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The Implementation of Simulation Modeling in the Extreme Psychology Master's Course

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Abstract

With the development of computer and information technologies the best way to make science more attractive for students, and promising for meaningful learning, is to integrate new technologies in the teaching process by using innovative teaching and learning strategies. Simulation or computational modeling has unique advantages in this respect as a tool of constructing a virtual learning environment dealing with the scientific content area of different disciplines. Simulation modeling suits well for the study of complex behavioral systems and is widely used in psychological researches, but the educational value of simulations is not widely investigated.

The aim of this study is to explore the effect of students' simulation investigative activities, in their general experimental abilities and special competences in the area of Extreme Psychology. Extreme psychology is a relatively new area of interdisciplinary research that deals with questions related both to developmental, social, juridical, clinical etc. psychological problems and to psychology of rescue and risk, disasters, terrorism and crimes.

A total of 116 Extreme Psychology Master's Course students were involved in investigative activities with virtual data manipulations in a simulated laboratory. Two of three main simulation types of models: agent-based (1) and systems dynamics (2) procedures served for explanation, proof and prediction purposes. The modifications of the Science Research Team format - the Interrupted Case Method, was applied to resemble the scientific method in a real context – the students worked with incomplete data, made tentative hypotheses, collected more information, made more predictions, and so on.

After the semester's course there was improvement observed in the students' skills to design experiments in extreme psychology: the majority were able to formulate hypothesis with scientific criteria; define the criteria for their profing; adequately define the appropriate initial conditions of the system and explain its changes; choose the necessary exploration devices and instruments; better predict the possible outcomes. Simulation modeling in a virtual laboratory proved to be an important resource to improve the understanding of the science content and the development of scientific skills of students.

1. Introduction

Master's Course in Extreme Psychology does not resemble the usual scholarship program for an academic degree, as extreme psychology is a relatively new area of interdisciplinary research and practice. Being related to different areas of Psychology (environmental P., social and organizational P., juridical P., clinical P. etc.), it deals with the psychological problems of rescue and risk, psychology of catastrophes and disasters, terrorism and crimes.

Interdisciplinary approach comes into conflict with the formal educational system and traditional disciplinary boundaries, both in curricula and educational practices. On the contrary, the evidence-based teaching and learning systems fit the nature of extreme psychology courses well [1], [2], [3].Team-based learning is widely used in science, business, and medical education disciplines with positive results. In extreme psychology education teamwork not only actively engages students in the learning process and provides a supportive learning environment, but it also promotes 'real world' social and intellectual skills that will be needed in the working place [2]. Combined with the case method cooperative learning contributes to students' better comprehension of complex course concepts, critical thinking skills, higher level of educational outcomes for both high and low achieving students etc. [1], [2]. Along with evidence-based methods, the research-oriented approach is

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successfully practiced as an alternative way of organizing the teaching-learning process during interdisciplinary science lessons.

The Science Research Team format has been found to be the most convenient for extreme psychology Master's course classes [1], [4]. The best case technique for the Scientific Research Team format is one called "Interrupted Case Method" [5] modeled to resemble the scientific method in real life – the students work with incomplete data sets, make tentative hypotheses, collect more information, make more predictions, get more data, and so on.

The development of computer and information technologies has opened the new way to make science more attractive for students by integrating high-tech methods in the teaching process and using innovative teaching and learning strategies. Simulation or computational modeling has unique advantages in this respect as a tool of constructing a virtual learning environment dealing with the scientific content area of different disciplines, that permits to construct and to investigate complex objects of multi- and interdisciplinary nature [6], [7].

In comparison with laboratory researches, simulations obviously have disadvantages, since their objects are artificial agents, and so are the data. At the same time, simulation experiments have some advantages, including perfect variables and conditions control, less dependence on a sample size, the ability to manage greater complexity in experimental design, and so on [6]. Simulation models are especially helpful for extreme psychology investigations in high-risk environments, where getting it wrong is costly, where there are practical or ethical difficulties in conducting real-world research, where they wish to examine the multiple factors and/or the time impact on behavior [7].

Simulation modeling suits well for the study of complex behavioral systems and is widely used in psychological researches, but the educational value of simulations is not widely investigated.

2. Goals and Procedures

The combination of the team-based Interrupted Case Method with simulation research computor modeling was practiced during the second semester of the extreme psychology Master's course in order to organize the teaching-learning process so that it could help to:

- integrate different science disciplines' content for extreme psychology theoretical and empirical aids;
- increase students' interest and engagement during science lessons;
- promote students' self-direct learning and research skills;
- achieve a better integration of psychological theory with practice.

We focused on the combined evidence-based and research-oriented method package for some reasons. The course was completely structured from the beginning to the end, in format that defied both the teachers' role in facilitating learning and the students' activities in the interaction with the information and in the presenting of the results. The elaborated sequence of teachers' and students' activities shifted the focus of learning from science content to students apply the content. This allowed the teacher to aim at identifying not only the system's effectiveness at achieving high student learning outcomes throughout the course but also the key components of it that are responsible for this achievement.

A total of 116 extreme psychology Master's course students were involved in investigative activities with virtual data manipulations in a simulated research laboratory. Two of three main simulation types of models: agent-based (1) and systems dynamics (2) procedures served for explanation, proof and prediction purposes.

In the format of Case Interrupted Method, students were given the appropriate information in portions. Computer simulation modelling helped them to structure the vast amount of the information to decide on what, and for what to use. The experimental procedure played a minor role in the session, as it served as a tool for the modeling. Students worked directly on data to elaborate a concept or a representation model, to verify it and to test the usefulness of a law or a rule. The students were asked to build a theoretical or conceptual model and to switch back and forth from theory to data. It helped them to deepen understanding of how course content applies to real-life situations and problems.

According to team learning format, peer assessment and feed-back were used to develop students' team problem solving and decision-making abilities. The process repeated for each session with students filling out peer evaluations for members of the team [1], [2].

In order to analyse the efficiency of the method package we evaluated quantitative (test results) and qualitative data from students' reports. The test was given as an examination course procedure. A pre-post comparison methodology was applied concerning written tests and personal information.

3. Outcomes and Results

After the semester's practice of the team-based Case Interruped Method in combination with simulation modeling the sufficient improvement was observed in the students' academic achievements and research skills. In particular the majority (80%) of students demonstrated high level examination test results. They showed better comprehension of complex course concepts, greater understanding of its interdisciplinary links, higher level of hypothetico-deductive, critical thinking and argumentation abilities than at the beginning of the semester.

The improvement in research skills related to specific aspects of the experimental design: the majority were able to recognize the dependent and independent variables; formulate hypothesis using scientific criteria; decide the criteria of the hypothesis verification successfully; adequately define the appropriate initial conditions of the system and explain its changes; choose the necessary exploration devices and instruments; better predict the possible outcomes; design experiments in order to deal with real life problem situations concerning extreme psychological phenomena.

The above results in students learning were accomplished following their engagement in simulation modeling, in which they were involved in research activities with virtual objects and data manipulations in a virtual laboratory.

In addition, students expressed their opinions of the combined method package used in classes. It appeared that distinctively the majority of the Master's course students taught in this format felt satisfied and very satisfied by the teaching method (82%)

The observed outcomes could be mainly attributed to the specific features of the Interrupted Case Method virtual research laboratory in general and to simulation modeling research approach in particular, as it offered students opportunity of actions on virtual objects and data in life-like research context, linked to the theoretical positions and concepts of extreme psychology. Such results give a firm evidence base for the great educational potential of evident-based and simulation modeling research methods for facilitating students in doing science and developing scientific skills.

The combination of the evidence-based methods and computer simulations modelling permit teachers to deal on the one hand with theory and research and on the other with psychological practice, and to succeed in "translating" from research and theory to practice and back again.

4. Conclusion

We consider the team-based (students working cooperatively in permanent groups) Interrupted Case Method combined with computer simulation experiments to be the optimum approach for science teaching and learning in extreme psychology Master's course frame. It is especially effective for applied interdisciplinary subjects' group, to which the extreme psychology belongs. The entire package is more suitable for a module course than for a single classroom session, though the interrupted case method is a universal procedure for different teaching occasions. This teaching approach refers to Evidence-Based Teaching systems, and it is suitable for achieving different teaching goals and students' objectives. However, there are sufficient restrictions in its supply: this method package requires from the academic professional to be an expert practitioner, as well as an experienced researcher.

Further research will be useful, in larger samples and other science fields in order to explore the potential of simulation modeling and virtual laboratories since they are easily handled by both teachers and students and can be flexibly integrated in science teaching process.

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