CONCEPT PROPOSAL FOR INTERACTIVE COLLECTIVE DECISION MAKING INTEGRATED BY MOBILE ICT

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Abstract: Through the affordability, huge usability and ubiquitous connectivity, information and communication technology (ICT) tools spread among population across the planet and became omnipresent. Smart phones allow unexploited possibilities and new innovative activities to enhance educational process practiced by academic institutions. This paper proposes a simple interactive concept model using ICT that provides benefits to soft skills development of participating users. It focuses on a greater participation of students in assessment of their peers and decision-making in a chosen lecture course during their academic study and exemplifies the use of it in a model situation in a course class. The proposed concept can be used analogically in decision-making during team discussions and negotiations in a business company too.

Keywords: mobile information and communication technology, group decision-making, management study, innovating educational processes, smart technology in education, student centered university, interactive education, learning.

1 Introduction

With the emergence of digital technology, the information and communication technology (ICT) was developed that irreversibly revolutionized our lives (Dávideková & Greguš, 2016) by allowing real-time communication and collaboration across any distance (Dávideková & Hvorecký, 2017). It changed every facet of our lives: the way people work, communicate, learn, spend time, and interact (Jorgenson & Wu, 2016). No other former technology has had such an immense global impact on our lives as ICT (Al-Rodhan, 2011). It has allowed increasing the output per worker through enabling to quickly find and distribute information (Ogbomo & Ogbomo, 2008) and immense processing speed and so it has relatively a high contributory power on long-term sustainable economic growth (Kumar, Stauvermann and Samitas, 2015).

In 1909 Nicola Tesla developed the first concept of a device combining the technology of computing and telephony (Lim, 2010) nowadays called smart phone. Since then a combination of many technological advances has made modern smart phones the enormous success they are today (Mallinson, 2015). It integrates several technologies into one small device that can accompany us everywhere thanks to its tiny dimensions and lightweight (Dávideková & Greguš, 2016). Through the enormous established and well-developed infrastructure of mobile wireless technology, the connectivity to the Internet became ubiquitous enabling more and more functionalities to be bundled into small mobile devices.

Smart phones represent flexible mobile phone technologies that provide possibilities and constraints for our lives (Wellman & Rainie, 2013). Through their flexibility, small dimensions, versatile usability and omnipresent connectivity smart phones gained popularity all over the world (Lee, Ahn, Choi & Choi, 2014). These powerful devices can be used in many innovative ways (Guenaga et al., 2012) and their versatility found many applications in several activities of our everyday life (Wang, Xiang & Fesenmaier, 2014). They are considered handheld computers rather than traditional phones (Ahn, Wijaya & Esmero, 2014) as they allow far more processing possibilities and not only telephony. Yet if compared with computers, smartphones are far smaller and by integrating, many individual appliances including GPS and two cameras smart phones allow far more versatile and sophisticated utilization than a notebook or a desktop computer. In contrast to computers, smart phones

are more user friendly through their more intuitive usability provided by touch screen and simple operation that is accessible also for younger and older generations.

Smart phones spread among students and young generations by an immense speed. If compared to traditional telephony where Alexander Graham Bell constructed the first telephone in 1875 (Coe, 1995) and its spread to 81% coverage of UK households in 1985 took more than a century (Statista, 2014), the smart phone firstly constructed by IBM in 1994 (Buxton, 2011) achieved a spread of 66% coverage of UK households in 2015 (Ofcom, 2015) where the cell phone coverage of households achieved 80% of UK households already in 2006 (Statista, 2016).

A smart phone provides the comfort of being online anywhere at any time (Agger, 2011) and becomes an integral part of students' life (Hurlen, 2013) on that way. Students are using it to communicate with their peers, taking photos, recording audio and video records, for calculations, as e-book readers etc. Smart phones alternated the way we used to stay connected with friends and share our experiences on instant through video, audio, pictures, location and/or text.

This paper proposes an innovative integration of smart phones into educational process during academic lectures and classes studied at university. This concept is based on the belief, that the widespread ICTs will improve the quality of life, as well as active participation (Veselý, Karovič & Karovič, 2016) of students on educational process and may enrich their professional development and education. It aims to increase the interactivity through innovative use of omnipresent ICT means, to enhance the quality of academic study by active participation of students in assessment process during their education and to equip future managers with valuable experiences through the training and development of their soft skills that are essential for professionals in managerial positions in business organizations. As the availability of skills has become the key to achieving innovation (Volná et al., 2015) and assurance of sustainable successful existence of business entities, this concept proposal focuses on development, deepening and training of expertise and skills of future managers already at time of their studies to allow their future employers' further fruitful exploitation and utilization.

This paper is organized as follows: Section 2 provides a brief description of proposed concept model for collective decision making that can be implemented by means of mobile ICT. This particular section demonstrates its use through a possible scenario of a standard use case during the managerial academic study at the same time. The conclusion summarizes the motivation of the proposal as well as opportunities offered by the integration of presented concept model that may provide a benefit in form of priceless valuable experiences to students that may foster their professional development.

2 Concept Proposal

For the convenience of the reader, this section provides a visual presentation of proposed concept with a description of the process depicted in it. It also describes a scenario of a use case.

The purpose of presented proposal is to enable interactive collective participation in decision making with instant evaluation allowed by means of available mobile ICT. It combines affordable and available technology into a system that allows group decision making in real time. The proposed concept model will be described in terms of uses in a university lecture of a study subject in a managerial study program as such a use represents the main targeted utilization in this paper. IT represents an innovative enhancement for management and business oriented studies that is possible to implement in lecture courses and that provides added value for students. It may lead

to deeper skills development and exploitation through participation.

However, there are no limitations avoiding its use in other situations like brainstorming meetings or other discussions requiring the same or analogue functionality supplied by the proposed concept.

It intends to foster the collecting of experiences in decision making that represents a significant activity in managerial positions in any type of an organization. It aims to enhance the collecting of necessary experiences already during the academic studies of any business specialization with sufficient room for internalization through several iterations, analysis of conducted practical exercises to gain knowledge from lessons learnt and facilitating the development of soft skills by a guidance of lecturing experts.

2.1 Architecture

The proposed concept is based on combining available and affordable technology into an intrinsic system that provides required functionality with versatile usability. Required functionality includes real time receiving and processing of requests and providing responses. In other words, students can build a connection, submit their assessment and send it. The system receives assessments and processes them in a queue by combining all assessments into one: the results. The results are the output of the iteration and can be analyzed in the class under the supervision of the lecturer.

The system consists of following necessary parts that are further described in subsequent subsections:

- Entry point
- Database with user data
- Processing system
- Database with object data
- Presentation system

2.1.1 Entry point

Entry point may denote a Mobile Application for smart phones, tables or other mobile devices enabling the access to the processing system set up on an online server over the Internet. A mobile app is easy to be shared and installed on devices of participants and the smart phone is wide spread among university students. The proposed concept model utilizes the powerful equipment that every student brings along with himself/herself.

Another recommendable option for integrating the entry point denotes an access through a web page portal optimized for computer internet browsers. Based on the omnipresence of smart phones and connectivity as well as considering the targeted use, a mobile application for smart phones will denote the standard entry point further in this paper. An end user would access the system via the mobile app by providing his/her user credentials and remain signed for a limited or even unlimited period of time depending on the actual implementation of proposed concept.

The integration of entry point optimized for computer internet browsers is highly recommended as it may represent a more comfortable and convenient access for setting up of new objects where various settings can be placed on one page without excessive scrolling. Next aspect to consider is also the comfort of lecturers who might be more proficient with working on a computer and therefore prefer this entry point.

2.1.2 User Data Database

The credentials are to be verified against a database containing all user accounts allowed to access the application. This may be represented by a separate database where those user accounts are set up e.g. manually by an administrator or in another database of given institute and accessed through an application programming interface (API). APIs allow composing flexible

and business specific applications (Molnár, Kryvinska & Greguš, 2014). In the analyzed utilization case, a management faculty of a university represents the institution and users denote students attending academic lectures. It is possible to communicate with university information system via designed API for accessing those relevant data with no need of additional separate database. The authors will further consider an API for communicating with university information system.

2.1.3 Processing System

Next necessary item of proposed conceptual architecture is represented by the processing system. A recommended implementation denotes the integration in form of a web application running on an online server accessible via Internet that collects data of sent requests and processes those in a query by providing resulting responds. The system counts the votes for a specific object and processes those according to set up rules. This is possible to implement also with several various checks for example: only one vote per user ID for a particular object, to determine how many users of all voted, how many times a user voted and with which answer etc. The system stores all the information in an appropriate database.

2.1.4 Object Data Database

A separate database for object data stores data assigned to each voting event. Those data may include but are not limited to: a list of users that voted, optionally list of users not allowed to vote, occurrences of various voting options, the number of all users authorized to vote, date and time, name of the user creating given object, title of given object, categorizing attributes for later listing options etc. It is also possible to differentiate various indicators or aspects that end-user shall assess.

2.1.5 Presentation System

Last part of proposed concept model denotes a presentation system. This could be the same mobile application that denotes also the entry point. However, as the concept is designated to serve in an academic lecture class attended by students, it is recommendable to implement also a web interface accessible through an internet browser that would display the results of occurred voting in a window easily projectable through a projector on a wall or plane. This may increase the collective visibility to everyone and simplify the post analysis of results as well as possible defense of submitted voting of a participant (described later).
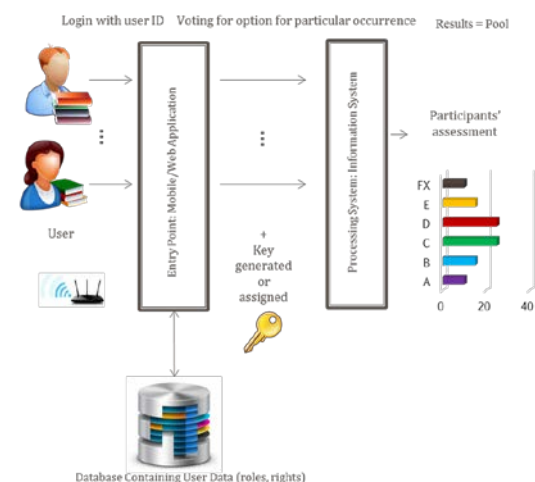
2.1.6 Concept Visualization

Figure 1: Simple concept for voting integrated by ICT means
Source: own elaboration

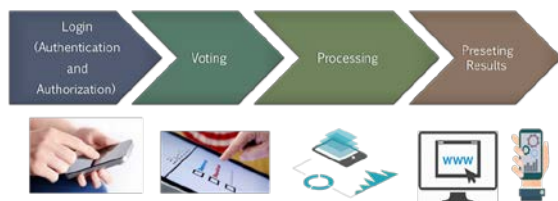The described architecture is shown in fig. 1.

Figure 2: Process flow of proposed concept
Source: own elaboration

It is recommendable to search for possible involvement of any existing scalable voting mobile applications to implement a finished solution instead of own in-house software development or even contracting of external software company. In-house software development may take long time. It is important to consider how an integration of an existing app with its constraints may affect its utilization for targeted purpose described in following subchapter.

The concept depicted in fig. 1 demonstrates the high-level architecture of proposed concept. Here it is necessary to consider the security of user credentials and data, the possibility of limiting the number of voters and how the group of users entitled to vote may be populated, how the connection on internal databases shall be ensured, how data from conducted voting shall be preserved, how the proposed model can be made scalable to needed level for various utilization cases, etc.

2.2 Use Case Scenario

This subsection demonstrates a typical use case that was targeted to be solved by provided concept proposal.

University students are often assigned to elaborate various projects that shall be presented in front of the whole group and the lecturer assesses the conducted work with a note, eventually by a number of points or other corresponding evaluation. This represents a typical assessment and decision-making process. Such a situation offers the opportunity of including students into decision-making where they can collect experience in assessment and through comparing other students among themselves. They can develop their soft skills in various fields, e.g. giving and receiving constructive feedback, defending their decision and viewpoint with arguments, making fast valid decisions based on relevant aspects.

In typical use case scenario, the lecturer determines and distributes assignments to students or students groups that are to be elaborated until a given specified deadline. After the deadline, students are presenting the results of their work in front of their peers.

The lecturer sets up a new object or item in the system through an entry point by providing some description and optionally some attributes for later categorizing that may be used for later data mining analysis like which study subject etc. The setting up could already include using of a preset template that may foster easy and fast set up. The system would generate an ID. There are several options how to generate such an ID. It could be also a combination of an arbitrary word entered by the lecturer combined with a consecutive number referring to the number of occurrences of given key word. Alternatively, it may consist purely of a sequential number of given created object. Although there are several ways, the authors of this paper recommend a combination of an arbitrary entered word by the lecturer and a consecutive number, as the setting up is considered comfortable for lecturers.

The system would further automatically populate some fields like date and time, faculty, subject, optionally name of the lecturer etc. This data is possible to be automatically populated based on user accounts data. It may simplify the setting up for lecturers and become a user-friendly environment.

After the setting up is closed, the object may become available for users to send requests, in other words, for students to vote. After any presentation students, representing the audience may send their votes in points or by selecting an option from provided offered choices and evaluate the performance of their peer on that way.

The lecturer would open the object for viewing results in appropriate presentation system and the processing system would update the results by any new received vote. The lecturer may discuss the voting results with students and draw their attention to not considered aspects, mistakes done etc. There is also room for further analysis and discussion of various aspects by students at time of their voting about their reasoning like why they chose conducted option for a given result. On this way, students may be more motivated and animated to listen to contributions of their peers as they are requested to assess their work and have to explain their decisions. At the same time, students may get motivated for giving a better performance as they will be evaluated objectively by a broader group of evaluators: a whole group of their peers and not only subjectively by one lecturer.

The exemplified application of presented concept denotes only a very simple use case of various possibilities. It is also possible to use such voting style also for discussion events, analyzing historical events by asking how students would behave (decide to act on different ways based on projected situation), or even giving comparisons of voting results of performances of various students.

2.3 Possible Misuses, Extensions or Further Applications

In order to achieve the goal of an objective assessment, it is important to prevent students voting always in superlatives for all their peers by desiring only good notes for all or only for particular peers. Therefore, the voting itself is not determining the resulting note of a student, but the lecturer does. It is only an opportunity to collect the opinion of every one student within a very short time and to combine him or her contribution into one collective decision. It represents a way of gathering experience in making objective decision based on prescribed assessing aspects and opens the possibility of training in giving constructive critical feedback towards given performance.

In case the application stores the whole voting of each user separately, it is possible to choose some of the assessing users (one or more) to explain the assessment they gave and eventually to let them confront each other against their assessments. This proposes a new opportunity to vote for assessment and evaluation of given performance that is represented by giving explanations to given voting and taken position. If an end user is forced to objectively explain his/her decision, the motivation to participate is higher than by an anonymous voting. At the same time, it may enhance the whole process with the aspect of giving constructive and critical evaluation when the end user is forced to defend his/her opinion against an opinion of someone else with relevant arguments and explaining them to everyone in the group. The ability to defend a standpoint or conducted decision represents a skill that is significantly important and essential for managerial positions and management professionals.

The selection of "*assessment defendants*" could be implemented by random choice or by a pseudorandom selection from a group that fulfills some criteria (e.g. users who were mostly negative, positive or neutral or even including the aspect whether the user already absolved the defending of his/her assessment already in the past), based on some statistical evaluation e.g. whose voting is outside the median or conducted manually.

It is also possible to use such a voting application for other purposes: collective decision making among lecturers about any topic during their meetings, brainstorming within a team in a business company, decision making in any big group analogue to using color cards for vote expression used by agile project management processes, etc.

A great extension to proposed concept model shall be represented by the opportunity to ask questions that would be visible on the pane and the presenter could answer those at appropriate time. These questions would be collected also through such an online system in real time providing a smooth processing without any delays caused through the collecting step.

The analysis of applications provided by given studied academic institution showed only one application provided in app stores of mobile app providers. This application represents only a very limited read access to very few information of academic information system not allowing interaction similar to proposed concept. Therefore, the authors of this paper intent do highlight the innovative ways for the utilization of the omnipresent affordable technology to provide more student focused interactive study with greater room for skills development as the availability of skills nowadays represents the key in achieving innovation (Volná et al., 2015) and success in contemporary business environment.

In addition, a search for other applications of academic institutions in Slovakia in the application stores had negative results.

The lecturer who shall intervene in any adverse effects or dangerous situations reduces a possible threat in terms of unhealthy competition among students through the facilitation of whole process. Unhealthy effects of smart phones on physics of people have not been confirmed through scientific research (Hardell et al., 2002).

3 Conclusions

The development of information and communication technology (ICT), in particular the emergence of mobile ICT in form of smart phones, revolutionized our lives by changing the ways of processing and conducting of daily activities. Nowadays, a small tiny device, the smart phone, enables real time communication with another user or even with whole group across any distance. The digital environment created new ways of executing activities by allowing processing of large volumes of data within a very short time as well as their spreading through continuously increasing pace of informational dissemination to a much broader group.

Smart phone - the modern combination with all the high-end technology allows many devices to be integrated in one small device at hand (Dávideková, 2016). It represents a very powerful device that can be used in many innovative ways (Guenaga et al., 2012) through various software mobile applications opening new ways of interaction even in academic institutions. A typical academic institution offers wireless access to its students that represents the core premise for proposed concept. Still, academic institutions are not excessively using the communication channel denoted by smart phones to animate students for interactive participation in lectures and developing their soft skills on this way.

This paper proposed an inventive interactive involving of students into dynamic collective decision making within a lecture class to enhance the academic business oriented studies of future management professionals. It offers the opportunity to collect experience and practice in fast decision-making, assessment of their peers, giving and receiving constructive feedback and defending of their opinion against the opinions of others through formulating arguments.

The proposed conceptual model provides an innovative option for enriching business-oriented lectures with greater interactivity by involving students in voting and creating more room for fruitful discussions targeting professional personal development and training of soft skills including decision making of future managers as those are of significant importance and essential in managerial positions.

The proposed concept was tailored to the needs of provided use case describing a lecture class of business oriented academic management study. However, as aforementioned, there are various opportunities for a possible application of proposed concept model not only limited to utilization by an academic institution, but it can be used also by business organizations in their operation.

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