Laptops vs Desktops in a Google Groups environment

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Abstract:

Current literature on m-learning refers to the lack of studies on real use of m-learning applications and how they can compete with current desktop counterparts. The study consists of an experiment involving one hundred and twelve students of higher education and a set of learning activities that they have to accomplish. 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, when using Google Groups. This study is based on the flow experience introduced by Csikszentmihalyi (1975). It was possible to conclude that students have experienced the flow state both by students using laptops or desktops, but having the laptop students a more positive effect in the flow experience.

1 Introduction:

Computers are becoming increasingly indispensable in our lives today, with this, the market has increasingly invested in this reality. 10 years ago, a mobile device only served to send text messages and for calling. Today, because of the large advances in technology, these mobile devices let us do almost everything a computer does, besides telephone calls and sending text messages.

With the advancement of mobile technologies, the use of a computer is no longer restricted to a computer lab, a classroom or an office. We can transport them anywhere and anytime we want [1].

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, to provide a greater range of application and obtain the benefits that mobile computing offers to 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.

2 Technology Environments

Imagine that we are living in a time where cars could not go faster than 25 km / h; where letters were only written on paper; and where computers were only used for writing text. How could one live in this global economy and in this century? If you can not work with obsolete tools and services when it comes to survival, how can we continue to support an educational system that ignores the new researches on learning and continues to "educate" using outdated tools? [6].

For a long time, people thought that teaching consisted on the transmission of knowledge and on the training of the memory, and instil in students the values of society. People felt that learning was to acquire knowledge through a process of attention, memorization and reproduction of it, which is an individual and homogeneous task, that can be standardized [7]. "The integration of the computer in education is now a reality impossible to ignore and that we must understand." [7]. That also brings new ways of working with data, information and
knowledge and to relate with others. We can say that computers and networks have turned learning in a more open and freely activity.

The use of computers in teaching fits the constructive approach of learning (although other approaches are possible). Although the computer is not a technology designed for the education system, its characteristics of interaction and its capacity to deal with information, makes it a very useful and promising tool [7].

Teaching using computers is an added value to our society; it is certainly very appealing to students and more motivating, stimulating them to interact with different situations and depictions of real life, forcing the student to think creatively and independently about new subjects and materials.

Information technologies are rapidly changing the way we live. Computers, calculators and other technologies for processing information, help our brains to create knowledge from data and available information. Until recently they were being used in the majority of cases, for repetitive tasks (writing and printing), performing these in a more rapid and with minimum possible of errors. Since the evolution of computers, they are already capable of being used for tasks far more complex than in the past. These tasks have a direct implication on how to create a better learning environment [8]:

- Access to unlimited information: computers allow users to access a vast amount of information;
- Interactive teaching: computers may be chosen for interactive learning environments allowing students to learn at their own pace;
- Multimedia: since the arrival of the CD-ROM, these have enabled us to integrate teaching with voice, video, text, graphics and music getting sights and sound from real world;
- Simulation: The computers allow students to simulate different kind of experiences. This allows the exploitation of various kinds of experiences without students being limited to physical environments;
- Virtual Reality: Allows users to create experiences in an environment in three dimensions and try even new approaches and perspectives for interaction;
- Distance learning: The technology allows students to learn at any point in time, at any place, without having to be in a particular geographical place (at least at the same time);
- New connections: Computer networks allow students to connect with each other in order to share a common knowledge among them.

When using technology for education we should use this in a fair and moderate way. We must not use it too much, because it may lead to cases where the users are so addicted to the technology that they cannot release it or its use superposes to the learning. Also if users are far removed from it, they never benefit from its advantages [9] (as the technology becoming a barrier).

We can list the main advantages that contribute to technology as an asset to a school environment as [10]:

- The technology is attractive: You cannot think of using a particular technology if it is not attractive. The attractiveness of technology is achieved by the mode of operation, and its appearance;
- The technology is available: A particular technology has no value to society if it is not used. The technology should not be locked behind a door where nobody can access it;
- Technology is addictive: This is an ambiguous feature of technology. This feature reflects the learning effort that users do to use the technology and also place some restrictions for future change.

Educational technologies can be considered simply as a set of information technologies. However, important is what we do with these technologies, it is the way we are encouraged to
use this set of technologies that becomes the ultimate challenge for the learning outcome (Buchan, 2008).
Technologies for education are a key part of a learning environment [9].

3 Mobile devices

Quin cited by [11] 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). M-learning is not a substitute of e-learning, but a subset of the e-learning environment. However, m-learning can improve some of the e-learning advantages. This new form of learning is a method with potential, as it enables students to learn anywhere, away from the traditional classrooms [12].

There is a widespread use of mobile devices in an m-learning environment, 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 just few years ago.

There are a number of mobile devices that can be considered for an m-learning environment [11]:

3.1 iPod

The media player from Apple, allows users to download music, books, audio, podcasts, photos and video from the Internet. It also includes an address book and a calendar that syncs with Microsoft Outlook or Outlook Express. It can also serve as a storage device.

With the iPod, students can download podcasts of relevant educational materials, along with audio and video lectures. Although most models have a small screen, future versions will probably have bigger screens, so that users can read e-books on them. The iPod video (iPod Touch), for example, takes a step in this direction. And recently Apple has launched the iPad that has a bigger screen, offering the user a much more convenient way for reading (and interact with them!) electronic materials.

With the iPod, students can exchange files, review materials for a particular discipline, prepare them self’s for exams, show their work to others and share the results of a project, with their colleagues.

Pros: With 87% of the market share, the iPod has proven its popularity among students. Apple's iTunes U (http://www.apple.com/education/itunes-u/), allows teachers to upload their lessons for students to download these materials, so they can study from them.

Cons: First, consider the cost. An iPod cannot be accessible to all students, and also because this device requires an application owned by Apple, the iTunes. We should also consider the screen, these are generally too small to be used by sophisticated applications or even to read large amounts of text (although this will probably be changed in the future versions, we can see this change already in the iPod touch and iPad) and also because these devices do not record sound (their major critique).

3.2 MP3 Players

This digital music player reads music and audio files. Some of these models have an integrated voice recorder.

Students can use these MP3 players to download and listen to podcasts and audio lessons. Students can also review the materials for a particular course, study for exams, stay informed about course contents, listen to audio books, and with some devices, record lectures.

Pros. MP3 players are compact and light. They have an excellent audio quality and they are upgradeable and expandable.

Cons. An MP3 player may be replaced with other devices that also play audio files.
3.3 **PDA**

The PDA combines the computing power and Internet access in one single system, with a calendar, notepad, address book, and also productivity tools. It is a device integrated with Bluetooth, Wi-Fi and a mini USB interface.

A PDA plays audio, video, Flash animations, allows editing of text documents, allows users to access their e-mail and also web contents; supports instant messaging and text messages, and can be used to store information.

These PDA's provide support for collaborative learning environments. Students can use them to present projects, write documents in Word, and take notes in a classroom.

**Pros:** The PDA's have a big screen (for a portable device) that makes reading easier. They also combine the various types of computing and communications tools in one single device. Data entry is possible through the on-screen keyboard, a pen, or through external peripherals.

**Cons:** The PDA's are big when compared to other mobile devices. They are not efficient for the introduction of long e-mails or text, without the use of an extra input peripherals device.

3.4 **USB drive**

The USB drive is a storage device that connects easily to multiple computers and other types of devices.

The USB drive is ideal for storing work files, audio and video. Students can share files for collaborative work. They can also copy files from this drive to school computers and vice versa, and send their work to the teachers.

**Pros:** The drive is small and portable and the USB interface is compatible with all newer computers. It works well for transporting files from home to school and vice versa. There are applications with the autonomy to run in a USB Drive.

**Cons:** A USB drive is a device with just one purpose only. Other devices can also serve for storing information.

3.5 **E-Book Readers**

E-book readers are used to download text-based materials. They can store hundreds of e-books, newspapers and magazines. The zoom and the search function are one of the fundamental characteristics of these types of devices.

**Pros:** The e-book reader has a large screen for reading, and also has a light to facilitate the reading in dark places. The digital marker allows users to mark their texts, and the search function enables users to easily find a particular text. An e-book reader can also store the entire contents of books from various courses.

**Cons:** An e-book reader is a device with only one purpose, with limited computing capabilities. These may require proprietary file formats and there are a limited number of e-books available today, although the market is rapidly evolving.

3.6 **Smart Phone**

A smart phone combines the capabilities of a PDA, USB drive, MP3 player in one single compact system.

Students can download audio, video lectures and podcasts to their Smart Phones. They can play audio, video, flash animations, view and edit text documents, access e-mail and Web contents, send instant messages, send SMS and use the phone to storage files.

**Pros:** Smart phones can also be used in collaboration environments. Users can also access global information. These devices can support collaborative learning.

**Cons:** The small screen makes Web browsing and reading difficult. The small keyboards or the virtual keyboards make writing text inefficient for long emails and texts. Finally, some smart phones cost as much as a normal PC with only a fraction of their capacity.
3.7 Ultra-Mobile PC (UMPC)

The UMPC have the entire main features of a tablet PC, but on a much smaller size device. They offer support for audio, video, games, Internet and other types of communications and networking applications. They have Bluetooth, Wi-Fi and also Ethernet controllers. Students can download audio, video lectures and podcasts for their UMPC, surf the Web, send emails, send instant messages, send text messages and also log into sites of distance learning courses.

The UMPC allows users to participate in collaborative learning environments.

Pros: These ultra-small, ultra-portable PC's have a 7” touch screen, which is great for Web browsing and viewing multimedia contents. The small size makes these devices great for travelling.

Cons: These units are expensive, costing more than a high-powered PC. Due to its small size, most UMPC do not have a full-size keyboard.

3.8 Laptop / Tablet PC

The most complete system of all the mobile devices. Laptop/Tablet PC come with Bluetooth, Wi-Fi and Ethernet. These devices offer additional features such as handwriting and voice recognition.

Students can download audio, video lessons, podcasts, browse the Web, send emails, send instant messages, send text messages and log into the course website at home or while they are on the road. These devices are great for collaborative learning.

Pros: The Laptop/Tablet PC are very good for students who need to take their work with them. They provide greater power and capacity of all other mobile devices.

Cons: The Laptop/Tablet PC are still relatively expensive, and its size makes it more difficult to transport when compared with other mobile devices.

4 The flow experience

An aspect related with the interaction of the users with collaborative environments has to see with the flow experience introduced by Csikszentmihalyi (1975). The experience of the flow 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 [7]. 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 the computer systems, verifying if these are more or less playfulness [8].

The flow experience is used in this article to characterize the interaction between the human and the new technologies [8].

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 [9].

Csikszentmihalyi says that a person who is in the presence of the flow state has the following characteristics [10, 11]:

- 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 [7] (Figure 1).
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 [7].

Previous researches have used the flow experience to measure playfulness, involvement, satisfaction and other states with the involvement in computational environments [8, 12-15].

Trevino and Webster (1992) define 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 [16].

**Control**

Individuals should experience, feelings in control, within computer interactions [10].

**Attention Focus**

Attention focus is another important element of flow. When individuals are in the flow state, their minds are narrowed to what they are doing, filtering out irrelevant thoughts and perceptions [9].

**Curiosity**

Curiosity is aroused when in the flow state. The curiosity sensation can be aroused through varied, new and admirable stimulations. For example, the new technologies will be able to cause this sensation of curiosity through colours and sounds [9].

**Intrinsic Interest**

When people feel they are in the flow state, these are involved for the amusement and pleasure [9].

**Sense of time**

When people feel they are in the flow state, there is a perceptual transformation of time, characterized by the sensation of time slowing down or speeding up [16].

People who interact with computers, with an entertainment spirit, transmit a much more positive experience, of those, who are in the computer for obligation [9].

**5 The study**

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

Previously to this study, a test with five students was done, to analyze the effectiveness of the survey. From this previous study, we concluded that some questions were ambiguous for the population in the study.
After the accomplishment of the project given by the teacher, in which they used Google Groups, the students answered the questions of the survey.

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

The instruments used were Google Groups, Google Docs and Facebook and a survey consisting of 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 [9], as well as the dimension sense of time [16]. 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.

### 5.1 Sample

This study intends to determine if the students inquired are in the flow state. The data has been collected through one hundred and twelve surveys of students. The surveys have been submitted to a rigorous test, having not excluded any individual; therefore, the sample consisted on one hundred and twelve valid surveys. The criteria of exclusion of inquiries were: students who had not discriminated their sex or age in the survey; students with incoherent answers throughout the survey (e.g. answers that always presented values in the extremities of the scales, or incompatible); students who left 80% of the survey in blank. Once, one hundred and twelve valid inquiries were obtained, the sample is considered sufficiently satisfactory.

The statistical treatment of the data and the respective procedure[17, 18], that will be announced next, was carried through the software “S.P.S.S. - Statistical Package will be Social Science” (version 12.0 for Windows, [http://www.spss.com](http://www.spss.com)):

- Descriptive Statistics of the variables in the study;
- Evaluation of the index of internal consistency (Cronbach’s alpha) for the dimensions of the flow experience;
- Correlation between the variables of the flow;
- Factor analysis in order to reduce the number of variables.

### 5.2 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 for the project development, 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).
Table 1 – Number of factors to be retained (Mobile Device and Desktops)

<table>
<thead>
<tr>
<th>Component</th>
<th>Mobile Devices</th>
<th></th>
<th>Desktop</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial Eigenvalues</td>
<td>Component Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>2,371</td>
<td>47,422</td>
<td>47,422</td>
<td>65,047</td>
</tr>
<tr>
<td>2</td>
<td>.881</td>
<td>17,625</td>
<td>65,047</td>
<td>82,604</td>
</tr>
<tr>
<td>3</td>
<td>.707</td>
<td>14,136</td>
<td>79,184</td>
<td>93,905</td>
</tr>
<tr>
<td>4</td>
<td>.631</td>
<td>12,613</td>
<td>91,797</td>
<td>100,000</td>
</tr>
<tr>
<td>5</td>
<td>.410</td>
<td>8,203</td>
<td>100,000</td>
<td></td>
</tr>
</tbody>
</table>

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 mobile device, 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. We present below the matrix of components after rotation (Table 2) and the bold factor associated with each variable.

Table 2 – The matrix of components after rotation

<table>
<thead>
<tr>
<th>Mobile Device Component</th>
<th>1</th>
<th>2</th>
<th>Desktop Component</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration</td>
<td>.411</td>
<td>.614</td>
<td>.751</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>.653</td>
<td>.317</td>
<td>.011</td>
<td>.955</td>
<td></td>
</tr>
<tr>
<td>Curiosity</td>
<td>.874</td>
<td>.057</td>
<td>.714</td>
<td>.461</td>
<td></td>
</tr>
<tr>
<td>Intrinsic Interest</td>
<td>.705</td>
<td>.383</td>
<td>.841</td>
<td>.155</td>
<td></td>
</tr>
<tr>
<td>Sense of time</td>
<td>.033</td>
<td>.877</td>
<td>.694</td>
<td>.121</td>
<td></td>
</tr>
</tbody>
</table>

Having 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)

6 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 or desktops are in the flow experience and which of them are more in the flow experience.

Most people all around the world use mobile devices. Due to the advance of the new technologies, and its size, users can carry them anywhere; can connect with a wide range of information to anywhere whenever they go.
Despite the widespread use of mobile devices today, there is a lack of reference to identify the advantages and disadvantages of the m-learning in collaborative environments, this is, we can not see the m-learning as an extension of e-learning but a rupture in the process of teaching and learning.

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 Cronbach’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 used (laptop and desktop), 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. With this we can say that mobile users interact with Google Groups, with a more entertainment spirit and sense of involvement and satisfaction then the users that have used the desktop to access Google Groups. 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, when using Google Groups, than the people that use e-learning.

With these statements we can say that Google Groups is a good way for students to learn when using laptops and desktops, but having a more positive effect for the laptop users. We can also say that, m-learning when associated with the usage of Google Groups, it is a good tool for students to learn.

References:


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