MODELING LEARNERS' PERCEPTIONS TOWARD EDUCATIONAL PORTALS AND COLLABORATIVE LEARNING TOOLS USAGE: THE HELLENIC OPEN UNIVERSITY CASE

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Abstract

The educational collaborative virtual distance learning environment is supposed to promote the active participation of teachers and students, interacting one another, exchanging knowledge and creating new abilities. Consequently, the learning process is anticipated to be promoted on both sides, by exchanging experiences, discussing new ideas and accomplishment of group, thus allowing the creation of knowledge, based on the collective involvement. On the other hand, in the context of eLearning, many standard software platforms, so called portal servers, have appeared on the market integrating various and often advanced synchronous and asynchronous collaborative tools and features. In this paper, we conduct a preliminary analysis measuring the Hellenic Open University's (HOU) students' perceptions toward the educational portal's learning tools focusing mainly on collaborative activities. We make an attempt to identify whether the learners are using the portal, the tools it provides and to what degree. The study takes into account a plethora of variables to estimate whether these variables and at what degree are affecting significantly portal usability. Apart from normal descriptive analysis, we furnish two different linear regression models illustrating the various cross-dependencies among different dependent and independent variables and conducting two disparate Analyses of Variance (one-way ANOVA).

Keywords: Distance learning; Educational portals; Education technology; Collaborative tools; Computer Supported Collaborative Learning; Perceptions; Models.

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1. INTRODUCTION

Distance learning is generally defined as all types of formal instruction that are conducted when teachers and learners are not located in the same place (Gilbert, 1995). At least as early as the mid-90's, Internet penetration flourished the promise for connecting the remote teacher and learner, removing the location and time barriers while nowadays, the promise for anywhere, anyplace, anytime education (Rosenkrans, 2001; Downes, 1998; Cooper, 1999; Chute et al., 1999; Simonson et al., 2003) is about to be fulfilled.

As a result, the rapidly increasing use of computers in education and in particular the migration of many university courses to web-based delivery has caused a resurgence of interest among educators in non-traditional methods of course design and delivery. At present, several enterprises, institutions and research centers are developing many applications destinated to education. A common point among them is the embedment of interfaces capable of supporting a relationship among teachers and students. That relationship can be done through synchronous and asynchronous communication and is commonly aiming at promoting collaboration.

According to (Lotus, 2000), "Collaborative technologies support the learning objective of mental model and behaviour change in conjunction with learning team centered education. Collaborative technologies offer a rich, shared, virtual workspace in which interactions occur not between an individual and technology, but as many-to-many, interpersonal communication, among people who share a common goal. The interactions can be facilitated by an instructor". Computer Supported Collaborative Learning (CSCL) is directly connected with Computer Supported Collaborative Work (CSCW) systems, which is defined as a computer based-network system that supports work in a common task and provides a shared interface for groups to work together (Ellis et al., 1991).

The above definition provides only a starting point mentioning some of the key elements of collaboration. That is mental models of participants, behaviour change, interpersonal communication, shared workspaces and goal sharing. However, behind all these issues many cognitive theories are standing. Some of these are (Roberts, 2004): The sociocultural theory (based on Vygotsky), constructivism theory, self-regulation learning, situated cognition, cognitive apprenticeship, problem-base learning, distributed cognition, etc.

Another important point is the distinction between synchronous and asynchronous collaboration. Synchronous collaboration tools allow different persons, in different places, to communicate following either formal communication procedures or in totally informal ways, sharing goals, data and knowledge at the same time. Synchronous collaboration requires

students and instructors to be consistently connected and in constant attendance. Chat groups, multi-point videoconferences, group editors, media spaces and shared workplaces are examples of synchronous collaboration tools and methods.

On the other hand, asynchronous collaboration systems allow parties to communicate and share goals, data and knowledge in a disconnected fashion. Examples of such systems include email, asynchronous groupware applications, organizational memories, discussion forums and in a broader context workflow systems. However, a major question arising here is: To what degree these tools can support collaboration?

As already noticed, during the last decade several collaborative tools and systems have emerged. These can be totally autonomous e.g. chat, email, discussion forums, wikis, etc or embedded in larger and usually complex applications, systems or platforms. For instance, collaborative features can be found almost in every Learning Management System (LMS), Learning Content Management System (LCMS) or Virtual School platform today (Horton & Horton, 2003; Kambourakis & Loukis, 2005).

Modern software is complex and expensive. This fact has motivated many companies and educational institutions to invest in enterprise and educational portals as a mechanism to manage their information and support eLearning procedures in a cohesive and structured fashion. Portals offer many advantages over other software applications. They provide a single point of access for students, employees, partners, and customers to various types of (structured and unstructured) information, making an important contribution to enabling knowledge management.

The ultimate goal is to provide the learner with a consolidated, personalized interface to all information and tools he needs in order to assist him in the distance learning process. Additionally, modern portal platforms more and more converge with other knowledge management tools e.g. LMS, LCMS.

Portals have become the *de-facto* standard for Web application delivery. In fact, analysts have predicted that portals will become the next generation desktop environment. Portals provide the ability to integrate disparate systems and leverage the functionality provided by those systems. They provide a unique opportunity to combine nascent technologies with mature, well-established software applications. Technically, a portal combines multiple web applications (as so-called *portlets*) to one single portal webpage.

Meanwhile many standard software platforms, so called portal servers, have appeared on the market. The main features of such portal servers are (Schelp & Winter, 2002):

- Personalization, i.e. it is possible to create user profiles in order to offer frequently used functions and save user specific parameters.
- Integration of various information sources and applications into a single web-based user interface, i.e. the system provides predefined portlets for standard data sources and a development environment to build custom portlets.
- Collaboration features.
- Content and document management functionality.
- Flexible search functionality.

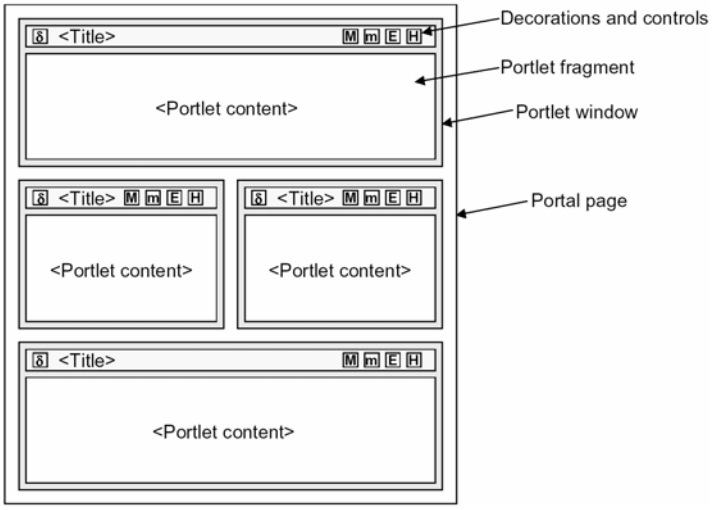

Figure 1. Elements of a portal page (Java Community Process, 2003)

The focus is, however, clearly on collaboration tools and on personalization and integration features. In particular, portal servers act as a container for portlets which deliver HTML fragments that together with the portal frame and portlet decorations are combined to the portal page. Figure 1 presents a schematic view of such a portal page with four portlets. Users can personalize the system by choosing their portlets and placing them on their portal page. They can usually also adjust the portal appearance by means of so-called “skins” (sets of colors and decorations).

Nowadays, almost every vendor of application server software (Sun, IBM, Oracle, BEA, etc.) has a portal server product in its portfolio. Even in the open source community the Apache Software Foundation offers the Jetspeed portal platform (http://portals.apache.org). Under this settings and trends in eLearning technology, the Hellenic Open University (HOU) has moved forward to offer to its students and educational personnel a portal server called Websphere from IBM (http://online.eap.gr). This server was initially developed from IBM and Lotus to support enterprise focused demands in knowledge and workflow management and eLearning procedures. However, with some modifications, additions and partial

interface translation this product is serving HOU's distance learning needs for (almost) the last two years. In addition, as depicted in Figure 2, Websphere offers various types of asynchronous and synchronous tools to support collaboration activities among all the participants.

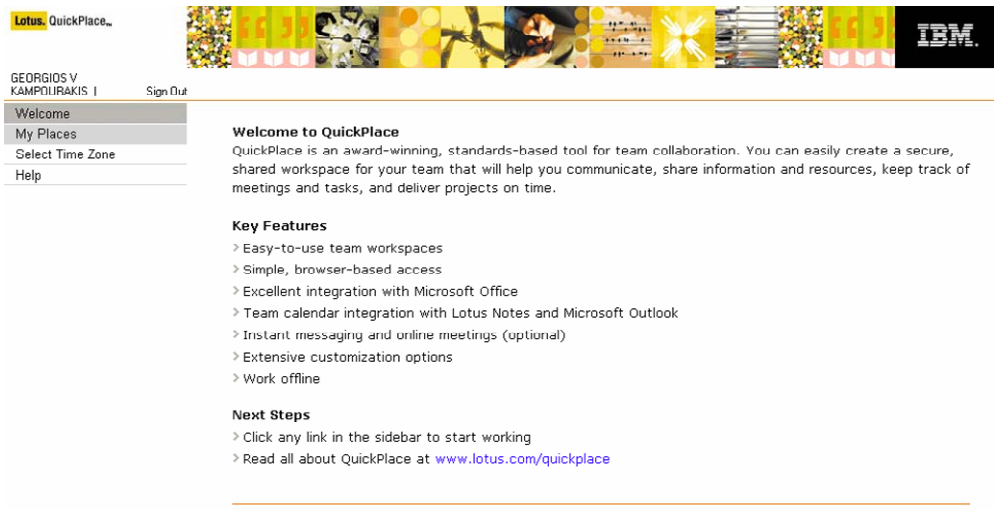

Figure 2. General view of collaboration features of the Websphere portal.

The purpose of this paper is to perform a preliminary analysis measuring the HOU's student's perceptions toward the portal learning activities and tools, focusing mainly on the collaborative features provided. By doing this, we attempt to identify if the learners are using the portal, the associated tools and to what degree. The study gives attention to a plethora of variables, e.g. student's experience with the Internet, the course/module that the students are enrolled and the level of portal usage, to discover important relations among them. In addition to standard descriptive analysis, we endeavour to compile two disparate statistical models, which are capable of depicting significant cross-dependencies. Moreover, we conduct two separate Analyses of Variance (one-way ANOVA) among two different variables serving as *factors* and some others acting as dependent.

The rest of the paper is structured as follows: Section 2 discusses the methodology, presenting important instrument and measurement procedure parameters and introducing the research questions. Section 3 presents the conducted descriptive results followed by a detailed analysis, while Section 4 provides a thorough discussion on the results. Section 5 concludes the paper and provides pointers to future work.

2. METHODOLOGY, DATA and HYPOTHESES STATEMENT

The data used in this study were gathered through a survey among HOU's students both postgraduate and undergraduate attending education and informatics courses. A

questionnaire consisting of fifteen questions and two parts was designed to collect students' experiences about the portal usage and the reasons they believe that the tools the portal provides are useful or not (useful) to them (positive and not positive worded statements in two, six and twelve-item Likert-type corresponding questions). Each statement has five alternatives to choose from: strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. The responses to the items were recorded so that strongly disagree=1, disagree=2, neither agree nor disagree=3, agree=4 and strongly agree=5.

The second part was targeted to collect some demographics data about the subjects. That is, age, gender, the course/module the students are attending, the subject's experience with PCs and the Internet, etc. Although, the questionnaire is not provided here for brevity reasons, the reader can download it from the following link: http://www.icsd.aegean.gr/info-sec-lab/userpages/fellows/gkamb/other/Q_Students_v2.pdf

The content validity of the instrument was reviewed by a panel of experts in eLearning projects, consisting of two lecturers, two assistant professors and two associate professors. The calculated coefficient alpha reliability from the results of this survey instrument was .902, which suggests that this instrument is suitable to measure the usage degree of eLearning collaborative tools embedded in the HOU's portal.

The instrument was transformed to an electronic questionnaire form using the Macromedia Dreamweaver tool and was placed to a corresponding Web-page. The subjects of the survey were informed to participate by e-mail. We sent subsequent e-mails to the head instructors of each course with the entreaty to forward the e-mail to their students. As an additional step we posted the email text concerning the questionnaire in the HOU student's unofficial forum in http://www.eap-forums.gr/. The students could login and fill in the questionnaire by providing to the survey's starting page a login name and password. The credentials were the same for every student and were included in the e-mail message.

We applied various cookies, IP address scanning and time/date techniques to ensure that each participant was able to submit only one questionnaire. The Web-page form logged the completed questionnaires into an MS Excel file. There was also the possibility for the researchers to login using their private credentials and keep track of the completed questionnaires at any time. This method was selected (or expected) to be the most flexible, convenient and remunerative for the researchers (Immediate, costless, on-demand, send-in-batch and in large numbers notifications/invitations to the subjects to participate, totally anonymity for the participants supported, trouble-free and foolproof way to import the data to the preferred statistical program).

The participants were assured that their responses would be anonymous and confidential and that no personal data were recorded during the overall questionnaire submission process. The questionnaire's Web page was left active online for almost two months collecting hopefully 107 cases. Three cases were removed due to considerable missing data amount, thus yielding to a final sample of 104.

As already stated, the main objective of the present study is to identify if the HOU students are using the portal, the collaborative tools it provides and to what specific degree. For this purpose:

1. The degree of HOU's portal usage and its associated tools by the students was selected to serve as the dependent variable for our models compilation.
2. The level of knowledge and experience of the subjects with Personal Computers (PCs) and the Internet and the educational program/module which they attend are selected as *factors* for One Way-ANOVA analysis.

In this direction we tested the following four hypotheses setting the predetermined level of significance at .05:

H1: There is a significant difference among the usability degree of the eLearning collaborative tools provided by the HOU's portal and the reasons that the subjects (learners) find these tools useful.

H2: There is a significant difference among the usability degree of the eLearning collaborative tools provided by the HOU's portal and the reasons that the students believe these tools are not useful.

H3: There is a significant difference among the subject's level of knowledge and experience with PCs and the Internet and the reasons why the subjects find the eLearning collaborative tools provided by the HOU's portal useful or not (useful).

H4: There is a significant difference among the course/module the subjects are enrolled and the reasons why the subjects find the eLearning collaborative tools provided by the HOU's portal useful or not (useful).

3. RESULTS

The subjects were 64 males (61.5% of the total sample) and 40 females (38.5%). Their ages varied in five categories. The first category included 1 subject (1%). The second category included 26 subjects (25%), who were 25-30 years old. The third category contained 55 subjects (52.9%) who were 31-40 years old. The fourth category had 21 subjects (21.2%) who were 41-50 years old, while the last category reported 1 subject (1%) who was over 50.

The course/module the subjects attended (named as Q_9) varied in four categories. The first category contained 40 subjects (38.5%), who participated in a Masters' Program in Education. The second category named Masters' Program in Adults' Education had no subject. The third category included 5 subjects (4.8%), who participated in a Masters' program in Information Systems. The last category had 54 subjects (51.9%), who attended the Undergraduate program in Informatics, while five values (4.8%) were reported as missing.

The students reported five different levels in relation to the portal and its associated tools usage degree (named as Q_1). The first category contained 10 participants (9.6%) who stated that they had not use the portal. The second category contained 43 subjects (41.3%) who reported some use of the portal. The third and fourth categories came up with 30 items (28.8%) and 15 (14.6%) correspondingly reporting moderate and intense use. The final category contained 5 subjects reporting very intensive use. The Mean and St. Dev. values for Q_1 were 2.63 & 1.01 respectively.

The subject's knowledge and experience with PCs and the Internet (named Q_{15}) were classified in five different categories. The first category contained 1 subject (1%) with inadequate knowledge and experience with PCs and the Internet. The second category had 4 subjects (3.8%) with little knowledge and experience. The third category included 12 subjects (11.5%) with fair knowledge and experience. The fourth category had 48 subjects (46.2) with good knowledge and experience, while the last category contained 38 subjects (36.5%) with excellent knowledge and experience. One value (1%) was reported as missing. The Mean and St. Dev. values for Q_{15} were 4.15 and .084 respectively. Finally, the frequencies for the significant variables, either dependent or independent, used in our models further down, are presented in Table 1.

Descriptive Statistics: Significant variables listing (Student's opinions about the portal's tools)

	N	Min.	Max.	Mean	Std. Dev.
Q4_1: [Convenience to the deliverance and organization of the educational material]	103	1	5	3.70	1.128
Q4_3: [Keep up with the course/module's significant events taking place during the semester]	104	1	5	3.88	1.180
Q4_4: [It's easier to pose questions and exchange opinions and ideas with the other students and the instructor, in order to solve educational issues arising during the learning process]	103	1	5	3.41	1.192
Q5_1: [Lack of proper training and familiarization with the tools that the portal provides]	103	1	5	3.52	1.243
Q5_2: [The students don't participate in asynchronous chats or chat rooms which are arranged by the instructors or the other students]	103	1	5	3.85	1.033
Q5_4: [The synchronous and asynchronous collaborative tools that the portal offers are not really or practically useful]	102	1	5	2.52	.864
Q5_6: [I prefer the direct communication by phone]	103	1	5	2.79	1.210
Q5_7: [The students prefer the traditional communication methods with fax, telephone or surface mail]	104	1	5	1.77	1.054
Q5_8: [It requires considerable time for the students to aquire experience in using these collaboration tools]	103	1	5	2.52	1.228

Table 1. Frequencies of the significant variables used in models and One Way-ANOVA

Table 2 depicts the ANOVA results from linear regression analysis for the first of our models taking the level of portal usage by the learners as the dependent variable. The reasons the students find these tools useful and have been identified as the most significant independent variables are: (a) Convenience in delivering and organizing the educational material (Q_{4_1}), (b) Easy notification for the course/module significant events taking place during the semester (Q_{4_3}) and (c) Posing questions as well as exchanging opinions and ideas with the other students and the instructor in order to solve educational issues arising during the learning process (Q_{4_4}).

ANOVA for the first model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.890	3	7.963	9.743	.000
	Residual	79.279	97	.817		
	Total	103.168	100			

Coefficients

Model		Unstandardized Coefficients		Sig.
		B	Std. Error	
1	(Constant)	1.112	.343	.002
	Q4_1	.288	.103	.006
	Q4_3	.291	.110	.010
	Q4_4	-.194	.101	.057

The derived model is described as:

$$Q_1 = 1.11 + .28 * Q_{4\_1} + .29 * Q_{4\_3} - .19 * Q_{4\_4} + u_t$$

(where 1.11 is the model constant and u_t the residuals).

Table 2. ANOVA results for the level of portal and its associated tools usage and the reasons that the participants find useful these tools as the independent variables

The results of ANOVA for the first model indicated that there was a significant difference among usability degree of the portal's usage level and its corresponding collaboration tools

and the three aforementioned reasons (F = 9.743, Sig. = .000). These findings support hypothesis *H1*.

Table 3 presents the ANOVA results performing linear regression analysis for the second model. This case considers the level of portal usage by the students as the dependent variable and the reasons why they believe that the corresponding collaborating tools are not useful (or acting to an extensive degree as limitative) as the independent variables. These are: (a) The students don't participate in asynchronous chats or chat rooms which are arranged by the instructors or the other students (Q_{5_2}) and (b) The synchronous and asynchronous collaborative tools that the portal offers are not really or practically useful to them (Q_{5_4}).

ANOVA for the second model

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	11.770	2	5.885	6,254	.000
	Residual	91.270	97	.941		
	Total	103.040	99			

Coefficients

Model		Unstandardized Coefficients		Sig.
		B	Std. Error	
2	(Constant)	2.606	.468	.000
	Q5_2	.211	.094	.027
	Q5_4	-.308	.112	.007

The derived model is described as:

$$Q_1 = 2.60 + .21 * Q_{5\_2} - .30 * Q_{5\_4} + u_t$$

(where 2.60 is the model constant and u_t the residuals).

Table 3. ANOVA results for the level of portal and its associated tools usage and the reasons that the participants believe that the corresponding tools are not really useful

The results of ANOVA for the second model shows that there is a significant difference among usability degree of the portal's usage level and the reasons why the students do not find those tools practically useful (F = 6.254, Sig. = .000). These results support hypothesis *H2*.

Table 4 depicts the One Way-ANOVA results with the level of subject's knowledge and experience with PCs and the Internet as *factor* and the reasons why the participants find the tools that the portal provide useful or not (useful), as the dependent variables. More specifically, four reasons have been identified to be significantly affected by the Q_{15} *factor*. These are: (a) Lack of proper training and familiarization with the tools that the portal provides (Q_{5_1}), (b) Easy notification for the course/module significant events taking place during the semester (Q_{4_3}), (c) Usually they prefer the traditional communication methods with fax, telephone or surface mail (Q_{5_7}) and (d) It requires considerable time for the students to acquire experience in using these collaboration tools (Q_{5_8}).

The results of One Way-ANOVA indicated that there was significant difference among the level of subject's knowledge and experience with PCs and the Internet and the reasons that the participants find the tools that the portal provides useful or not (useful). These outcomes support hypothesis *H3*.

One Way-ANOVA: Q15 with Q4_3, Q5_1, Q5_7 & Q5_8

		Sum of Squares	df	Mean Square	F	Sig.
Q4_3	Between Groups	23.499	4	5.875	4.855	.001
	Within Groups	118.598	98	1.210		
	Total	142.097	102			
Q5_1	Between Groups	20.719	3	6.906	5.028	.003
	Within Groups	134.624	98	1.374		
	Total	155.343	101			
Q5_7	Between Groups	14.074	4	3.519	3.437	.011
	Within Groups	100.333	98	1.024		
	Total	114.408	102			
Q5_8	Between Groups	33.678	4	8.419	6.932	.000
	Within Groups	117.812	97	1.215		
	Total	151.490	101			

Table 4. One Way-ANOVA results for experience with PCs and the Internet as *factor*

Table 5 depicts the One Way-ANOVA results with the course/module that the subjects attend as *factor* (Q_9) and the reasons why the participants find the tools that the portal provide not handy, as the dependent variables. More specifically, three reasons have been identified to be significantly affected by the Q_9 *factor*. These are: (a) Lack of proper training and familiarization with the tools that the portal provides (Q_{5_1}), (b) The direct communication by phone is most preferable (Q_{5_6}), (c) Usually they like better the traditional communication methods with fax, telephone or surface mail (Q_{5_8}).

One Way-ANOVA: Q_9 with Q5_1, Q5_6 & Q5_8

		Sum of Squares	df	Mean Square	F	Sig.
Q5_1	Between Groups	18.639	2	9.319	6.987	.001
	Within Groups	128.048	96	1.334		
	Total	146.687	98			
Q5_6	Between Groups	33.949	2	16.975	14.56	.000
	Within Groups	110.745	95	1.166		
	Total	144.694	97			
Q5_8	Between Groups	18.428	2	9.214	7.171	.001
	Within Groups	122.062	95	1.285		
	Total	140.490	97			

Table 5. One Way-ANOVA results for course/module that the subject's attend as *factor*

Summarizing, the results of One Way-ANOVA indicated that there was significant difference among the course/module that the subjects attend and the reasons why the participants find the tools that the portal provides unsuitable. These outcomes support hypothesis *H4*.

4. COMMENTS ON THE RESULTS

The first two independent variables identified in the first model of this study ($Q_{4\text{-}1}$, $Q_{4\text{-}3}$) make a positive and statistically significant contribution (Sig. < .05) (Gujarati, 1996) to the level of portal and its associated tools usage (Q_1), while the other ($Q_{4\text{-}4}$) poses a negative and statistically significant one (see Table 2). However, the strength of this negative relation, as depicted in the derived model is quite weaker compared to the other two ($Q_{4\text{-}1}$, $Q_{4\text{-}3}$). Cross-tabulation analysis between these two variables showed that students who scored 2 and 3 in Q_1, scored between 3 and 5 in Q_{4_4} pointing out that they probably need these tools, but as explained further down, the portal and the associated tools are, among other reasons, somewhat badly shaped, inconvenient or inadequately supported. This fact is further sustained by Q_{4_4} Mean value (see Table 1).

In the second model, students who scored higher in statement Q_{5_2} use the portal quite frequently (see Table 3). That, in a sense, confirms the first model's third co-efficient (Q_{4_4}), which also shows a negative relation. Consequently, students who use the portal to an excessive degree do not consider the portal's tools useless. Thus, someone can declare that although these tools are useful for the students, they are not functional, practically awkward, faultily designed or inadequately supported by the other stakeholders. These findings are strongly supported by the fact that 84.6% of the total sample recommend to another question (Q_6) that the portal environment, interface and the embedded tools ought to be friendlier or more functional. They also state that the portal's throughput and the connection (network) speed are considerably slow (83.7%).

Experience with the Internet was found to be a significant *factor* (see Table 4). In other words there was a significant difference among the levels of learners' experience with the Internet and their experiences toward the portal. Various researchers have noticed that experience with technology, in general, affects user acceptance, and as a result increases one's comfort level in using the technology (Koohang, 1989). The direct relation of Q_{15} with e.g. statement Q_{4_3} effortlessly confirms the aforementioned fact.

Finally, the last complied One Way-ANOVA showed that there was a notable difference among the course/module that the students attended (Q_9) and their experiences toward the portal (see Table 5). Cross-tabulation between the dependent variables and the selected *factor*, as presented in Figure 3 (Q_{5_8} is omitted due to space limitations), reveals that students who attended courses/modules in education, scored clearly higher to statements Q_{5_1}, Q_{5_6} and Q_{5_8}, while their colleagues who attended courses/modules in Informatics scored considerably lower.

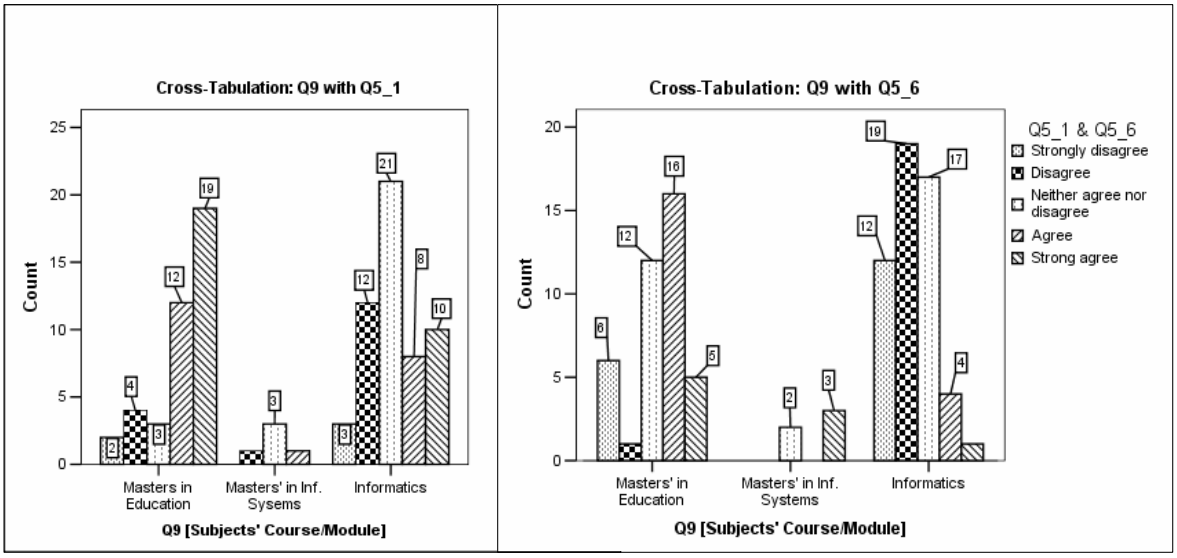

Figure 3. Cross-Tabulation results for Q_9 with Q_{5_1} & Q_{5_6}

5. CONCLUSIONS

In this paper we made an attempt to conduct a preliminary study on the HOU's educational portal usage level, employing various descriptive statistical methods. It is worth noting that to the best of our knowledge, few research works deal with students' perceptions / experiences towards educational portals and especially with collaborative features (Koohang & Durante, 2003). It is also true that due to space limitations, several other cross-dependencies were left for future work. For instance, gender, age and usage level for each separate asynchronous or asynchronous tool variables were consciously left out.

In an abstract view, the results showed that apart from the *connectivity / communication paradox* (the more connected we are the more isolated we are), a number of problems are apparent, among the most prominent of which are the simple problems of inertia and attitude change. It is common in higher education for institutions to follow accepted practices than to carve new paths. So, in spite of the major HOU investment in modern portal software, the students do not seem to take advantage of it, at least to a substantial degree.

Briefly, this can be explained, to some extent, by the following reasons: (a) As regarding the students, those facing Web-based and CSCL technology having little experience beforehand, can be apathetic or even hostile. Generally, this is because of the acronyms "CS" or/and "CL". The solution to both problems is to ensure that the students are computer-literate and used to the idea of working in teams prior to the e-delivered material and collaborative activities (introductory course, awareness of CSCL, informing about group work, etc). However, since all this require cooperation with program administrators and

academic supervisors, it may not be possible at all. (b) As regarding the instructors, it is typically the case that teaching staff prefer (or feel more comfortable with) the traditional methods of distance teaching. Further on, the majority of them do not have any training in delivering collaborative activities via the Web. This points out the fact, that the skills required on the part of the instructor are far more complex and diverse than those in traditional distance learning settings. If the instructor has also to play the role of the instructional designer e.g. by planning collaborative activities to be delivered over the Web, then the demands are even higher. However, for many Universities, as in HOU case, the teaching staff is not constrained by contract to promote such activities or to produce new educational material. (c) Last but not least, from the educational organization side, it must precede a serious planning procedure with clear objectives before and during the adoption of such technologies, in order for these technologies to become really fruitful and have a significant Return of Investment (ROI).

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