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**THE IMPORTANCE OF NATURAL USER INTERFACE  
IN DESIGNING MOBILE LEARNING APPS**

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**Abstract:** *Mobile learning is a very wide term which encompasses not only learning principles, but also in most cases a bunch of smart devices, from smartphone to tablet or wearable devices. Any device that allows learning anywhere and anytime is a channel to information, a channel that helps gain knowledge and apply it, and this is the main goal of mobile learning. It is not so simple to develop such a system in practice. One of the most important question is how an app can be designed to support learning and to help the user and not to tangle him or her in mobile apps that are too sophisticated and difficult to be handled. In this purpose the Natural User Interface (NUI) principles help, and with this article we want to prove that the university students are interested in applications that are easy to use, fun and help learning in a natural way, without barriers like the dimension of the screen or the lack of features. The study will use data gathered from questionnaires, to extract the needs of the students, in the context of a mobile world, and to compare it with the principles of NUI design. We consider, this is necessary before trying to develop an app, to determine the degree of utilization in the future implementation, but also to meet and support the needs for learning and information of the students, which is one of the main goals of mobile learning and not waste our efforts and resources.*

**Keywords:** *natural user interface, mobile learning, technology enhanced learning.*

## **I. INTRODUCTION**

In the world of gadgets and new devices or new implementations, an old term comes to life and reminds the developers, designers and not only, that the user is the center of each interaction. In the early times of computers, there was a small number of people able to use them. In the same period, the first touch tablet emerged in it's incipient phase. Mobile phones were there, but not so affordable. We assist now, after 35 years, to a complete shift of these technologies. The road to this stage of development was long and full with failures or successes, but most important, they define the technological era we live in.

When new devices emerged, new opportunities arrived on many levels and in many domains. In offices we use laptops or PCs, when we want to take a photo or check the email we use the smartphone, if we want to read unlimited books we have eBook readers, and the tablets are the embedding of all these into one single piece of wonder. Now wearable technologies and smart TVs, or smart houses are the new trends. In fact, the various forms of computing morph, adapt, and coexist with new forms of computing [11; 18].

Although it may seem easy, all these changes needed a long way to become what we live today, from the implementation stage of a product, to software design and architecture and then to user experience. In the last years, after all these gadgets and devices became more and more ubiquitous, the user experience and the design of a web site, of a software product or a mobile app become the main point of attraction for any stakeholder.

In this paper, the main interest is in how can these new user interface techniques to be applied in designing an application to support mobile learning. The focus is on mobile devices and applications specially designed for learning, because mobile devices are touch based devices integrated in the category of Natural User Interface devices.

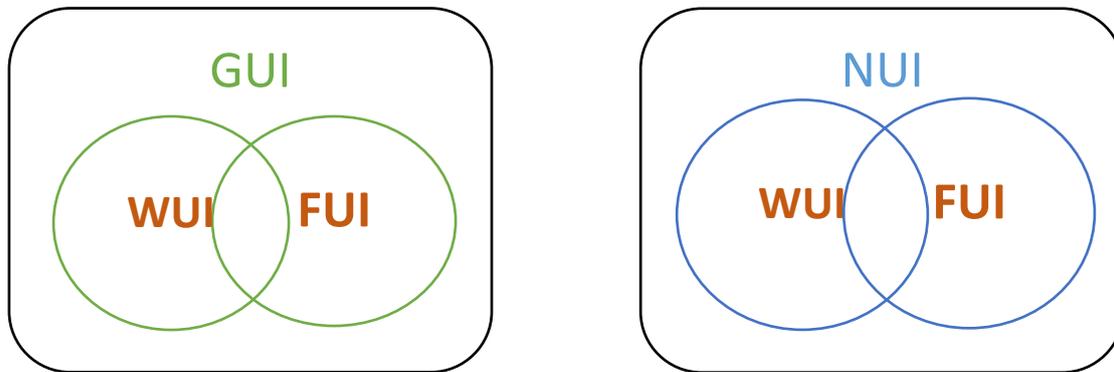
## II. USER INTERFACES: AN OVERVIEW

A user interface can be defined in a simple manner as a mediator between a machine and its user. Each time someone uses an application, or any digital product, he carries on a conversation with the machine. It may be literal, as with a command line or phone menu, or tacit, like the “conversation” an artist has with her paints and canvas - the give and take between the craftsman and the thing being built. With social software, it may even be a conversation by proxy. Whatever the case, the user interface mediates that conversation, helping users achieve whatever ends they had in mind [9; 2].

There were identified 4 types of interfaces [10; 18]:

- GUI or the graphical user interface which is interaction mediated by mouse (also known as WIMP, an acronym from Windows, Icons, Menus and Pointer);
- FUI comes from Fun User Interface and represents the interfaces for consoles or games;
- WUI or Web User Interface represented by the unique combination of links and pages from websites or web pages;
- NUI coming from Natural User Interface which is well known from devices with touch, or motion sensors, accelerometers, etc.

And as the computing forms merge or work together, these interfaces contain each other or work related with each of them. According to this classification, GUI may contain WUI or FUI, FUI may also be contained by WUI and NUI contains also WUI and FUI. The appurtenance of these specific interfaces may be seen below in figure 1.



**Figure 1** Possible mixtures between user interfaces

The user interfaces should also follow some basic principles [1; 317]:

- Layout should be organized, clean, simple and clear with an intuitive flow;
- Content awareness is based on the idea that the user must be informed about the type or data of each screen, page or layout that is displayed or presented;
- Aesthetics characterizes interfaces that are pleasing to the eye, functional and inviting to use
- User experience refers to designing interfaces according to the level of expertise of the users. For novice users ease of learning is important while for experimented ones, the ease of use is more important;
- Consistency regards the characteristics of the systems which makes it predictable for the user in such manner that interacting with one part of the system is sufficient to understand and to use it entirely;
- Minimize user effort, means helping the user to accomplish tasks with minimum effort.

When designing interfaces, the design depends very much on the type of the target device, the purpose of the applications and on the environment and the target users. Each type of application must adapt to the needs of the user and the device used. There can be encountered applications that have the capabilities to run in web browser, as a desktop application or as mobile application. This differentiation although it doesn't seem visible for the user, has a large amount of work behind.

From the user perspective, the expectations are different. Each user group preferences differ and each individual expectation is different than the other. For example the user of a scientific application may be more interested on the functionalities and less on the design of the application. And also the novice users which need easy to use and easy to learn interfaces, may be different than expert

users which may want some features removed because they may seem too obvious or intuitive for them [9; 5].

### **III. NATURAL USER INTERFACE: CHANGING THE ROAD DIRECTION**

Natural User Interface is a special category of interfaces. We will treat it from the point of view of touch devices, because it may be regarded from many other perspectives, related with the devices or the technology that use it. For example the use of speech recognition or body movements to communicate with a device is also a manner to implement NUI approach as we can see in the next definitions.

It is defined as an emerging computer interaction methodology which focuses on human abilities such as touch, vision, voice, motion and higher cognitive functions such as expression, perception and recall [6; 204].

It is also seen as an interaction method where computer adapts to human behavior rather than requiring human to interact with computer with traditional interactional devices like keyboard or mouse [3; 103].

Design of Natural User Interface has some principles or guidelines and the most important are synthesized in the book *Brave NUI World*:

- Seamless experiences: are those experiences that make the user feel that they can embrace these new experiences and rapidly progress to skilled practice by cognitive and emotional involvement. The basis for this is the “suspension of disbelief” provided by gaining the willing of someone to accept something as true or sufficiently real, even if it is fantastic or impossible in the real world [10; 43];
- Super real experiences: are those fluid, natural experiences obtained by mimicking real-world physical interactions and augment them beyond what is possible in the real world [10; 47];
- Scaffolding: is the creation of a design that promotes autonomous learning by employing actions that encourage users to develop their own cognitive, affective and psychomotor skills. This also should help the user achieve expert level starting from novice level, quickly and with pleasure [10; 53];
- User differentiation is a must have, because each user is different and uses the device or app in different contexts, has different needs, roles, responsibilities or tasks [10; 59];
- Avoid fat fingers problem, meaning that each element on page or screen must be large enough to be touched without inconveniencing the user, offering confidence that each touch movement is felt by the device;
- No touch left behind is an important aspect in designing a NUI application. Each touch must be treated accordingly so that the user is notified about the actions he/she did and if the touch gesture is processed or not, or if it can be processed or not.

Because native mobile applications run well natively, offering access to hardware capabilities that can't be accessible to web applications [11; 15], NUI design applies more to mobile applications. Web applications, which lately implement HTML5 and CSS3, have the capability to identify the device type and the size of the screen so that the web page or application adapts to the device size. Meanwhile, in mobile apps, each piece of design matters and performance and access to the device resources is significantly different [8; 25].

### **IV. MOBILE LEARNING TODAY: A NECESSITY**

Mobile learning is a type of technology enhanced learning. By technology enhanced learning we may understand, the learning process aided by the technology. Technology enhanced learning considers the use of Information Communication and Technology (ICT) in its widest sense to support and improve the learning experience [4; 4].

Although many times mobile learning was considered a subtype of eLearning, the differences between using mobile devices and computers are numerous, and designing for these two modes of learning can differ in many aspects [5].

This leads us to the findings of Robert Myer that technology – centered approach which assumes that learners and teachers must adapt to new technology, is not suited anymore to the new trends in education and technology. Instead learner – centered approach which focuses on how people learn and view technology as an aid to human learning, is more suited in this context [2; 182].

The differences between these approaches can be seen in Table 1 below.

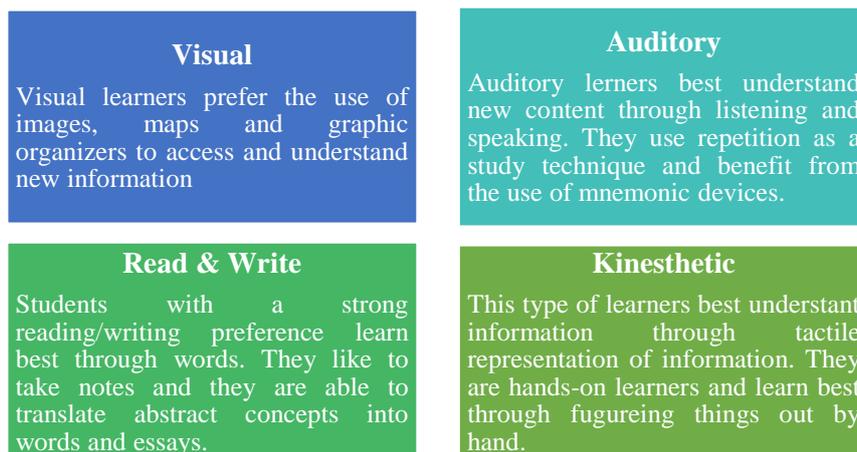
**Table 1** The distinction between technology – centered and learner – centered approaches to learning with technology [2; 182]

Approach	Focus	Role of technology	Goal
Technology - centered	What technology can do	Provide access to instruction	Use technology for teaching
Learner – centered	How the human mind works	Aid human learning	Adapt technology to promote learning

In mobile learning there can be applied some important principles from cognitive sciences that were synthesized by Robert Myer [2; 186]:

- Dual channels: people have different channels to process verbal and visual material;
- Limited capacity: people can process a small amount of material in each channel at any time;
- Active processing: meaningful learning occurs when learners engage in appropriate cognitive processing during learning;

Mobile learning is a process taking place anywhere and anytime. The advantages of mobile phones like portability, mobility, accessibility and availability are the main factors that attracted the interest to this type of learning.



**Figure 2** The description of VARK learners [5]

Also the new findings in the process of learning are other important factors in supporting mobile learning. Although this type of learning is considered to support only informal learning, it can support formal learning too which is more organized and structured. The online platforms for massive open online courses also have developed apps for mobile platforms.

The identification of more types of learners or learning styles, had a big impact if we think about a learner – centered approach in mobile learning. The VARK learning model, acronym from Visual, Auditory, Read&Write and Kinesthetic preferences of the learners, is the one which matches very well here, because mobile devices interact with three senses of the user: touch, hearing, and sight. The description of each style from VARK model can be seen in Figure 2.

A recent survey conducted by Webanywhere, a provider for eLearning and mobile learning solutions in United Kingdom for University London College Hospitals, British Safety Council, Inditex, UCFB, British Safety Council Olympic Games, etc. , revealed that [7]:

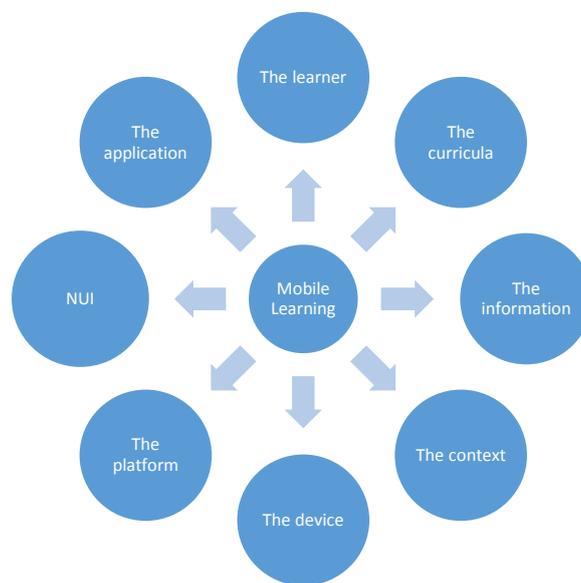
- 100% of participants would complete more training if it were in the mobile format
- 99% believed that the format and presentation enhanced their learning
- 75% praised the convenience and time management benefits
- 45% said that less time was taken in training, with no loss of comprehension

We can understand from this survey that the preferences of the users for mobile devices and mobile learning grow, and this is because of the advantages of mobile learning but also thanks to a good interface design.

## V. THE INCLUSION OF NUI IN MOBILE LEARNING

It is more than obvious that NUI applies to mobile learning apps. Mobile learning takes place into a context, environment, has a certain type of users. Mobile learning apps are applications that are designed to support learning and to be accessed via mobile devices. They may be designed, or not, especially to support learning. The extensions for mobile of online courses (MOOC), or learning management systems (LMS) are apps specially designed for learning. The other adjacent applications are not specially designed for learning but they support learning in a manner suited to the needs of each learner.

As the preferences of the users for mobile devices grow, the need for mobile apps grows in educational context. Mobile learning requires some valuable resources presented in figure 3 below.



**Figure 3** The components of mobile learning

In this paper we studied the learner from VARK perspective, because the requirements of a successfully applied NUI must take into account these styles of learning. The user is the center of the NUI implementation, and the application is the final result of all these resources combined.

The learner is the person involved in the learning process. He/she needs his/her own intellectual capabilities, but also needs help to sustain the learning process. While the resources are everywhere, especially with a mobile device in the pocket, the amount of information may be overwhelming [4; 9], just like an app that has what he/she needs, but it's not suited with the context or knowledge of the user. This is why here we can identify the problem of user differentiation which is the main and maybe the most important part when designing these type of interfaces for mobile learning.

While on mobile markets there are a lot of applications available for each style of learning identified before, the time spent on testing if each application meets the requirements may discourage the user.

The time spent to learn the functionalities of each application is a valuable resource, because instead of learning, the user is trying to figure out how an app works. This leads us to one of the principles of the NUI presented before called scaffolding which is also related to the consistency principle of interface design. In the same time, there can be observed that the principle stating that the user should use the app intuitively and with pleasure, may not be met in this case.

An application that meets the purpose, meaning that it has what the learner needs, but it lacks the nice design and the coherence (fluidity), may be also dropped down by the user, because the aesthetics and content awareness requirements are not met which may be associated with seamless experiences principle from NUI. Seamlessness involves some cognitive and emotional involvement which may be lost if the user doesn't have the patience to use an interface that he/she doesn't like.

Fat fingers problem may be frequently met in apps that use small controls in their interfaces. Again, the user misses time, patience and maybe internet resources (if the app uses the internet) to try to push a button, or to touch a small link. Even more in mobile learning this aspect is important, because people that want to learn, are looking for a certain information, and not to find out how to touch a small area on the screen.

If a user has decided to use an app with the purpose of learning something and that app doesn't show him that a touch gesture is wrong or right, it doesn't process it correctly, and the user waits for a feedback to the gesture, again we talk about time and user emotional involvement. This falls under the principle of no touch is left behind, meaning that the user must be notified if the application is processing the request or not. Otherwise the user may think that the phone has a problem, or the app is too slow for his requirements, or uses too much resources, when in fact the application didn't catch the touch gesture.

A nice to have, but not necessarily a must have, because it depends very much on the curricula each is studying, super real experiences are not all the time necessary. They depend very much on the type of interaction, on the context, or the content needed to be augmented.

While NUI is the basis for any mobile app, and NUI is an interface, same principles from interface designing are applicable here too.

When someone chooses to develop a mobile learning app, the resources enumerated before (in figure 3) are very important. A mobile learning app may be not only an app that provides access to classes or courses, but may be also a notifying app, or an organizer, a way to communicate with other colleagues or an app for reading or writing. This is why, the context is important when designing the app, and it is also met in user interfaces principles. In the context of presenting content, the implementation is different than from the one for socializing, because other items are important in each one of them.

In the end, minimize user efforts is like encompassing all these principles together. While learners are a special category of users, the minimum effort spent on learning to use an app is essential, because the main purpose of the app should be to support learning. But again it all depends on the context in which the user should use it.

## **VI. CONCLUSIONS**

Mobile learning and natural user interface can't exist one without the other. And this, because mobile devices (tablets, Kindle, smartphones, iPods) are suited for this kind of interface. But again, this is a special type of interface, because instead of using a mouse and a pointer which has accuracy, NUI must consider touch gestures as the main input channel.

After understanding the principles of designing interfaces, and the ones related to NUI, we could notice that NUI has some specific features which triggered specific principles. In fact, the principles from interface designing apply also to the one from NUI designing and plus, specific features emerge.

One of the most important principle of user interfaces is the user centered design, and this, compared with user – centered learning becomes a common point for both these concepts. Meaning the user/learner is the main actor and gainer.

The minimizing the user efforts is again a common point, because mobile learning comes to help user to learn by using mobile devices, while a well designed interface encourages user to use an app specially designed for him, with the purpose of learning and not only. Learning process is continuous, so we can't assert that only applications with pedagogical content are mobile learning apps. The social media apps are also applications supportive for another type of learning called social learning also met in mobile learning.

And finally we identified that an interface which is not conceived by respecting the basic principles of interfaces and specifically of NUI may affect the user time, patience and willing to use

the application. And by this we can conclude that only a NUI well designed supports mobile learning, because well designed applications encourage users to use mobile devices for learning.

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