A STUDY ON THE USAGE OF MOBILE DEVICES IN COLLABORATIVE ENVIRONMENTS VS DESKTOPS
An Approach based on Flow Experience

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Abstract: In order to evaluate the use of mobile devices (laptops) and desktops and the potential of mobile devices in collaborative environments vs desktops, it was performed an experiment involving one hundred and twelve students of higher education. This study has the main objective to validate if the students that use laptops or desktops are in the flow experience and which of them are more in the flow experience. This study is based on the flow experience introduced by Csikszentmihalyi (1975). The main purpose of this study is to establish whether the user is in the flow experience when using Google Groups when using laptops or desktops. In the context of this study, information has been gathered through a survey, applying the five dimensions of the flow state. The sample used consisted on one hundred and twelve students. At the end of the study, after analyzing the gathered information, it was possible to conclude that students have experienced the flow state and it had a positive effect on their learning experiences both by students using laptops or desktops, but having the students that used the laptops a more positive effect in the flow experience than the students that used desktops.

1 INTRODUCTION

Technological applications and the way they are used has advanced in such a way that the manipulation of learning objects is no longer limited to a desktop, but extended to the use of mobile devices (PDA, mobile phone, Smartphone, Laptops, and Tablet PC) to provide a greater range of application and obtain the benefits that mobile computing offers in the education sector. This results in the establishment of a new area of activity, related with the use of mobile technologies in learning, named m-learning.

This educational model based on the use of mobile devices, has been developed over the past few years, resulting in several research projects and some commercial products. Current and past promises of more learning outcomes are needed to be evaluated.

2 M-LEARNING AND MOBILE DEVICES

Quin cited by (Corbeil and Valdes-Corbei, 2007) states that m-learning is the interaction of mobile computing (small applications, portable, and wireless communication devices) with e-learning (learning facilitated and supported through information and communication technologies).

We can see an widespread use of mobile devices in our modern world: mobile phones, PDA's, MP3 players, portable gaming devices, Tablet PCs and laptops, which predominate in our everyday lives.

From children to older people, they are increasingly linked with each other, communicating through communication technologies, something that didn't happen a few years ago.

There are a number of mobile devices that can be considered for an m-learning environment (Corbeil and Valdes-Corbei, 2007): iPod , MP3 Players,

PDA, USB drive, E-Book Readers, Smart Phone, Ultra-Mobile PC (UMPC) and Laptop/Tablet PC. These mobile devices have some advantages and disadvantages (Corbeil and Valdes-Corbeil, 2007). One of the biggest advantages of mobile devices, when compared with desktops, is its ubiquity. With mobile devices people can connect to many kinds of information where they want and whenever they want.

3 THE FLOW EXPERIENCE

An aspect related with the interaction of the users with collaborative environments has to do with the flow experience introduced by Csikszentmihalyi (1975). The flow experience means the sensation that people feel when they are completely involved in what they are doing, that is, people like the experience and want repeat it (Csikszentmihalyi, 1982). This means that for students to be involved with collaborative environments, it is necessary that they presence the flow state.

The theory of the flow allows us to measure the interaction of users with computer systems, verifying if these are more or less playfulness (Trevino and Webster, 1992).

The flow experience is used in this paper to characterize the interaction between the human and the new technologies (Trevino and Webster, 1992).

When one is in the presence of the flow experience, this will bring to the users, a sense of pleasure of what he is doing. This satisfaction will encourage the user to repeat the task again (Webster et al., 1993).

Csikszentmihalyi says that a person who is in the presence of the flow state has the following characteristics(Csikszentmihalyi,1975, Csikszentmihalyi, 1990):

- Clear goals and immediate feedback;
- Equilibrium between the level of challenge and personal skill;
- Merging of action and awareness;
- Focused concentration;
- Sense of potential control;
- Loss of self-consciousness;
- Time distortion;
- Autotelic or self-rewarding experience.

For a person to be in the presence of the flow experience it is necessary a balance between the level of challenge and personal skill (Csikszentmihalyi, 1982) (Figure 1).
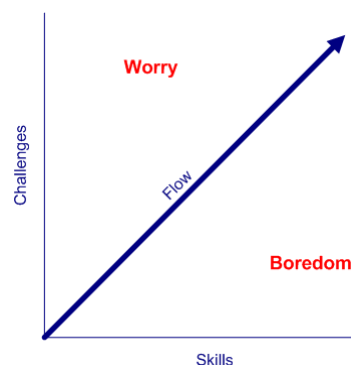

Figure 1: Flow Experience (Csikszentmihalyi, 1982).

The sensation of an excellent experience in the accomplishment of any day by day task is our reason of living. If we do not feel this excellent experience with our everyday tasks, we will question our self, if it is worth living (Csikszentmihalyi, 1982).

Previous researches have used the flow experience to measure playfulness, involvement, satisfaction and other states with the involvement in computational environments (Chen et al., 2000, Ghani and Deshpande, 1994, Novak and Hoffman, 1997, Novak et al., 2000, Trevino and Webster, 1992)

Trevino and Webster (1992) defines four dimensions for the flow experience:

- Control;
- Attention Focus;
- Curiosity;
- Intrinsic Interest.

There is one more dimension, sense of time, that is also important to measure the flow state (McKenna and Lee, 2005) .

People who interact with computers, with an entertainment spirit, transmit a much more positive experience, of those, who are in the computer for obligation (Webster et al., 1993).

4 THE STUDY

To evaluate the flow experience and to verify its occurrence in collaborative tools, an experience was carried through involving one hundred and twelve students from a university school. The main tool used was Google Groups, for this experience. This paper presents the carried through experience, the data obtained, as well as the statistical procedures applied.

After the accomplishment of the project given by the teacher, in which they used Google Groups, the students answered the questions of a survey.

The survey was passed through the Internet with the help of "LimeSurvey". The data collection was performed in the first week of November of 2009.

The Instruments used were Google Groups, Google Docs and Facebook and a survey consisting on some questions, in order to verify, in the end of the study, if the students were in the presence of the flow state. This survey will use the four dimensions: control, attention focus, curiosity and the intrinsic interest (Webster et al., 1993), as well as the dimension sense of time (McKenna and Lee, 2005). Beside these questions, this survey also contains other generic questions. All the related questions from this survey were built on a Likert scale of five points, since one (I totally disagree) up to five (I totally agree). Two questions for each dimension were elaborated.

4.1 Analysis

This study was composed of 78.57% males and 84,82% had ages between sixteen and twenty four years. Most of the students have already used discussion forums in a fairly way.

The majority of the respondents used the laptop (72.32%) to access the tools of the project, followed by the desktop (27,68%).

We verified that Cronbach's alpha is always superior to 0.7, being able to conclude that the data is related to one same dimension, that is, the questions of the survey for the use of Google Groups, allowed us to determine if the individual finds himself in the presence of the flow experience, for students using a laptop or a desktop.

To determine how the variables are correlated with each of the different devices used (laptop and desktop), a correlation matrix was created for both types of the devices, where the correlation coefficient, R, is presented, that is a measure of the linear association between two variables. We can conclude from the correlation analysis that the correlation between the variables, for laptops, has a greater number of variables positively correlated than the desktop.

After the studies mentioned previously, we used the factor analysis in order to reduce the number of variables, both for laptops and desktops.

The extraction of the factors is given by considering the percentage of variance explained by the factors (Table 1 and Table2).

Table 1: Number of factors to be retained (laptop).

| | laptop | | |
| | Initial Eigenvalues | | |
Component	Total	% of Variance	Cumulative %
1	2,371	47,422	47,422
2	,881	17,625	65,047
3	,707	14,136	79,184
4	,631	12,613	91,797
5	,410	8,203	100,000

Table 2: Number of factors to be retained (desktop).

| | desktop | | |
| | Initial Eigenvalues | | |
Component	Total	% of Variance	Cumulative %
1	2,374	47,475	47,475
2	1,053	21,053	68,528
3	,704	14,077	82,604
4	,565	11,301	93,905
5	,305	6,095	100,000

To set the number of components to be retained, we choose, by default, those that have eigenvalues greater than one. If the total variance explained by the factors retained is less than 60%, then, at least, one more factor should always be selected. Thus, for this case study, two factors were retained in each type of device. For the laptop, it appears that the first factor explains 47.422% of the total variation and the second 17.625%, both explaining 65.047% of the total variation that exists in the five original variables. For the desktop, the first factor explains 47.475% and the second 21.053%, explaining both, 68.528% of the total variation.

The matrix of components after rotation (Varimax method) aims to exaggerate the value of the coefficients that relates each variable to the factors retained, so that each variable can be associated with only one factor. The higher the value of the coefficient that relates one variable to a component, the greater is the relationship between them. From this study we have concluded the following for the case of the laptops: Factor group 1: (Intrinsic Interest, Control and Curiosity); Factor group 2: (Attention Focus and Sense of time)
And for the case of the desktops:
Factor group 1: (Attention Focus, Sense of time, Intrinsic Interest and Curiosity) Factor group 2: (Control).

5 CONCLUSIONS

In order to evaluate the use of mobile devices and desktops and the potential of mobile devices in collaborative environments versus desktops, it was performed an experiment involving students of higher education. This study has the main objective to validate if the students that use laptops (mobile device) or desktops are in the flow experience and which of them are more in the flow experience.

The analysis of data allows us to conclude that the majority of the students were males, had ages between sixteen and twenty four years and that most of the students have already used discussion forums.

When going further to the analysis of the data, we verified that the variables described all the same characteristic (threw the determination of the Cronbhach's alpha), that is, the variables describe the flow experience.

We can conclude from the correlation analysis that the correlation between the variables, for laptops, has a greater number of variables positively correlated than the desktop.

From the factor analysis it was possible to isolate two factors that explain the majority of the total variation. Such factors had been Factor group 1: (Intrinsic Interest, Control and Curiosity), Factor group 2: (Attention Focus and Sense of time) for the laptops and Factor group 1: (Attention Focus, Sense of time, Intrinsic Interest and Curiosity) Factor group 2: (Control) for the desktops.

In order to determine the presence of the flow experience for each type of device, it was verified that, on average, the students were above value three (Likert scale of five points), that is, the majority of the students, in each of the different devices (laptop and desktop) used, are in the presence of the flow experience, for the five variables mentioned for this study (attention focus, curiosity, control, intrinsic interest and sense of time). We can also see, that the average of the five variables associated with the flow experience, for students who used the laptops, were greater than those using the desktop to access the tools of the project development.

From this study we can conclude that the flow experience exists for people that use Google Groups, both for people that used the laptop or even the desktop, but having a more positively effect for users of the laptop. Considering that people use mobile device for m-learning and desktops for e-learning, we can conclude that people that use m-learning have a more positive effect on learning than the people that use e-learning.

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