method (Toloie, 2006):

In this method a semi-metric scale on the [0-100] interval is used and then normalized to make the weights comparable.

In pair comparison, according to the Thomas Saaty algorithm, ICT-based education is compared two by two, then the weights are converged by Eigenvector and then measured. To make some deviations more reliable, every variable is measured by the second method offered by Toloei. Then arithmetical averages of the two methods results are calculated.

The ICT-based educations studied in this paper are listed below with the name of each variable represented in parentheses.

- (A1) On campus education and presentation of courses using PowerPoint slides.
- (A2) On campus education and presentation of courses using a Smart board.
- (A3) Online education and presentation of courses using PowerPoint slides.
- (A4) Online education and presentation of courses using Smart board.
- (A5) Video conferencing / Web conferencing

- (A6) Virtual reality and multi-media, providing communication tools to support collaboration amongst students and teachers using avatars (which help them feel a greater sense of immersion in the educational environment [6]).
- (A7) Text-based structured electronic courseware with information presented in manageable "chunks". (offline)
- (A8) On screen synchronous presentation of PowerPoint slides and recorded video/audio of teachers. (offline)

One of the experts' results is shown in Table 1.

Insert Table 1, Table 2, Table 3, Table 4, Table 5, Table 6, Table 7 Here

The final weights for this method for this expert are shown in Table 2.

Arithmetical averages of two methods are shown in Table 4.

After weights and importance of variables for each of the 9 professors in the study were calculated, the Borda technique in group decision making approach brought them in to agreement. The results of this technique are shown in Table 5.

Insert Figure 3 Here

As shown in Figure 3, attendant education presented by PowerPoint slides was ranked first, followed by attendant education by Smart Board presentation courses, and the 3rd ranked teaching method was the virtual reality environment for online education. This ordering places online education using Smart boards and PowerPoint slides at the same level, followed by on screen synchrony of PowerPoint slides and recorded teacher's video/audio (offline), Video conferencing/Web conferencing, and Text-based structured electronic courseware (offline).

7. Second phase: Define suitable e-content creation tools

In this section the experts' data were tabulated by the Single weighted method. Table 8 presents the experts interval data on a [0-100] semi-metric scale. In addition, Table 9 shows calculated weights of experts' data using the single weighted method.

Insert Table 8, Table 9

Insert Figure 4 Here

Then tools weights were transferred to ranking numbers according to each person, as are shown in Table 10. Table 11 transfers ranking numbers to the Borda ranking numbers. Fig 4 shows that the ranking of e-content tools was agreed upon by the committee of experts.

Insert Table 10, Table 11 Here

As illustrated, PowerPoint ranked first, then graphic tools, followed by Smart board, and finally the iCam2. So for e-content creation for quantitative IT-management course for students in an MS degree program, Microsoft Office PowerPoint is the most suitable methodology.

8. Results of Hypothesis Verification

The first purpose of this paper was to define a suitable ICT-based education methodology for quantitative courses of an IT-management M.S. Program; Methodologies that have been thoroughly analyzed and their related tools verified and ranked.

The first methodology received the highest rank according to some independent studies and the facts that students can review the materials at their own convenience and can pause and resume as many times as necessary (Stephenson, Brown, Griffin, 2006). Also, based on the student motivation at the post graduate level and their level of knowledge the first hypothesis the paper is based on, on-screen synchrony of PowerPoint slides and recorded voice (offline) is the most suitable one for presenting courses. But, according to experts' opinions, this style was ranked lower.

The second purpose of the paper was to determine the most suitable tools for E-content creation for quantitative courses for an IT-management MS program. Based on this purpose and the results gathered in this paper, the tools were ranked. According to the related studies, the second hypothesis is the more suitable one as it utilizes graphic utility tools in a computer-mediated environment and has various features which make e-content more interesting. Hence students can easily communicate with the environment and interact in it (Tung, Deng, 2007). On the other hand, according to the results of this paper, the tool mentioned is not suitable for quantitative courses because prompt creation and updating of e-content is of great importance in post graduate levels and this tool is incapable of satisfying the requirements .

9. Conclusion

According to the results of this study, in an educational environment communication and interaction with peers and teachers is of great importance for learning in quantitative IT- management courses. So, on-campus education is the most suitable method of teaching. If it is necessary for some students to take online course, a virtual reality environment is the most appropriate method, as students can gain a sense of being present in the same environment as their peers, despite their remote physical locations. Hence e-learning is not just about completely turning traditional,

classroom-based courses into online versions but rather more about identifying opportunities where the technology will add value to learning.

According to results of the first phase analysis of this paper, the video/web conferencing method, despite of having interactive features, took the 7th position. This is due to the absence of suitable technical structure in the environment under study.

The results of second phase analysis of this paper found that prompt updating of the e-content is the most important factor for post graduate level and Microsoft Office PowerPoint was defined as the most suitable method for accomplishing this. Therefore, special software capable of creating electronic and web-based quantitative course content that can be utilized to quickly update and customize the course contents for teachers and classes are proposed.

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Table 1. Importance of ICT-based educations according to an expert based on the Eigenvector method

	A1	A2	A3	A4	A5	A6	A7	A8
A1	1	5	7	8	6	7	9	3
A2	1/5	1	7	9	7	7	9	9
A3	1/7	1/7	1	8	6	5	9	9
A4	1/8	1/9	1/8	1	3	3	9	9
A5	1/6	1/7	1/6	1/3	1	3	5	5
A6	1/7	1/7	1/5	1/3	1/3	1	9	9
A7	1/9	1/9	1/9	1/9	1/5	1/9	1	7
A8	1/3	1/9	1/9	1/9	1/5	1/9	1/7	1

Table 2. Final weights by Eigenvector method for the expert.

	A1	A2	A3	A4	A5	A6	A7	A8
Final weights by Eigenvector method for one person	0.3680	0.2693	0.1502	0.0724	0.0481	0.0506	0.2280	0.0186

Table 3.The results of the same expert person by using Single weighted method.

	A1	A2	A3	A4	A5	A6	A7	A8
Interval weights [0-100] in scale of semi metric	90	80	60	50	10	20	30	70
Normalized weights	0.2195	0.1951	0.1463	0.1219	0.0244	0.0488	0.0732	0.1707

Table 4. Arithmetical averages of Eigenvector and Single weighted methods according to an expert.

	A1	A2	A3	A4	A5	A6	A7	A8
Arithmetical averages of two methods	0.2938	0.2322	0.1483	0.0972	0.0362	0.0497	0.0480	0.0947

Table 5.Importance of each variable according to all experts.

	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9
A1	0.2938	0.3429	0.1407	0.0234	0.1897	0.2607	0.116	0.368	0.1163
A2	0.2322	0.234	0.1009	0.044	0.1212	0.2389	0.1676	0.2693	0.064
A3	0.1483	0.0874	0.0866	0.0706	0.0624	0.1625	0.1158	0.1502	0.0514
A4	0.0972	0.0874	0.086	0.0937	0.0498	0.1154	0.062	0.0724	0.1399
A5	0.0362	0.037	0.034	0.0671	0.1899	0.0919	0.0125	0.0481	0.2558
A6	0.0497	0.1467	0.0254	0.3488	0.3392	0.0822	0.0281	0.0506	0.2535
A7	0.0480	0.0301	0.3325	0.1966	0.016	0.0277	0.0169	0.0228	0.0436
A8	0.0947	0.0344	0.194	0.1559	0.0317	0.0208	0.481	0.0186	0.0755

Table 6. Ranking of ICT-based educations according to whole experts.

	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9
A1	1	3	1	1	3	8	1	3	4
A2	2	4	2	2	4	7	2	2	6
A3	3	5	3	4	5	5	5	4	7
A4	4	6	4	5	6	4	4	5	3
A5	8	7	6	7	2	6	6	8	1
A6	6	8	5	8	1	1	3	6	2
A7	7	1	7	6	8	2	8	7	8
A8	5	2	8	3	7	3	7	1	5

Table 7. Borda ranking results (the total row of Borda numbers are in the last column)

	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	The total row of Borda numbers
A1	7	5	7	7	5	0	7	5	4	47
A2	6	4	6	6	4	1	6	6	2	41
A3	5	3	5	4	3	3	3	4	1	31
A4	4	2	4	3	2	4	4	3	5	31
A5	0	1	2	1	6	2	2	0	7	21
A6	2	0	3	0	7	7	5	2	6	32
A7	1	7	1	2	0	6	0	1	0	18
A8	3	6	0	5	1	5	1	7	3	31

Table 8. Experts' interval data.

	Graphic tools	PowerPoint	Smart board	iCam2
a1	70	50	70	80
a2	90	70	30	30
a3	80	70	50	30
a4	20	10	40	90
a5	60	60	40	40
a6	89	75	72	62
a7	70	80	50	50
a8	40	70	90	80
a9	30	30	72	90

Table 9. Calculated weights of experts' data by single weighted method.

	Graphic tools	PowerPoint	Smart board	iCam2
a1	0.127505	0.097087	0.136187	0.144928
a2	0.163934	0.135922	0.058366	0.054348
a3	0.145719	0.135922	0.097276	0.054348
a4	0.03643	0.019417	0.077821	0.163043
a5	0.10929	0.116505	0.077821	0.072464
a6	0.162113	0.145631	0.140078	0.112319
a7	0.127505	0.15534	0.097276	0.09058
a8	0.07286	0.135922	0.175097	0.144928
a9	0.054645	0.058252	0.140078	0.163043

Table 10. E-content creation tools ranking according to each person.

	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9
A1	3	4	2	1	4	2	4	2	1
A2	4	2	1	2	1	1	2	1	2
A3	1	3	3	3	2	4	1	3	4
A4	2	1	4	4	3	3	3	4	3

Table 11. Borda ranking numbers.

	DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	
A1	1	0	2	3	0	2	0	2	3	13
A2	0	2	3	2	3	3	2	3	2	20
A3	3	1	1	1	2	0	3	1	0	12
A4	2	3	0	0	1	1	1	0	1	9

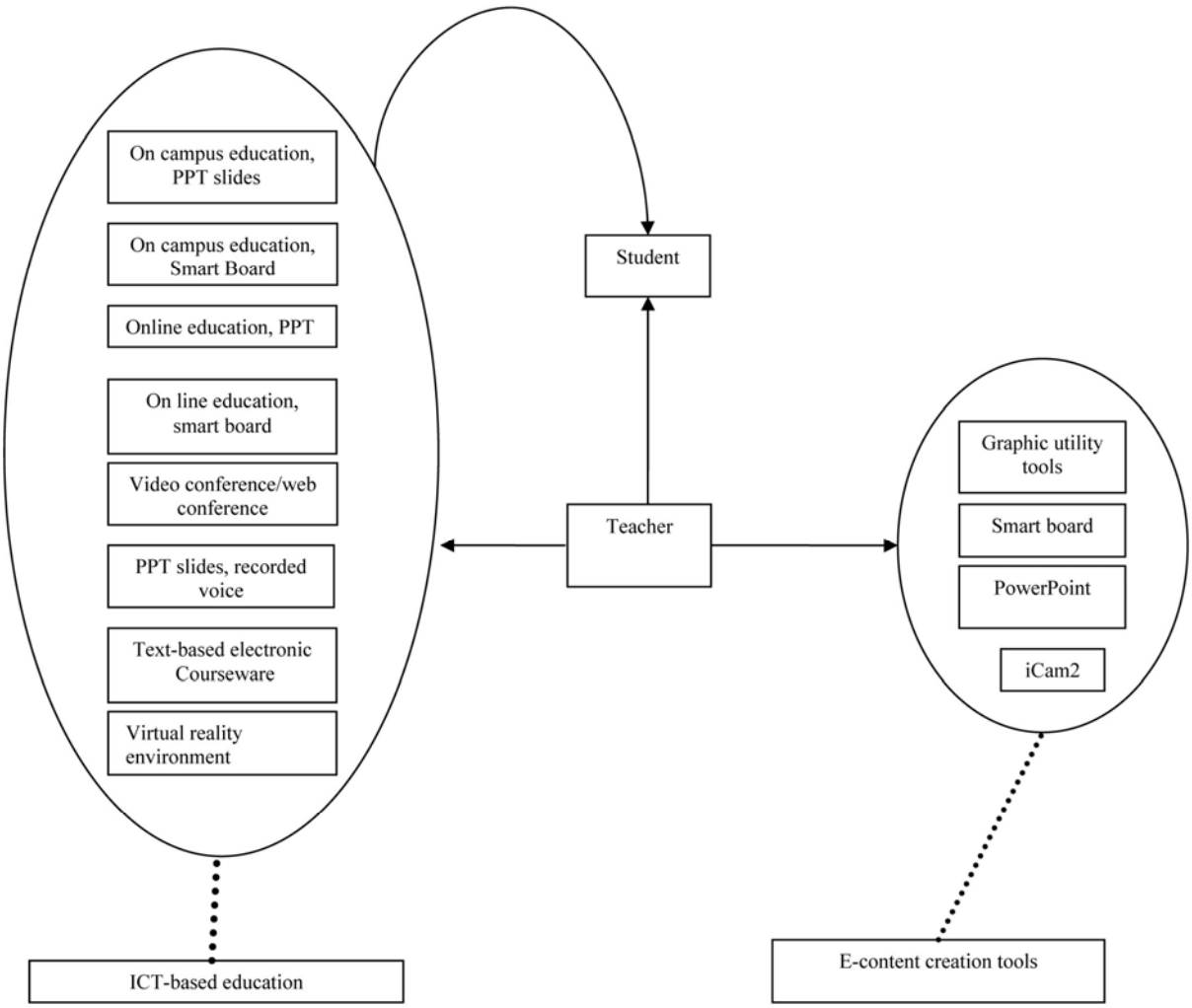

Figure1.The concept model of research

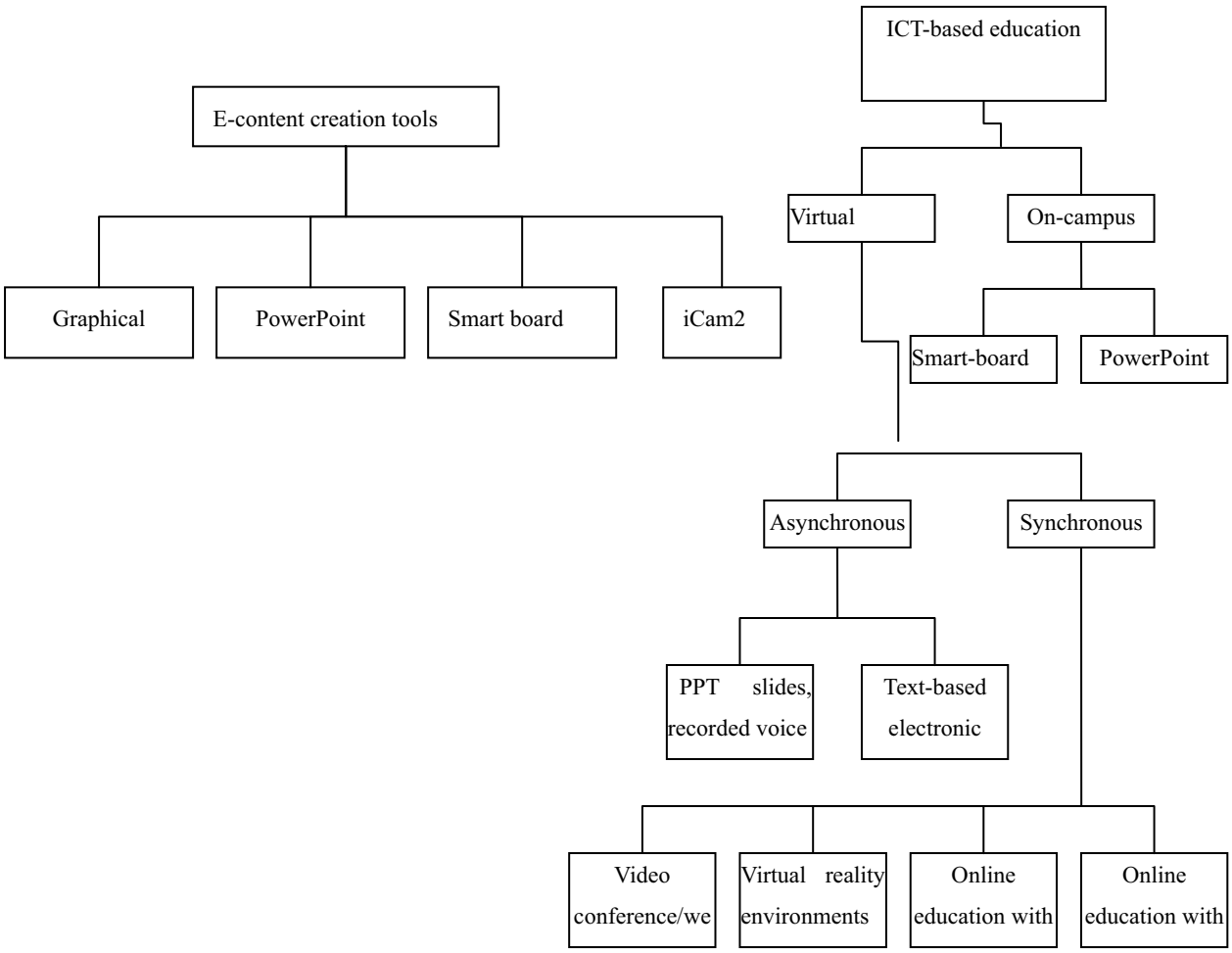

Figure 2.The category research model

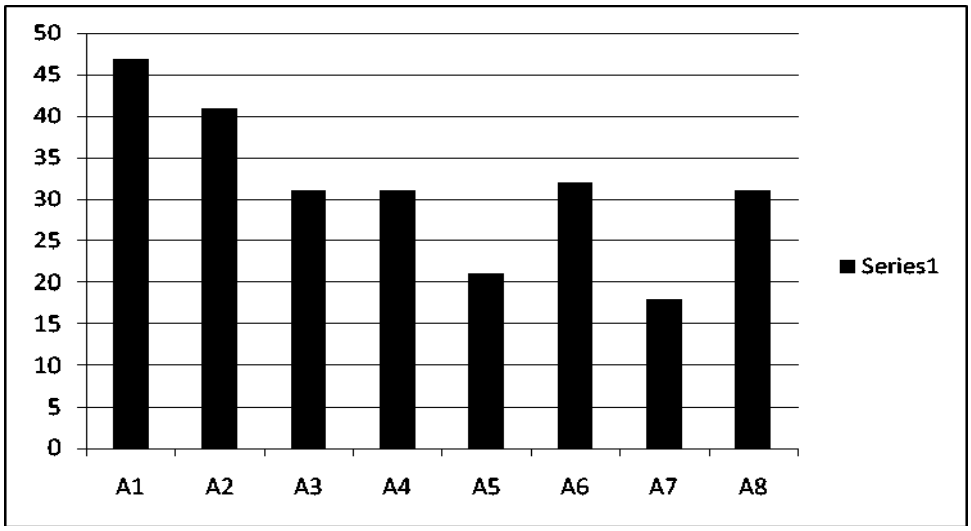

Figure 3.Importance of ICT-based education according to research methodology.

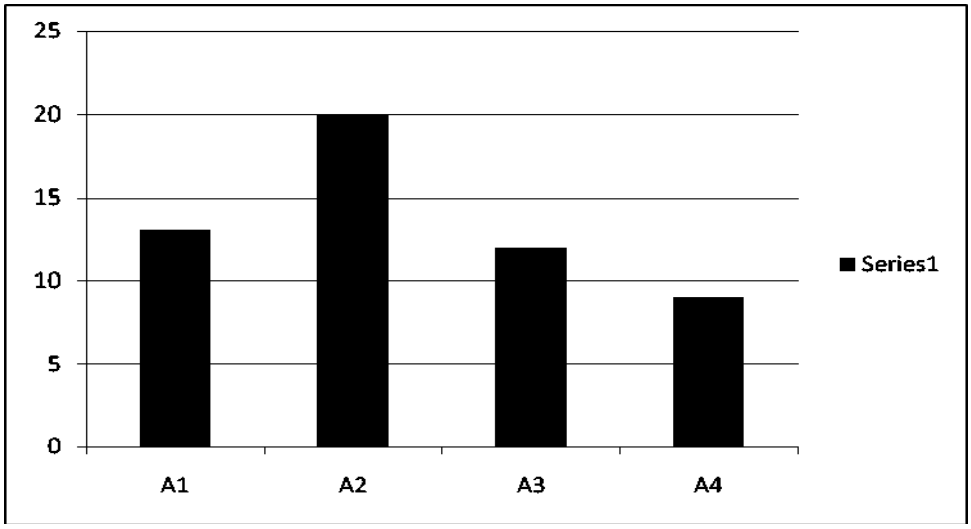

Figure 4. E-content creation tools ranking according to agreement of the experts.