

e-learning at the Technological Educational Institute of Crete: An Evaluation Based on the Student Experience

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Abstract: - The student experience and the criteria used by the students in evaluating the platform of asynchronous tele-education at the Technological Educational Institute of Crete are in the focus of this study. A measuring tool combining both quantitative and qualitative techniques is presented. An important dimension in the evaluation of a virtual learning environment is the assessment of e-learner satisfaction. Critical elements in the assessment procedure are the learner interface, the course content, the access and interaction with the learning community, the personalization of learning and the degree the teachers establish and promote new learning styles via the platform. Based on these elements, questionnaires were developed assessing quantitatively e-learner satisfaction allowing in addition student comments necessary to extract qualitative data regarding the e-learning experience. Qualitative data were also collected by a limited number of unstructured interviews in order to give a deeper insight in the causes of learner satisfaction and dissatisfaction. The data manipulation is not restricted to descriptive statistics of quantitative data, the results are checked for their validity and reliability by comparison with qualitative data and by the use of statistical reliability estimators.

Key-Words: - Evaluation, Electronic Learning, e-Learner Satisfaction, Asynchronous Teaching

1 Introduction

E-learning systems are attracting scientific interest and appreciable funding for both research and practice. The interest for the development of e-learning practices is observed in typical education, as well as in further education and training [1-6].

According to Britain & Liber, who set a framework for the evaluation of Virtual Learning Environments (VLEs) [7]: «*Most of these systems are intended not simply to reproduce the classroom environment - 'on-line' [...] They aim to accommodate a wider range of learning styles and goals, to encourage*

collaborative and resource-based learning and to allow greater share and re-use of resources». Main perspectives pursuing the development of e-learning systems are: the improvement of the quality of learning, the improvement in access to education and training as well as the reduced cost and the increased cost-effectiveness of education [8].

The variety of existing e-learning platforms and the diversity of their applications make it difficult for a global evaluation framework to be developed. Although numerous journal articles, books and web resources are dedicated to e-learning practices and

guidelines for appropriate development of VLEs, there is still a lack of validated knowledge and evaluation data [9]. Furthermore, there is still much to do for the establishment and realization of quality standards and development criteria regarding good practices of e-learning [10].

Among the attempts to set a generic framework for the analysis and evaluation of e-learning practices Britain & Liber have used Conversation Theory and Systems Theory to build two distinct analytical tools [7]. Using Conversation Theory, Britain & Liber focus on the more effective and versatile teaching styles that can be promoted while the application of Systems Theory to e-learning systems provides a framework to analyze the impact of a change in one element of a system (such as teaching via Web-based infrastructure) on the other elements [7]. For Garrison and Anderson, the critical points judging e-learning quality are technology, pedagogy and organizational context [11] while Blass and Davis focus on four criteria: appropriateness, design, interaction and evaluation [10]. Johnson et.al. have developed a model for e-learning effectiveness adding the variable of social presence to other studied variables such as application-specific computer self-efficacy (AS-CSE), perceived usefulness, course interaction and e-learning effectiveness [12]. Finally, Ardito et. al. [13] focus on the usability evaluation of e-learning applications based on students' perceptions while other researchers go one step further to assess student satisfaction [14-18].

The present paper focuses on the assessment of students' satisfaction as well. It combines key components and criteria found in literature and adapts them to the characteristics of the platform of asynchronous tele-education (e-class) of the Technological Educational Institute (TEI) of Crete. Critical elements in the assessment procedure are the *learner interface*, the *course content*, the *access and interaction with the learning community* and the *personalization of learning* [16]. These elements provide the guidelines for the development of appropriate questionnaires. The proposed model combines quantitative and qualitative data analysis, the latter being necessary since they give a deeper insight in the causes of learner satisfaction and dissatisfaction.

2 Assessing Satisfaction

2.1 The context of e-learning satisfaction

Satisfaction with an educational product or service is one outcome of the interaction between instructors and students [16].

In the criteria for the evaluation of educational organizations according to the principles of Total Quality Management (TQM), students' satisfaction is of key importance. The criteria of quality in management according to the American model of Baldrige are: i. *Leadership*, ii. *Information and Analysis*, iii. *Strategic and Operational Planning*, iv. *Human Resource Development and Management*, v. *Educational Process Management*, vi. *School Performance Results* and vii. *Student focus and Student and Stakeholder Satisfaction* [19].

The European Foundation for Quality Management (EFQM), as adopted for the evaluation of educational organizations, divides the outcomes of an organization to four categories: a) students' satisfaction according to their needs and their expectations, b) applicability, c) social impact and d) results of learning according to the strategic and operational planning, that is according to the wills and goals of the educational organization [19].

The students' satisfaction is selected as an outcome-variable to describe the effectiveness of VLEs since, according to Guolla, it is a relatively unambiguous concept reflecting outcomes of reciprocity between students and instructors [14,18]. Wang has resumed the findings of Giese and Gote regarding consumer satisfaction to give the following definition of e-learner satisfaction [16,20]: *«a summary affective response of varying intensity that follows asynchronous e-learning activities, and is stimulated by several focal aspects, such as content, user interface, learning community, customization, and learning performance»*.

2.2 Description of the Method

The questionnaires developed in the present work are designed so as to reveal as many focal aspects that stimulate e-learners' satisfaction with the platform of asynchronous tele-education of TEI of Crete.

Following the approach of Wang, critical elements in the assessment procedure are considered:

- the learner interface,
- the course content,
- the access and interaction with the learning community and
- the personalization of learning to account for the variety of individual learning styles.

These critical elements are actually providing the guidelines to form four groups, of four or five questions each, in the questionnaires. Each group of questions corresponds to one of the critical elements which can be resolved in four or five items. The questions are based on a five point Likert scale with

scores from 1 (Totally Disagree) to 5 (Totally Agree). To make correlations and check the role of all these items to total student satisfaction, an additional question on Likert scale is necessary inquiring if the student is satisfied by the e-learning service as a whole.

The element of the *learner interface* can be resolved in: easiness in usage, easiness in access of the needed content, understanding of provided content, stability and user-friendliness of the e-learning system.

The element of the *course content* can be resolved in provision of content which is : useful, sufficient, up-to-date and fitting to the students needs and expectations.

The element of *access and interaction with the learning community* can be resolved in the availability and easiness for: discussion, communication and interactions between students, discussion, communication and interaction with the teachers/instructors, and sharing the knowledge obtained during the course with the learning community.

The element of *learning individuality* acknowledgment and *personalization* can be resolved in enabling: learning according to the student's needs and expectations, selection by the student of the desired content among various data resources, self-controlling of student learning plan and progress, and recording and evaluation of student progress.

The latter two elements are consistent with the following pedagogical and psychological evaluation considerations expressed by Collace, De Santo and Vento: focus of attention on students and their relationships, enhancement of the learning scenario with a rich variety in communication, focus on the social environment and acknowledgment of the individuality of learning styles [21].

This structure of the four elements, resolved in a total number of 17 items, is integrated with two additional questions regarding the global items of: satisfaction with the platform, and success of the platform as a whole.

Another important feature of the designed questionnaires is the recording of how e-learning is designed and accomplished in the platform under investigation. This could be subsequently correlated with the reported student satisfaction. Each student is asked to select and write down up to three courses he/she has fulfilled where teaching and learning involved usage of the e-class platform. Then the student is asked to place each lesson in the appropriate quadrant in a system of co-ordinates which is designed according to the online paradigm

grid [4,22]. The four quadrants are illustrated in Fig. 1. They correspond to the four approaches for designing and implementing online learning [4]:

- specified and teacher-controlled learning activities
- teacher control but open-ended or strategic learning
- learning activities managed and specified by the learner, and
- learner-managed and open-ended or strategic learning

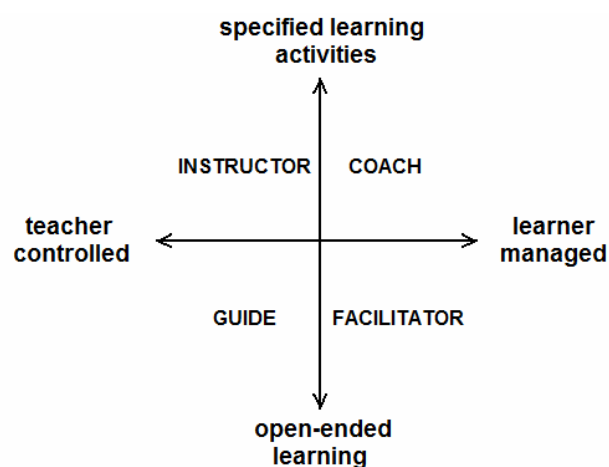


Fig. 1 Simplified presentation of the paradigm grid for online learning as a system of co-ordinates [4,22]. The teacher's role in each quadrant is highlighted in capital letters.

The different role of the teacher in each quadrant can be analyzed in terms of the following characteristics: *dialogue*, *involvement*, *support* and *control*. The differentiation of these characteristics between the four quadrants are summarized in Table 1.

The third part in the structure of the designed questionnaires is an entry for comments where the students are called to report up to three characteristics of the e-learning system that need improvement and up to three characteristics they consider successful. In this way - far from closed forms of questions - the students will express in their own words their perceptions and expectations regarding the e-learning platform.

The last part of the questionnaire collects data that describe the demographic profile of the respondents and their educational experiences. It encompasses questions regarding general computer skills, knowledge of electronic communications techniques

and experience in web-based learning (i.e. number of courses taken using the e-class platform). These items are quite important in order to associate students' perceptions and attitudes with the e-learning platform itself rather than with other factors which depend on the student characteristics.

Table 1. The four approaches of online course design and implementation [4].

(D=dialogue, I=involvement, S=support, and C=control).

TEACHER AS INSTRUCTOR
D: Teacher controls dialogue and interaction
I: Learner rarely influences content
S: Teacher only, e-mailed or scheduled meetings
C: Teacher controls materials and deadlines
TEACHER AS COACH
D: Teacher sets out general responsibilities
I: Task-focused learner-managed groups
S: Teacher provides advice on task's nature
C: Learner conducts tasks, variety of sources
TEACHER AS GUIDE
D: Teacher-led and learner-managed parts
I: Mostly individual activities from online texts
S: Online or occasionally face-to-face
C: Learner controlled specific goals & activities
TEACHER AS FACILITATOR
D: Self or peer-group directed, many choices
I: Total involvement in learning activities
S: Teacher in the background, feedback
C: Learner determines goals and outcomes

The collected quantitative data are manipulated in two steps. The first step involves the application of descriptive statistics such as tables, averages, and distribution charts while the second step involves validity and reliability checking of the outcomes.

In order to give a deeper insight at students' satisfaction and dissatisfaction and increase the validity of the assessment procedure, qualitative data via unstructured interviews are proved to be useful (in a methodological-triangulation approach [23]).

In unstructured interviews where students are let free to express their satisfaction or dissatisfaction, the researcher can identify the criteria the students use in their evaluation [24].

Characteristic are the results of the evaluation Gilbert, Morton and Rowley conducted on an MSc in Information Technologies and Management. They found that the criteria students used for expressing satisfaction were: synergy between theory and practice, discussion forums, other means of student interaction, and other learning support. Sources of dissatisfaction were: robustness and usability of

platform, access to resources, currency of the study materials and student work scheduling [24].

In the case of the platform of asynchronous tele-education at the Department of Applied Informatics and Multimedia at the TEI of Crete such criteria can be identified by the entries for comments regarding sources of satisfaction and dissatisfaction encompassed in the questionnaires. However the need for deeper insight into students' perceptions dictates the use of more in-depth qualitative analysis using unstructured interviews or even brainstorming sessions where the researcher discusses with a group of students *why* they are satisfied or dissatisfied and *how* the quality of the e-learning platform can be improved. The discussion regarding an e-learning platform improvement can be held on the basis of fostering student creativity, teamwork and interaction [25-26] as well as supporting distant education courses [27].

3 Results and Discussion

The students' responses concerning the seventeen items resolving student satisfaction with the platform are illustrated in the pie charts of figures 2 - 18. The fragment corresponding to the percentage of answer '1' in the Likert scale appears exploded while the percentages of the other answers move in a clockwise manner from '1' to '5'.

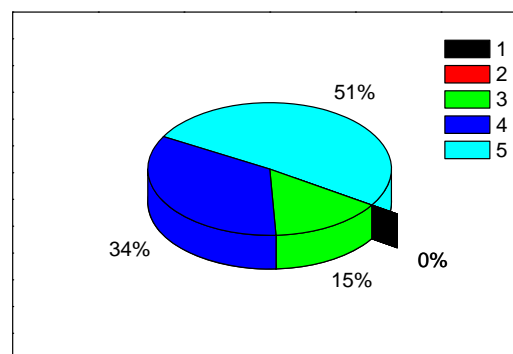


Fig. 2 Easiness in the platform use

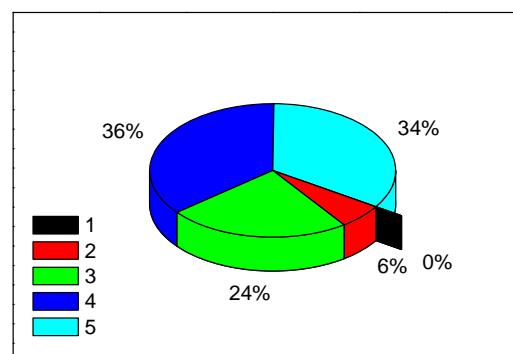


Fig. 3 Platform friendliness

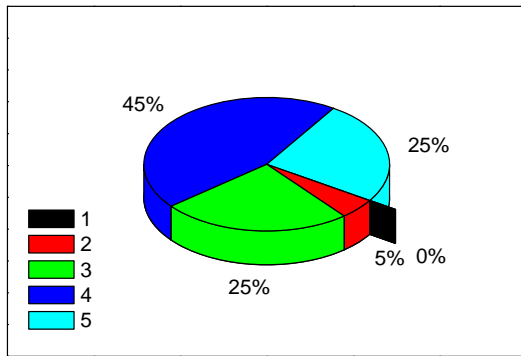


Fig. 4 Content easy to understand

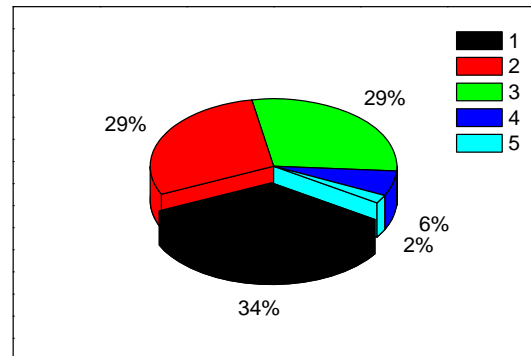


Fig. 7 The platform enables students discuss their questions on a topic with their peers

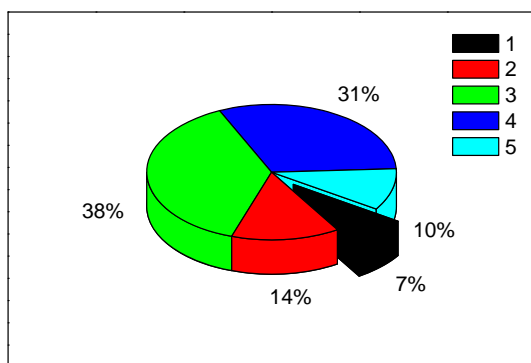


Fig. 5 Operation stability

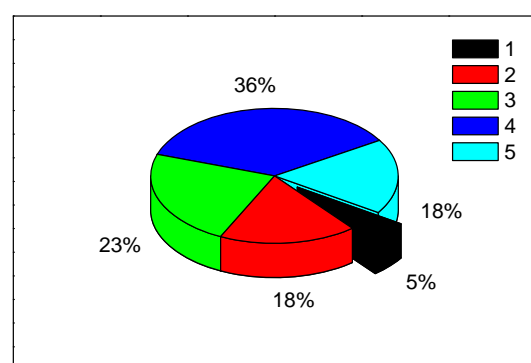


Fig. 8 The platform provides efficiently access to information resources of the learning community

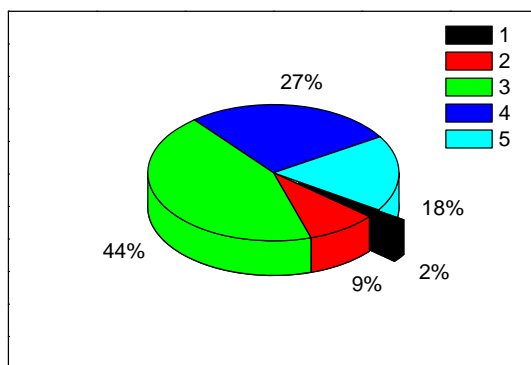


Fig. 6 Easiness in finding the content needed

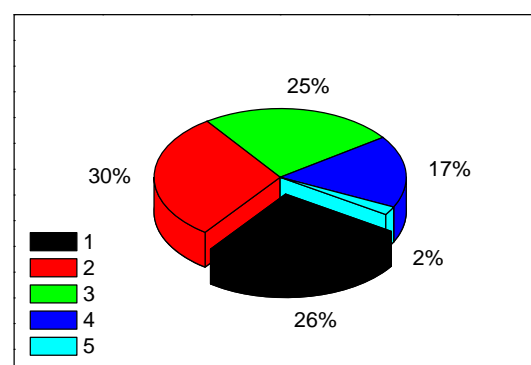


Fig. 9 The platform enables students discuss their questions with their teachers

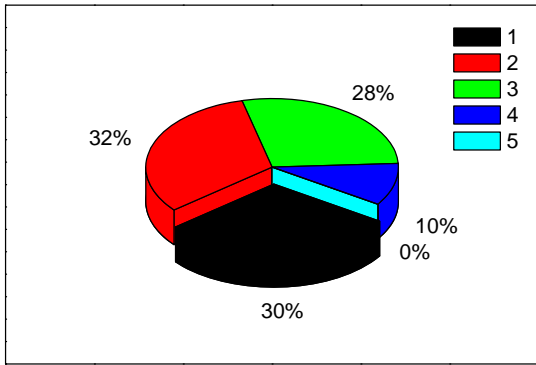


Fig. 10 The platform makes it easy for a student to discuss the content learned during a course with the learning community

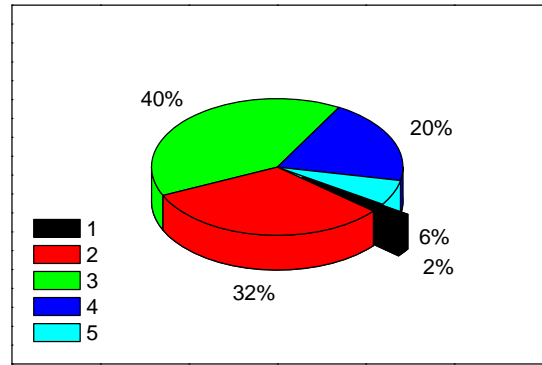


Fig. 13 The content of the platform is sufficient

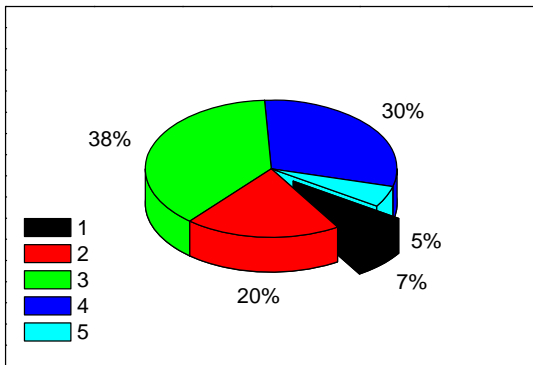


Fig. 11 The content of the platform is up to date

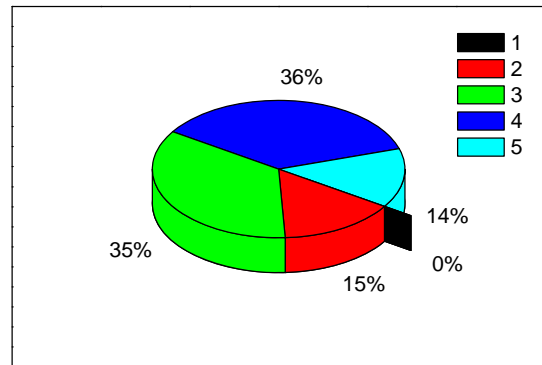


Fig. 14 The platform provides useful content

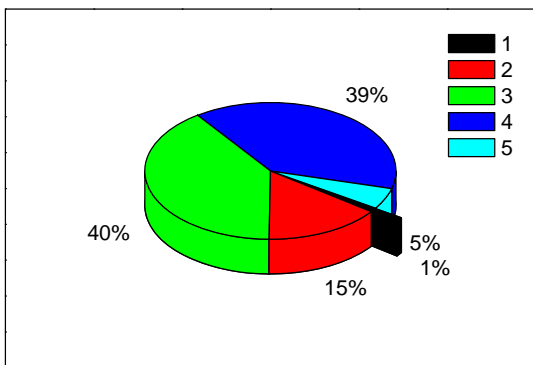


Fig. 12 The platform content fits to the students' needs

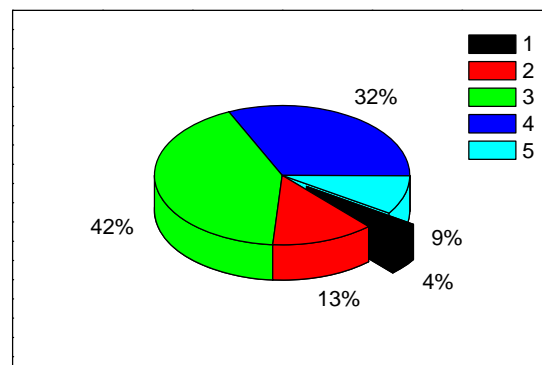


Fig. 15 The platform enables students to learn the content they need

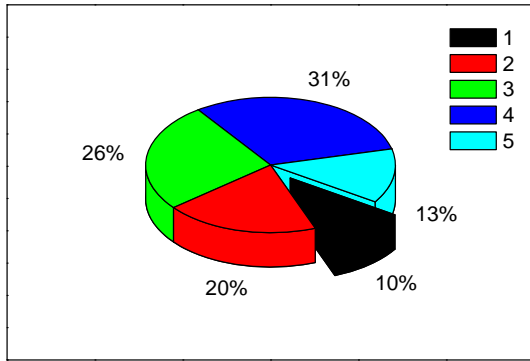


Fig. 16 The platform enables students to choose the content they want to learn

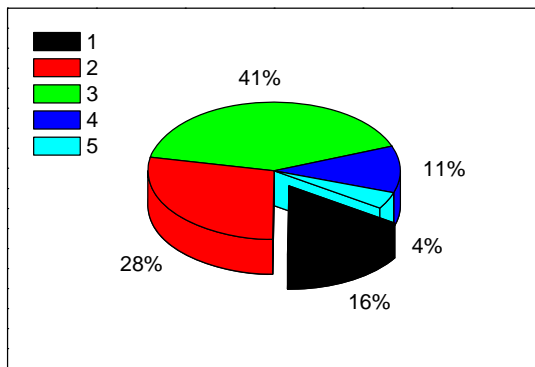


Fig. 17 The platform enables students to control their learning process

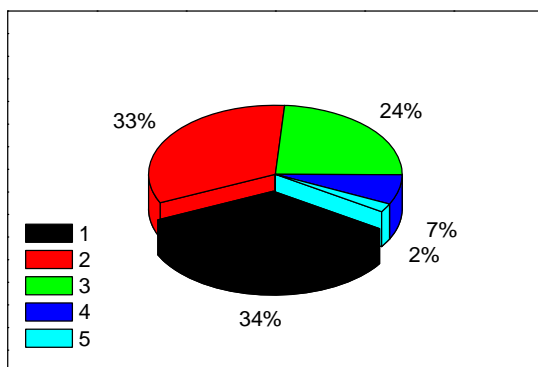


Fig. 18 The platform monitors the students' learning process and progress

The students' responses concerning the two global items of overall satisfaction with the platform and success of the platform respectively are illustrated in the column plots of figures 19 and 20.

The most common responses for these global items were 3 and 4 respectively in the five-point Likert scale. No significant discrepancies were found

between the responses of male and female students. The average value of the responses as well as the standard deviation for both of the global items are listed in Table 2. Average scores and standard deviations regarding the elements of learner interface, interaction with the learning community, course-content and learning personalization are also listed in Table 2. For each element, the items with the higher and the lower average score respectively are shown. Average scores below 3.00 were counted for course-content sufficiency, discussion of questions via the platform, and recording and evaluation of student progress.

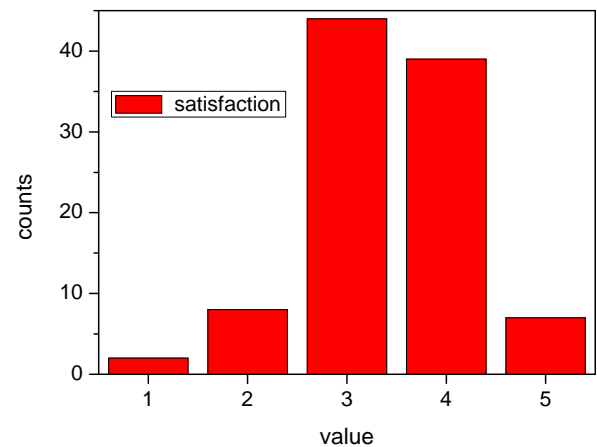


Fig. 19 Distribution of scores regarding overall student-satisfaction with the platform among 100 respondents

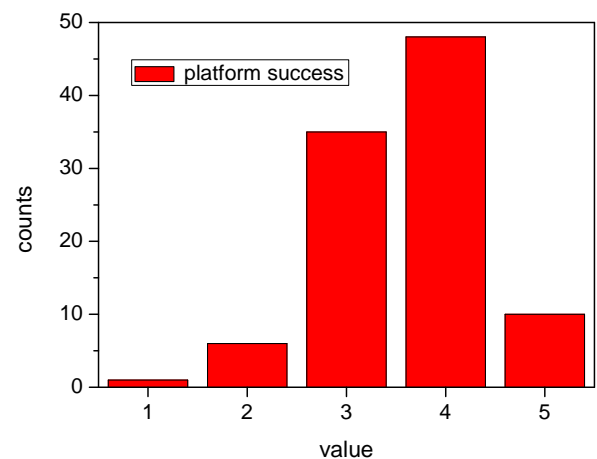


Fig. 20 Distribution of scores regarding overall platform success among 100 respondents

The low scores in these three items are consistent with the results of interviews with individual students as well as with the students' statements in the special comment-entries of the questionnaires regarding causes of dissatisfaction. Many students complained about the lack of (or limited)

communication with their teachers as well as with other students and the learning community (a necessity for forums, online workgroups and internet-links to other academic resources was addressed).

Table 2. Average scores and standard deviations in selected items of the questionnaire. Items with extreme average scores for each element are listed, compared with the average scores and standard deviations of the global items of satisfaction and success regarding the platform.

Element	Item	average	s.d
Learner interface	Easiness	4.36	0.73
	Stability	3.23	1.04
Interaction with the learning community	Access to shared content	3.44	1.13
	Discussing questions with peers	2.13	1.02
Course content	Useful	3.49	0.92
	Sufficient	2.96	0.92
Learning personalization	Enables Learning	3.29	0.95
	Monitors Student performance	2.10	1.02
satisfaction		3.41	0.82
success		3.60	0.79

In some courses the content was considered insufficient, inappropriate (i.e. complaints for texts written in English rather than in Greek) and not up-to date. The lack of feedback paths regarding their progress and the lack of a system to monitor the current status of their studies were among the main causes of students' dissatisfaction. On the other hand, the positive comments mainly concerned the provision of free educational material and information resources. The students generally realize the benefits of a platform of asynchronous tele-education in their studies and seek for interaction with their peers and the learning community.

The qualitative data from the comment-entries of the questionnaires as well as the outcomes of the content analysis of the interviews can serve: i) as means to get a deeper insight in students' perceptions and the way of thinking regarding the evaluation of the e-learning platform and ii) as complementary data necessary for the validation of quantitative data. The reliability and the validity of the quantitative data were also checked inherently.

The correlation matrix of measures was built and the standardized Cronbach's Alpha reliability estimator was used in this perspective.

If an element is comprised by k items then there are $n = k(k-1)/2$ pairs of inter-item correlations (for the element of learning interface $k=5$ and $n=10$ while for each of the other three elements $k=4$ and $n=6$).

The average, \bar{r} , of the inter-item correlations within each element was calculated yielding the values of 0.38, 0.44, 0.50 and 0.41 for the learning interface, the access and interaction with the learning community, the course content and the personalization of learning respectively. The standardized Cronbach's Alpha reliability estimator given for each element by: $a = n\bar{r}/[1 + (n-1)\bar{r}]$

was found to be 0.86, 0.83, 0.86 and 0.81 within each of the four elements respectively. These high alpha-values reveal the high reliability and internal consistency of the items representing each element.

A convenient way to estimate whether the designed structure of four elements measures the desired construct is to calculate the correlation between the sums of scores of all the items of the four elements and the sums of scores of the two global items (criterion-related validity) [16]. An array of $N=100$ elements was obtained by summing the seventeen scores from each questionnaire (average sum: 53.09, standard deviation: 10.03, min. sum: 29 and max. sum: 82). An additional array of $N=100$ elements was also obtained by summing the scores of the two global items regarding student satisfaction and platform success (average sum: 7.01, standard deviation: 1.51, min. sum: 2 and max. sum: 10). The correlation of these two arrays yielded a value of $r = 0,77$ revealing an acceptable criterion-related validity.

In the inquiry for the causes of students' satisfaction or dissatisfaction, the way the teachers design, organize and accomplish e-learning via the platform of e-class was examined.

A plethora of courses were cited and 95% of them (Fig. 21) were placed at the first quadrant in the system of co-ordinates designed according to the online paradigm grid (the teacher acts as an instructor controlling dialogue, interaction, material and deadlines). The minority of courses placed to other quadrants involved laboratory courses where collaboration between students and working in teams is more pronounced. In any case, it is apparent that the platform is used as a complementary tool to conventional teaching and learning. The content analysis of the students' interviews actually reveals

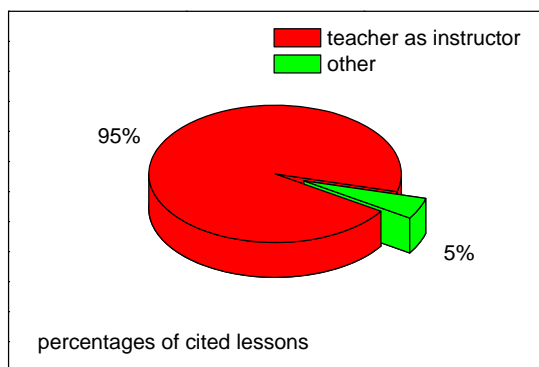


Fig. 21 Teacher's role in the e-class platform.

that some instructors do not use the e-class platform at all. This was pointed out by the vast majority of the students, thus indicating that they realize the importance of such a platform. The re-use intention of courses supplemented by the online platform and the negative feelings expressed for courses without online content and support reveal an approval-tendency of the e-class platform by the students. The results of the present study, although emerging from a different research-aspect, reveal the evolution of students' perceptions regarding asynchronous tele-education at the TEI of Crete when compared with first results reported in 2005 [28-32].

4 Conclusion

The students of the TEI of Crete realize the usefulness and welcome the operation of a platform of asynchronous tele-education. On the other hand the qualitative data reveal two main reasons of dissatisfaction: a) insufficient communication with the teacher (i.e. big response times to students' e-mail messages or lack of feedback), with peer-students and the learning community, and b) not updated and inappropriate content in some courses. Quantitative data, checked for their reliability and validity, reveal a moderate to high approval of the platform by the students. Students express satisfaction with an average score of 3.41 and consider the platform being successful with an average score of 3.60 in a five-point Likert scale. Many of these findings could seem obvious and expected, they are however useful and valuable since they monitor the current status of the e-learning environment at the TEI of Crete providing up-to-date empirical evidence of students' perceptions. Furthermore, they provide the guidelines for future planning and practice regarding e-learning at the TEI of Crete. In this sense, a forthcoming study should focus on teachers' perceptions regarding the platform usability and the

availability or need of tools that can really help them promote and establish new learning styles via the e-class platform.

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