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Shifting Education to Cloud: A Reference to Maritime Studies

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Abstract: *The basic hypothesis posed in this paper is that in the future education and professional training will be increasingly blended into the Cloud domain. The reasons are above all of the economic nature. They are reflected in space, time, teaching and administrative staff savings, since the education is mostly treated as a cost, and less frequent as an investment. This applies more and more to the developed parts of the world, and especially to those who are conditionally in development or in transition. In support of this hypothesis in the paper we have provided some useful examples of how off- and on-line computer assisted video tutorials from sea-navigation can be used in Cloud based education and training for (future) seafarers at maritime studies departments.*

Keywords: *Cloud; education and training; seafarers*

1. INTRODUCTION

Cloud can be described as a set of clusters of distributed computers with farms of servers, as enormous centers for data collection and processing, which provide resources and services via network medium, or Internet. Customers had deployed applications installed on their own (physical) computers or company (local) servers in the past, while today these applications are mostly moved to Cloud. For instance, when users check their g-mail account, bank account status, or update their Facebook status - they are in Cloud.

The question is: Why is such a large number of activities, including education moved into Cloud? – The literature sources say that this is in order to increase the flexibility and scalability of the users needs, to free the users of capital investments in infrastructure and software, to allow them ''pay as you go'' services, as well as automatic software updates, increasing the possibilities of collaboration, the ability to access resources from any place, more efficient group work on the same projects, increasing competitiveness [1], etc.

In fact, we are all faced with an expansive and less controllable growth of technical forms of material culture, which we are in a certain way forced to adopt. It is a kind of imperative of the new digital era. When it comes to the education in this context, it is to be said that the education is mostly treated as an expense, rather than an investment (and not only in developing countries, but also in developed ones). So, this is one of the additional reasons for moving, shifting or blended education into Cloud.

If we start off with the assumption that the increase in the adoption of Cloud services will be present in the field of education (especially higher, lifelong one, including professional trainings) in developed countries, indisputably, new opportunities in this domain will arise for developing countries, as well. For these countries, small capital investments and flexibility in the use of resources are of particular importance. By opening Cloud capabilities, developing countries should be able to use the same infrastructure and resources as technologically highly developed countries [2].

2. THE MODEL FOR ADOPTING CLOUD

There is a scarcity of literature resources and little preliminary research on the adaptation of Cloud sources in education and training, in so-called developing countries. The model proposed in [3] has been inspired by a study which had been carried out in sub-Saharan Africa [4]. This model represents the basis for designing a questionnaire, by means of which the readiness of the high education institutions in the developing country (Montenegro) to implement this type of education could be analyzed. The model is based on triangulation (reconciliation) of three theories of adoption and expansion of ICTs: theory of a technologically acceptable model [5], theory of diffusion of innovations [6], and theory of intelligent ICT user [7,8].

The model proposed includes one *dependent* variable: intention to adopt Cloud into education and professional training. The *independent* variables in the model are organized in several

subgroups: innovative, economic, technical, contextual and organizational factors or attributes. The last, but not the least, is the independent variable: actual use of Cloud in high education. In Figure 1, direct and indirect links between *dependent* and *independent* variables are shown.

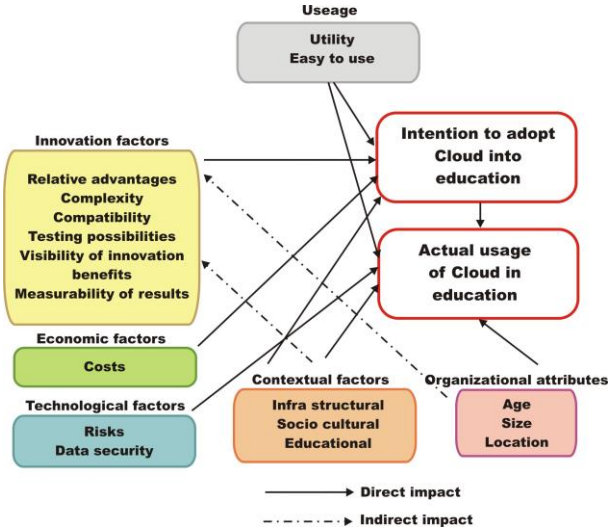

Figure 1. *Adopting Cloud educational model in a developing environment (Source: Adapted from [3])*

The main hypothesis on which the model is based, are as follows:

h1: Innovation factors are in positive correlation with tendency of introducing Cloud computing into higher education;

h2: Economic factors (costs and unpredictable return of investments) are in negative correlation with the introduction of Cloud;

h3: Technological factors (data security, system flexibility and scalability) are positively correlated with adaptation of Cloud computing in this domain;

h4: Technological factor related to obsolescence risks, on the other side, is negatively correlated with the introduction of Cloud;

h5: Simplicity of use, easy to create new content, and self-evaluation possibilities are positively correlated with the adoption of Cloud;

h6: The availability of ICT infrastructure, developed socio-cultural and educational factors are positively correlated with the introduction of this new concept into education;

h7: The age of the user is in a negative correlation with the Cloud adaptation. In other words, young people are usually pro innovation unlike elderly generation;

h8: The size of organization is in positive correlation with the adoption, i.e., a larger higher education organization will easily adopt the Cloud;

h9: Organizational culture is in positive correlation with the adoption;

h10: The level of actual using of the Cloud in educational purposes is in positive correlation with its future more extensive use.

The proposed model and afore given hypotheses are to show, to what extent considered factors influences the intent to adopt Cloud services in transfer of knowledge, with emphasize to the developing environment.

3. THE SURVEY AND OBTAINED RESULTS

The survey based on the above presented model has been realized by designing and delivering the questionnaires to the selected students, which have above average marks and high level of logical thinking at the Maritime Faculty Kotor (University of Montenegro). In total, 40 students at both Maritime Studies (academic level) and Nautical (applied level) departments have been interviewed. Preliminary version of the questionnaire has been sent to the experts so that they could give their recommendations, and by doing so, improve clarity and avoid ambiguity of the questions. The respondents use a five-point Likert type scale (range: 1-strongly disagree to 5-strongly agree) in answering the questions, which were created in accordance with afore set hypothesis. Then, the SPSS-Statistical Package for Social Science (ver.17) has been used in analysis of the responds [9,10]. The responds show statistically relevant positive or negative correlations between dependent and independent variables in the model (Table 1).

Table 1. *Strong correlations between dependent and independent variables in the model*

Correlations in the overall sample (N=40)	
Ind. Var. / Dep. Var.	Adopting Cloud
Actual use of Cloud	0.759**
Younger users	0.694**
Easy to use	0.648**
Data security	0.633**
Organizational culture	0.582**
Innovative factors	0.476**
Small organization	-0.602**
Technology obsolesce risk	-0.570**
Unpredictable return of investments	-0.483**

#Pearson: **Correlation is significant at the 0.01 level#

Consequently, in accordance to the conducted statistical analysis through the pilot study realized at the Maritime Faculty Kotor (University of Montenegro), in the summer semester of the past academic year, the following might be concluded:

(a) There is strong ***positive*** correlation between dependent variable *intention to adopt Cloud*

services in higher education, and the following independent variables:

- Actual use of Cloud services;
- Organizational attribute: younger users;
- Usage factors: easy to use, easy to create new content and self-evaluation possibilities;
- Technical factor: data security;
- Organizational attribute: organizational culture;
- Innovation factors: compatibility with previous systems, advantages in comparison to previous systems and measurability of achieved results.

(b) There is strong ***negative*** correlation between the dependent variable *intention to adopt Cloud services* in higher education, and the following independent variables:

- Organizational attribute: small organization;
- Technological factor: technology obsolescence risk;
- Economic factor: unpredictable return of investments.

Though, it becomes clear that there is a strong positive correlation between dependent variable intention to adopt Cloud into education and independent variables: innovation, technical (data security), usage, organizational (organizational size-big and organizational culture) attributes, and actual usage of Cloud. Further, there is positive correlation between intention to adopt Cloud and system flexibility, scalability, and contextual factors. This confirms the hypothesis: h1, h3, h5, h6, h8, h9 and h10. On the other side, the dependent variable intention to adopt Cloud is in negative correlation with the independent variables: economic (unpredictable return of investments), technical (technology obsolescence risks), and organizational (older users) attributes. This is in accordance to the hypothesis: h2, h4 and h7. Some more detail can be found in [3].

4. TOWARDS ADOPTING CLOUD

Some of the teachers at Maritime Faculty Kotor use multimedia-instructional materials, which support the previously assessed constructs in the model: the users (learners) are mostly young people, i.e., students, the materials are easy to use, they allow students' self-evaluation and cherish organizational and innovative culture at the Faculty. In this regard, below shall be briefly described three off- and one on-line computer assisted instructional resource(s) used in teaching and learning processes at Maritime Faculty. The off-line ones are Seagull products and the on-line one is produced by the cap. Marina Martic. Usages of such instructional materials lead us smoothly towards upcoming shifting of education into Cloud realm.

4.1. The RADAR multimedia materials

These Seagull's video materials include the following topics:

- Fundamental theory;
- Setting up RADAR display;
- Marine RADAR performance specification;
- Plotting;
- The use of RADAR in navigation;
- RADAR and COLREG.

The multimedia off-line instructional materials on RADAR provide self-evaluation tools after each sub-section, which allow the students to self-assess the acquired knowledge. Figures 2 and 3 show plotting basis in terms of target aspect - its R (red-portside) and G (green-starboard) side, and target aspect in relation to the own vessel. The speaker's narration follows these slides.

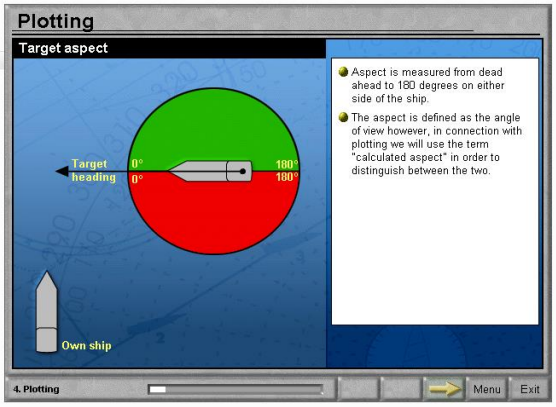

Figure 2. *Plotting: Target aspect and its R and G side (Source: Seagull)*

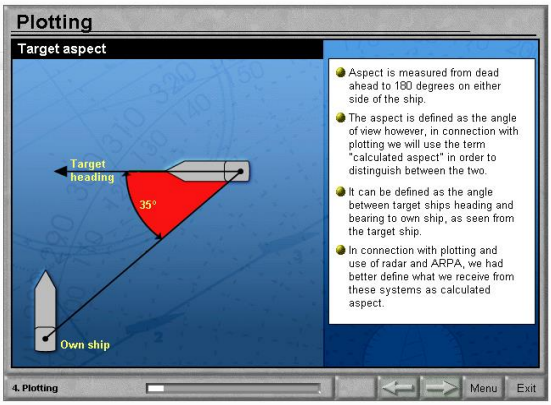

Figure 3. *Plotting: Target aspect in relation to the own ship (Source: Seagull)*

4.2. The ARPA multimedia materials

This instructional material covers the following topics:

- Review of plotting;
- Principal ARPA systems;
- IMO performance standards;
- Theory of ARPA tracking systems;
- Setting up and maintaining displays;
- Risks of over-reliance on ARPA;
- Standard ARPA system;
- Application of COLREG.

Figures 4 and 5 are extracted as the illustration from these video tutorials and they are all followed by the narrator's talk, i.e., by the appropriate descriptions.

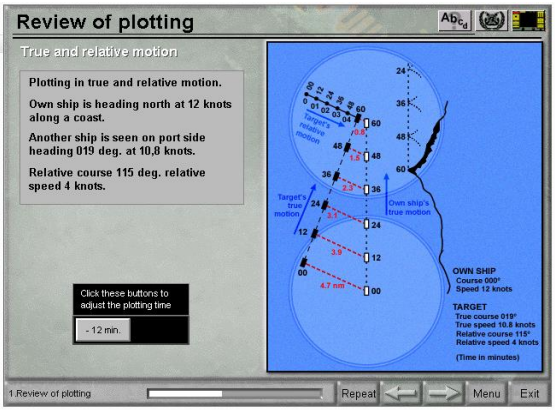

Figure 4. *Relative and true motion plotting simulation (Source: Seagull)*

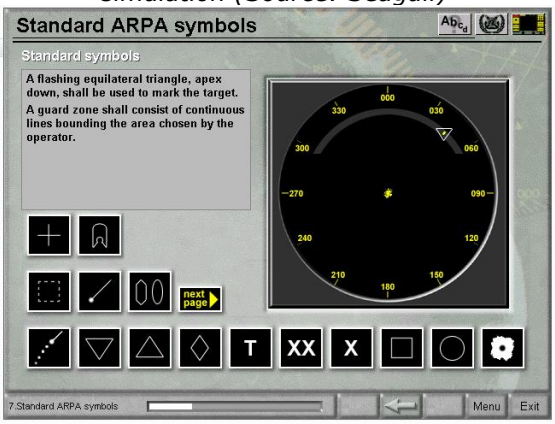

Figure 5. *Palette of standard ARPA symbols (Source: Seagull)*

4.3. The COLREG multimedia materials

These COLREG multimedia aids help understanding the topics:

- General;
- Lights shapes and sound signals;
- Vessels in any visibility;
- Conduct of vessels;
- Distress signals;
- Cases: 1, 2, and 3.

This module also includes self-assessment section. Figures 6 and 7 illustrate: how to avoid collision in the last minute and validation of the rule of the road, respectively.

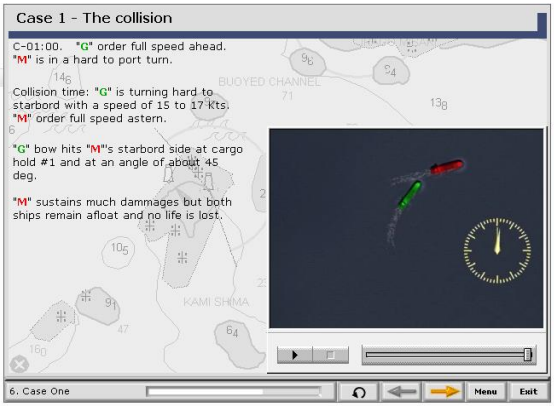

Figure 6. *Avoiding collision in the last minute (Source: Seagull)*

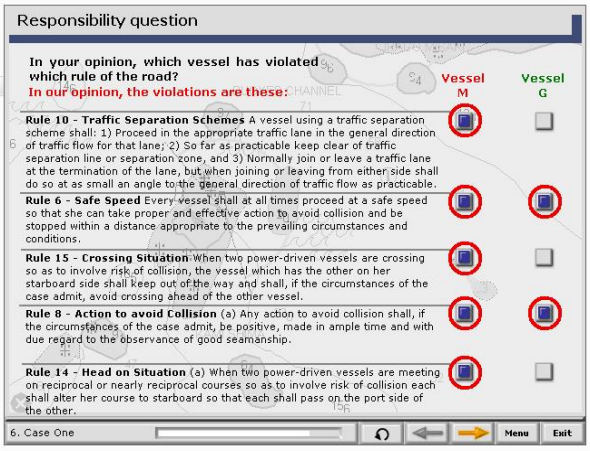

Figure 7. *The rule of the road – An exercise (Source: Seagull)*

5. 4.4. The Web multimedia materials

These materials are created by cap. Marina Martic and available at the web (URL: http://www.marinapomorac.com/; last access on 1st May, 2018). These tutorials are very comprehensive and contain textual, audio and video records on astronomic, terrestrial and electronic navigation, including maritime meteorology and safety communications. Cap. Martina Martic has rich experience as a navigator and as a trainer, as well. Therefore these materials should be recommended at maritime education and training institutions and centers within Serbo-Croatian speaking community. Besides, the students can use these materials when they are at home or at sea. This is an additional positive dimension or asset in comparison to previously shortly presented off-line multimedia instructional RADAR, ARPA and COLREG materials, which are in possession of the teachers.

6. CONCLUSION

The paper points out the trend of shifting education and professional training into Cloud. The model for adopting Cloud in education in the developing environment at the exemplar of Maritime Faculty Kotor (University of Montenegro) is proposed. The survey has been conducted among the students of afore mentioned Faculty, which identified the proposed constructs that are in positive or in negative correlation with adopting Cloud in education and training of the seafarers. Since usage of multimedia instructional materials in teaching and learning processes is in favor of the idea of moving education to Cloud, the paper additionally describes the four multimedia instructional aids developed for the needs of maritime studies students. These materials are of a great help, but it is necessary to use additional literature, e.g. [11,12], as well as guidance provided by the teachers. Accordingly, Lee [13] said: "There will always be a small percentage of

students with the necessary background, motivation and self-discipline to learn from self-paced workbooks or computer assisted instruction. For the majority of students, however, the presence of live instructor will continue to be far more effective than a computer assisted counterpart in facilitating positive educational outcome." Or, in other words, the students need to be informed about additional relevant literature references and above all motivated to learn by the teachers in the real world classroom and/or lab.

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