SIMAULA: a needs-based model of virtual practicum for future teachers

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SIMAULA: a needs-based model of virtual practicum for future teachers[1]

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I. Introduction

One of the main goals of the EU growth strategy "Europe 2020" is to use actively the opportunities that the modern technologies offer for improving the quality of learning. The active development of software for simulations of social processes provides realistic means for improving teacher education in a way that meets the needs and expectations of the modern society as well as of today's learners. The advantages which the inclusion of virtual reality offers, when considering professional training of educators, are growing with the development of the simulative software packages. A number of researchers point out the positive effect which learning in simulative environments has for increasing learners' motivation and individualization of the learning process, as well as for the development of practical and professional skills; in addition, the nature of the simulation software allows for the design of virtual learning environments which provoke students' cognitive and emotional activity [1, 2, 3, 4].

In the current paper the authors present an authored project, which aims to construct a model for a virtual simulation practicum for teachers' in-training. The project is based on in-depth qualitative research of users' needs and on a detailed analysis of the potentials of most recent social simulation technologies to support learning. The development of the presented simulation model involves the efforts of an practicing studentational team of professionals in the field of ICT in education who collaborate in the context of SimAULA Tomorrow's Teachers Training Project.

There were three stages in the process of the virtual simulation practicum design and development. During the first stage, an ethnographic study was conducted in order to reveal the views and needs of the stakeholders as well as a literature review. In the second stage, the team focused on the development of the specific technical parameters of the simulative game development. Finally, the third stage of the project involved elaboration of the conceptual framework and pedagogical desgn of the virtual practicum and methodology of its evaluation.

II. Research methodology

The in-depth analyses of literature and the outcomes of semi-structured interviews and focus groups were an integral part of the ethnographic study. In the study, there were three different groups of participants: (1) academics – faculty members from Sofia University "St. Kliment Ohridski", (2) resource school teachers who mentor practicing students, and (3) students from different faculties of Sofia University involved in programmes for teacher qualification. The faculty members are closely engaged with the organization and teaching of the practicing studentship courses in the three of the largest faculties involved in future teachers' preparation: The Faculty of Education, The Faculty of Biology, and The Faculty of Chemistry. The teachers who host practicing students in the process of their practicing studentship in elementary and middle school.

The results of the data analysis supported the understanding of the problems, barriers and challenges related to the overall educational goals of teacher-training programmes. They are evident in the process of planning, organization, and conducting of practicing studentship practice.

Based on the comparison of the problems and barriers identified by the three groups of participants, the authors were able to make the following conclusions: there are common problems and barriers identified by all three groups. These barriers are related to the application of the theoretical pedagogical knowledge into practice. The most important ones are: the lack of knowledge and ability to apply approaches for interactive teaching and learning as well as teaching strategies that would promote group work, individualization and differentiation of the learning process. In addition, there is a relationship between the way practicing students work in class environment and the quality of the

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equipment they have access to during their practicing studentship. Another important problem which was identified is the class discipline; the low class discipline levels can be interpreted as the reason for practicing students to be more likely to use teacher-centred approaches on one hand and on the other – inadequate discipline can be a result of the application of such approaches. It can be assumed that these difficulties and problems cause practicing students to experience a higher level of anxiety, lower levels of confidence, and lack of motivation to apply teaching approaches different from the teacher-centred ones; thus, teaching approaches that present direct transmission of knowledge become the main approaches used by the students and pupils in their classroom play the role of passive observers. This low involvement of the pupils possibly triggers the discipline problems [5, 6].

As a result of these barriers and challenges, a wide variety of learning objectives assigned to practical preparation of future teachers are not effectively reached. Often the result is that students enter the teaching profession after developing ineffective stereotypical approaches to teaching, which are often based on transmission teaching models.

III. Conceptual Framework of the Virtual Pedagogical Practicum

It is viewed that the constructivist paradigm offers a good framework for the effective development and application of serious games for students majoring in the field of pedagogy. A number of researchers acknowledge the role of serious games to support active learning by engaging students and encouraging them to involve in research, experimentation, and collaboration with peers [1, 7, 8, 9]. Wilson [8] claims that modern computer games could be viewed as a constructivist learning environment in which a space for collaborative work and problem solving is provided; this is a space in which learners can support each other, use various tools and informational resources in order to solve specific problems and achieve educational goals. According to Sara de Freitas [1], the digital games, which are based on the main principles of the constructivist paradigm, have the great potential to support and stimulate the in-depth learning of teachers in training.

The technological and pedagogical design of the virtual practicum SimAULA was informed by the three main trends that guided the conducted research: (1) problems and barriers revealed in the analysis of the way the pedagogical practicum is currently conducted, (2) the specific needs for increasing the quality of pedagogical practicum presented by the participants of the three groups that took part in the study, and (3) the pedagogical potentials of serious games.

These three trends laid the basis for specifying the educational goals of the virtual teaching practicum SimAULA. These goals were also based on the general understanding and the specific characteristics considered in measuring the acquired knowledge, skills, and models for professional conduct outlined in Dublin descriptors [10].

It was planned that as a result of the training with SimAULA, future teachers will gain specific knowledge, skills, and competencies, which can be grouped in five specific categories:

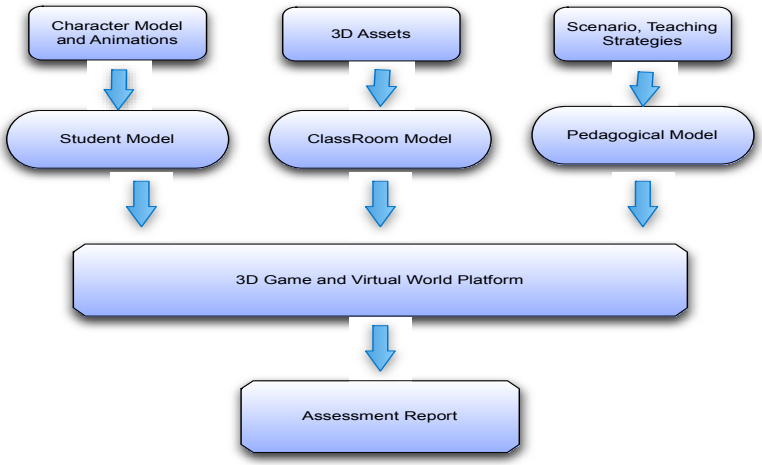
Knowledge and understanding of the nature of various strategies for management of pedagogical activities; the organization of working space and the type of activities which can be conducted in this space; the pedagogical potentials of specific ICT; the various students' psychological profiles; the pedagogical suitability of various types of learning activities as they are related to the learning goals, time schedule, available resources, and learning content; the organization of learning activities and assessment;
Knowledge application of: an assigned pedagogical strategy and of a pedagogical strategy chosen by the practicing student; a selected technology/s and learning resources for a specific learning content; a specific pedagogical strategy in the interaction with avatar pupils; teaching strategies which would improve pupils' motivation; content and theoretical knowledge when choosing learning activities suitable for a specific pedagogical strategy;
Making judgements: adequate choice of ICT based on the chosen pedagogical strategy, type of classroom, learning goals, and specifics of subject content; choice of strategies for working with problematic pupils; analysis of the target group, lesson goals, and specific learning situation; development of evaluation and assessment instruments; diagnostics of pupils' knowledge, skills, and behavior and choosing the adequate teacher's reaction to them; assessment of the quality of the conducted lessons and self-assessment of the work with the pupils;
Communications skills: for effective pedagogical interactions depending on avatar pupils' behavior; planning and organization of pedagogical communication as related to a chosen pedagogical strategy, ICT, and learning activity;
Learning skills: learning through reflection.

IV. Virtual practicum design

The technological and pedagogical design of the virtual practicum SimAULA was guided by the goals outlined above. The model of the virtual practicum at both technological and pedagogical level consists of three key components: the Student Model, the Classroom Model and the Pedagogical Model (Fig. 1).

1. Technological design

Fig. 1, The breakdown of the development process



The Student model includes a set of students' characters as well as the possibility for the end user to configure the number and composition of the class. The different types of characters were based on the ethographic studies undertaken in the duration of the project.

The Educational model (Pegagogical model) includes two main features: the activity script and the tips and hints for the teacher.

The classroom model is closely related with the physical organization of the classroom space. The simAULA classroom model will first of all include this types of classroom setting to be chosen by the end-user when starting the activity and can be modified during the simulation. For each setting, a short pop up hint will explain the type of the theory behind the setting and when is more suitable for using it.

The system is divided into two parts. The first part contains the graphical interface which is based on Unity3D, and contains the student and classroom model and the second part contains the simulation core and it contains the pedagogical model and this part is responsible for driving the simulation. The communication between the two different parts of the system is made through webservices. The implemented simulation game is available through either as a seperate application, ot it could be embed in a webpage.

2. Pedagogical design

Guiding the design of the **pedagogical model** of SimAULA are the problems and barriers, which the pre-service teachers experience in their traditional pedagogical practice. The data analysis revealed serious shortcomings in the preparation of the practicing students, their lack of organizational skills and low motivation for becoming teachers. All three groups of participants reported that the students most frequently apply teaching strategies associated with models of transmission teaching and almost never turn to strategies guided by the constructivist models and methods. As the main reasons for this limited choice of teaching strategies they point out: (1) the students' lack of developed teaching skills and competencies related to these models and to their systematic application in specific pedagogical contexts, (2) lack of classroom time, (3) the limited number of hours devoted to the pedagogical preparation of pre-service teachers, (4) students' feelings of insecurity and loss of control over the classroom when student-centered teaching strategies are used, (5) as well as the poorly equipped classrooms in most of the schools where practicing studentship courses are conducted which poses certain limitations in terms of resources and classroom environment organization.

In order to overcome the above problems, the virtual practicum includes a variety of constructivist models of learning: collaborative learning, learning through experiment, problem based learning etc. These models can be applied in different types of classrooms, with different ICT and resource

availability, and with a different range of learning activities for their realization – all these options are part of the software design. This variability of options provides the opportunities for students to practice professional behavior in the safe environment of the virtual classroom; in addition, the virtual classroom adds flexibility to this practice making it independent of the place and time limitations often experienced during the face-to-face practicum. Thus, in the virtual classroom, while working with avatar students, students can choose and experiment with the pre-programmed teaching strategies in order to build their competencies and develop confidence without negatively affecting the learning process of the actual classroom.

The pedagogical design comprises eight consecutive steps, on each of these steps the tutor and the practicing student can make a choice depending on learning objectives, their knowledge and needs, namely choice of: pedagogical strategy; type of classroom; technology; study material and resource packages; student-avatars with specific psychological profiles; learning activities; mode of assessment, monitoring, and feedback; self-reflection and self-assessment.

In addition to the above, the simulation classroom environment provides instruments for acquiring key skills and competencies related to the organization of group learning, as well as for differentiation and individualization of learning. The difficulty developing exactly these skills appeared, based on our analysis, to be one of the main problems experienced by practicing students. The simulation environment encourages students to assume an active role as teachers and to experiment with a variety of teaching strategies as well as with techniques for guiding the learning process based on learners' needs; the risk to overwhelm the students or to create the sense of failure in the process is minimized. In addition, working in this simulation environment, the students will acquire skills for interacting not only with the most active students but also for involving students who are less active either because they are ahead of the group or lag behind.

Another strength of the pedagogical model is its high interactivity. This interactivity supports practicing students' active learning of professional knowledge and competencies and their experimentation within the environment while solving various pedagogical problems. We expect that when the pre-service teachers are provided with the opportunity to reflect on a specific situation, to pose hypotheses about these situations, to take actions, and after that to research and reflect on the effects of these actions, many of the problems identified in our research might be solved. For example, one of the most prominent difficulties which students experience currently in the traditional practicum is their inability to control the classroom discipline and to deal with discipline-related problems. We perceive this problem to be both one of the main reasons for students choosing teacher-fronted strategies and a result of the application of such strategies. In the virtual practicum environment, the students can experiment with different teaching and communicative strategies while working with avatar pupils in order to observe and develop a better understanding of the relation between teaching practices, learning activities, and the learning outcomes. Here it is also important to point out that the virtual practicum offers the opportunity to work with avatar pupils who have different personalities and psychological characteristics; this adds to the realistic features of the classroom simulation.

The student model is developed based on the outcomes of the focus groups conducted with teachers in biology/chemistry from the same grade/class we intend to develop the pilot scenarios for (13 years old students – which are in 7th grade of lower secondary school). The focus group interview addressed the identification and detailed description of typical students profiles. These profiles include the roles, attitudes, behaviors etc – in order to support the development of the student model that could be used for this particular subject at this particular age for this particular scenario.

In the basis of this study are used two classifications of behaviors: the first defines the characteristics of the different roles of students in group work [11], the second is related to behaviors of students in the frontal work in the classroom [12].

During the focus group discussions teachers agreed on the following characteristic types of students' behaviour: collaborator, competitor, accommodating, hostile, disinterested (passive), coward, confused, idealist. In addition, they specified five types of problematic student behavior: the talkative, the spoilt, the moaner, the skeptic, and the joker. Specific behaviors, reactions, characteristics, and frequently used language were defined for each of these five types.

During the game, student avatars, and more specifically their behavior, are the main feedback that SimAULA users will receive to know whether their decisions are appropriate or not. In the classroom students can be grouped in two categories according to their reactions: first, the non-conflictive students that are focused on learning and follow the teacher pedagogical strategy, and secondly, students that develop some kind of disruptive/conflictive behavior under some of the roles previously

defined: skeptic, moaner, joker, etc. As an overall rule, the number of conflictive avatars depend directly on the teacher avatar actions. As it would happen in most of the classrooms, good teaching decisions create a better climate in the classroom. On the other hand, students' reactions in a classroom also depend on elements that are beyond a particular classroom situation. For that reason, some of the SimAULA avatars may develop a conflictive behavior non related to teacher actions.

The objective of the game, from the user point of view, is to make learners achieve learning objectives through a learning process where conflicts will appear. The variable 'Student Involvement' (S.I.) defines the overall student integration in said learning process, and the objective is to achieve the highest S.I. possible at the end of the game. The percentage of S.I. also determines the presence and the number of conflictive avatars, and it is quantified as the number of students that are engaged and paying attention at a particular moment during the game. As a general rule, classrooms with higher S.I. will be more successful than classrooms with lower S.I.

In conclusion, avatars behavior is the main feedback on how the user (practicing student) is performing. Performance depends on the design stage (when scenarios are defined) and teaching stage (when activities are implemented in class).

The classroom model deals with the organization of the classroom space. The choice of a classroom type is based on the existing organization of the working space (described as typical).

The classroom settings pose different types of limitations or possibilities for the application of various pedagogical strategies and learning activities. The readiness for testing pedagogical models in the different classroom settings and the ability to identify the advantages and disadvantages of a particular setting are important professional skills of a future teacher. The features which SimAULA offers in terms of manipulating and rearranging the learning environment in the process of teaching in the virtual practicum supports overcoming another limitation of the face-to-face practicum which confines practicing students to one type of classroom settings and thus does not allow for the development of these skills.

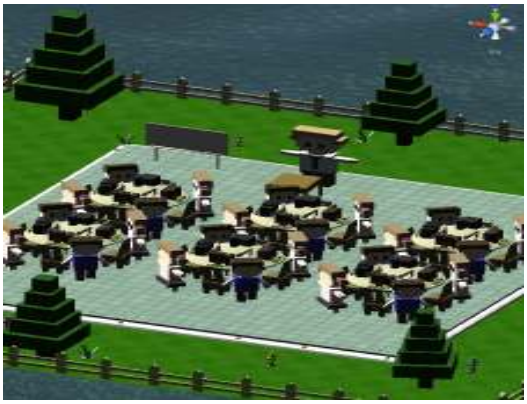
There are three selection options here:

Classroom Type 1 - the desks are arranged in three rows with students facing the blackboard. The teacher's desk appears in front of the blackboard. There are no much opportunities to rearrange the desks.

Fig. 1

Classroom Type 2 - the desks are arranged in several circles which are able to sit six students. The blackboard and teacher's desk are in the middle of the classroom. The desks and chairs can be moved, their size and number allow for a quick and easy restructuring of the workspace.

Fig. 2



Classroom Type 3 - the desks are arranged in a U-shape and the blackboard and teacher's desk are in the middle. Again, the desks and chairs allow to be rearranged which provides opportunities for a dynamic workspace.

Fig. 3

The evaluation in SimAULA is a complex issue, since it refers to a lot of areas within the implementation. Such complexity requires a multidimensional approach in terms of techniques and indicators. SimAULA experts have identified sets of indicators from several aspects: overall utility, technology, pedagogical aspects, usability, engagement, sense of presence and learning. These indicators will be assessed through qualitative and quantitative instruments such as questionnaires, interviews, focus groups and observation. In order to gather information from different types of users, SimAULA will apply evaluation in different contexts such as Universities, Summer Schools, e-learning conferences, etc.

Conclusions

Summarizing the presentation of the proposed needs-based model for a virtual practicum for training of pre-service teachers, it could be pointed out that the virtual practicum provides practicing students with the opportunities for the acquisition and development of specific professional knowledge, skills, and competencies; therefore, the practicum is a valuable instrument that could supplement the overall preparation of future teachers. This instrument can support the optimization and modernization of the practicum phase of teacher-training programmes according to the contemporary trends in education and career development. We expect the application of the simulation environment to help minimizing the difficulties experienced by practicing students when participating in the traditional practicum and to stimulate future teachers' creativity in planning, organization, and management of learning process.

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