

Introducing game-based virtual learning environment: Managing educational change in higher education

ANDREJA ISTENIČ STARČIČ

University of Primorska, Faculty of Education, Cankarjeva 5, 6000 Koper
University of Ljubljana, Faculty of Civil and Geodetic Engineering, Jamova 2, 1000 Ljubljana
SLOVENIJA

andreja.starcic@siol.net <http://www.pef.upr.si>, <http://www.fgg.uni-lj.si>

Abstract: - Game-based virtual learning environments are fostering new teaching and learning approaches, ensuring the worldwide collaboration of students and teachers. The paper presents a model of simulation-game-based virtual learning environment in four countries, in Finland, Slovenia, Germany and Estonia. Paper presents the classroom management model, outlining teaching and learning methods and assessment for virtual learning environments, where students may collaborate internationally, benefiting from guidance of international teacher teams. Simulation-game-based learning environment aims at assisting students in acquiring competences which will enable them to autonomously involve in their professional fields. Intended competences to be achieved are competences of working in the national, European and global tourism business environments. Quality assurance instruments were developed upon formative and summative evaluation. Investigated are new organisational solutions, which meet educational changes and are necessary so as to ensure international collaboration of students and teachers.

Key-Words: - Simulation game-based virtual learning environment, Instructional design, Computer supported collaborative learning, Higher education, Partnership, Business simulation

1 Introduction

Internationalisation of higher education extends over a wide range of activities, as for instance, the internationalisation of curricula, development of joint degrees, joint courses, student and teacher mobility, research and development cooperation. We are facing international competition in higher education, among the providers of virtual university and e-learning training courses. The university is expanding the provision of continuous professional development training courses, which are connected in a system of graduate courses.

Information communication technology increases the efficiency and flexibility of the learning and training systems, which can be implemented in employment environments, connecting formal learning with non-formal. Information communication technology helps universities in preparing students through the initial education and continuous professional development for the international and global markets. Studies of adaptation of information communication technology to teaching and learning have shown that technological innovation in this field is accomplished in a different way. Implementation of new technologies in teaching and learning is related to the change process which can, according to

Fullan [10], be of first order when not influencing organisational structure, and of second order when seeking change in organisational structure, goals and roles. Educational change involves changes in educational context and includes all the stakeholders: teachers, students, leaders, and administration. It can be accomplished by changing teaching approaches and beliefs [10]. As regards ICT innovation at university, a particular teacher as innovator needs to take into account the system and policy applicable at departmental level before acting as change agent. However, from the point of view of the day-to-day teaching practice, the key change agent is the teacher.

Higher education is more and more focused on approaches which shall enable students at all study levels to develop the generic and subject-specific competences so as to qualify them for obtaining access to the international work markets, where they shall prove successful in their respective activities.

Major changes in teaching and learning have been underway in higher education, which should enable the students during their studies to learn and obtain experience within the international student and expert groups, at studying cases of real-life working practice from the different cultural environments around the globe. Systemic

requirements for transparency and comparability of study programmes between the European universities have enabled the formation of joint study programmes, joint study subjects, and different forms of cooperation in implementing study programmes at all study levels. Changes at all the levels, systemic, organisational and individual, are required in order to put into practice the new teaching methods. Teachers are facing the need of permanently and continuously developing the teaching within the respective teaching environments. These teaching environments are most frequently a juncture of different cultures and most diverse student and expert groups. ICT-assisted learning environments are more and more common. They require the teacher to be competent in using the new systems and tools and new communication approaches within the multicultural environments. Quality assurance is required at organisational and systemic level, at planning and implementing subjects, where teachers and students from the different European universities are involved.

2 Simulation game-based instructional design to meet contemporary learning needs

Contemporary learning needs are defined with the expectations of young generations of students, who have grown up with immersive, computer-mediated experience as a norm [16], and with the expectations of graduates to obtain competences for working in international and global contexts. On this basis, universities are stimulated in building partnerships internationally so as to exchange students and to develop joint degrees and courses.

A digital game is a game played in an electronic platform with the following characteristics: a game as voluntary and enjoyable activity, guided by rules, separated from real world, uncertain and unproductive, and not producing any good of external values [4]. Games include many characteristics of problem-solving, adding the elements of competition and chance [7]. At defining an educational game, some additional characteristics are identified. For learning purposes, game is focused on the clearly defined learning tasks. Player learns new knowledge or already acquired knowledge [4: 2657, 22:250].

Game playing may help develop the skills, attain competences, develop behaviour and attitudes, share experiences, and discover new concepts. An important characteristic of digital games in

education is that they are appealing to the intrinsic pleasure of performance. M. Ebner and A. Holzinger had investigated the importance of joy and fun in creating motivating educational game-based environments in higher education so as to acquire complex theoretical knowledge by the more approachable learning activities which are enjoyable and, at the same time, enriching and transforming the learning environment [7].

Essential attributes to educational simulation are a model of reality defined as a system, a dynamic model, a simplified model, and a model that has fidelity, accuracy and validity [22:251]; on the contrary games don't intend to represent any real-world system [11, 22]. According to the constructivist theory, understanding of reality is constructed by an individual [13:5]. Simulation in learning has to provide feedback to learner and allow the learner to control this simulated reality in order to study and improve knowledge [22].

Educational simulation in order to simulate real life has to provide a type of controlled reality, where the learner can experiment with aspects of reality that would otherwise be impossible to study outside the real world [14]. Simulation used in social science to explain social phenomena, such as simulating human behaviour, interactions, relations, and business processes, have limitations. Simulation faces obstacles when representing complex systems, as economics, business, and human behaviour [20].

Simplifications are viewed as an essential characteristic of simulation [22]. The purpose of simulation is not to represent accurately the mind-boggling complexity of reality but rather to simplify segments of reality so that they may be analysed and understood [12].

Educational simulation as a simplified model is defined by the distance between the model of reality which has been produced, and reality itself, as well as the introduction of a degree of abstraction necessary for understanding the system's functions and inherent tasks [22].

3 Virtual simulation game-based learning environment model

In pedagogical design of VIRBUS the following factors were used:

- delivery mode,
- organisational social mode,
- learner control,
- levels of teacher assistance.

VIRBUS simulation is designed in a virtual learning environment to meet the challenges of

contemporary teaching and learning contexts and needs (Figure 2, 3, 4, 5). VIRBUS aims at presenting real business management operations so as to:

- improve international business management skills and competences of students and employees;
- increase the understanding of the business life cycle as well as international business life as a whole;
- connect real business life and incorporate aspects of it into teaching and learning.

Focus is on an individual student, who can work across time and space and outside the classroom, using national resources and real-life data accessible through virtual game environment. Fang outlines the advantages of learning on a web as nowadays authentic business environments [8]. Students can connect to their peers and professionals in the field, corresponding places in academic, scientific and classroom cultures. VIRBUS assists a range of student learning variations, which can be applied in different ways in a classroom, or remotely:

- designing a learning process for large groups, small group learning, peer learning, and individual learning;
- using various learning methods;
- tutor's role can be applied at different levels;
- learning in an international environment with the assistance of real-life data of Finland, Germany, Slovenia and Estonia.

VIRBUS simulation game presents business cycles:

- Start up and stabilisation,
- Growth,
- Co-opetition.

VIRBUS interdisciplinary integrates the learning aims of diverse study courses and is designed for use in all university and lifelong courses, as well as in enterprises involved in tourism business management in the global marketplace. Focus is an individual student. Before the learning process starts, the characteristics of every individual student need to be identified. They provide the basis for selecting the organisational social mode, methods, and tutor's role.

Individual student's characteristics to be considered are:

- student's knowledge and understanding
- student's experiences

- student's approaches to learning
- student's perception of study context
- motivation for learning.

VIRBUS stimulates students to the higher-order learning outcomes. Generic and transferable competences gained include:

- instrumental competences: cognitive abilities, methodological abilities, technological abilities and linguistic abilities;
- interpersonal competences: social skills (social interaction and co-operation);
- systemic competences: abilities and skills concerning whole systems (combination of understanding, sensibility and knowledge).

VIRBUS principles in promoting quality learning may be outlined from four angles:

- meaningful reflective learning through authentic learning activities,
- experiences as learning resources and active learning by various methods,
- collaborative learning,
- holistic learning, integrating feelings and values.

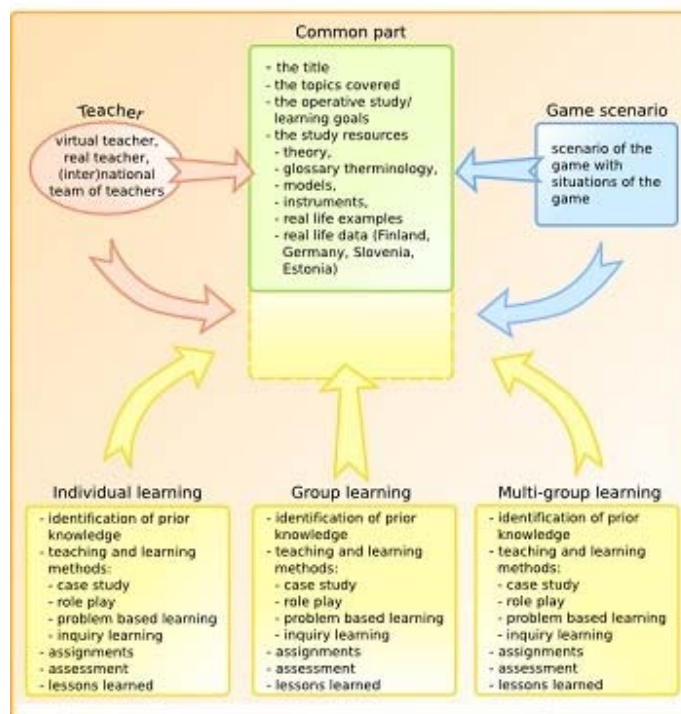


Figure 1: Instructional design model

Students learn best, when knowledge is meaningful to them. Complex systems, like tourism

business management in a global marketplace, are comprehended better if learned by doing, and by engaging in activities as close to real life as possible. Students need to apply the newly acquired knowledge in practice therefore VIRBUS provides authentic activities, followed by tasks for reflection. During the learning process, students constantly need to evaluate their outcomes and learning competences.

Active learning by various methods is provided for using experience as a learning resource. Students are stimulated in different ways so as to engage emotionally, socially, cognitively in learning by doing, using inquiry learning, solving problems, discussing, experimenting, role playing, defining operationally, formulating hypotheses, interpreting data, observing or predicting. Students are assisted to solve authentic problems as real experts [8].



Figure 2: VIRBUS

Students learn best, when learning from peers with a similar level of understanding [23]. Collaboration within an international group of students provides opportunities for learning and investigation at international level. Teacher interferes when the students do not have the prerequisite knowledge and skills or when they are not ready for learning.

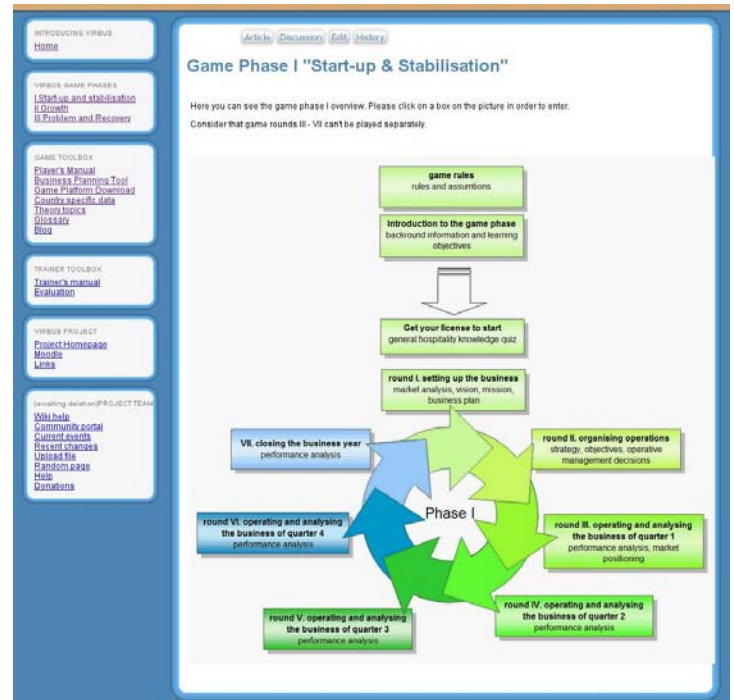


Figure 3: VIRBUS Phase I.



Figure 4: Theory



Figure 5: Glossary

Building a physical and social learning space, the holistic experience, integrating feelings and values, creates a good atmosphere and is the main condition, which the quality of learning process and outcomes depends on. The outcomes students anticipate depend on their judgments of how well they will be able to perform tasks.

Self-efficacy [1] is a judgment of one's ability to organize and execute given types of performances. The self-assurance with which students will approach and manage tasks determines largely whether they will efficiently use their capabilities. Keller [6] designed a model of Motivation, Performance and Instructional influence based on assumption that how students perform learning tasks depends on their motivation and their expectancies. In the model she performed four conditions for motivation: attention, relevance, confidence and satisfaction (ARCS). VIRBUS accordingly uses motivators (Figure 6) to implement self-directedness when fostering, guiding and challenging of activities, maintaining of attention, and intensifying of activities.

- Getting attention of students is achieved with interesting examples and problems, stimulating critical thinking. Game itself has characteristics that stimulate and maintain student's attention. Those characteristics are: competition, joy and fun, game story context, problem solving process. Keller suggests that instructions should relate to concrete examples which are familiar to students and therefore create a meaningful context.

- Relevance is achieved with high-level application of knowledge, appreciating personal experiences and aims. According to Keller the learner must first recognize that given instructions has personal utility, i. e., will help them to achieve personal goals [6].
- Confidence is achieved with clear and challenging objectives. Tutor's guide can be equally necessary at the different levels so as to provide feedback. Confidence in learning can be achieved by giving students just enough attention and support [23] fostering student's autonomy and self-control in learning.
- Satisfaction is achieved by ensuring the students of the usefulness of knowledge acquired, and as the student's expectations and outcomes have been aligned.

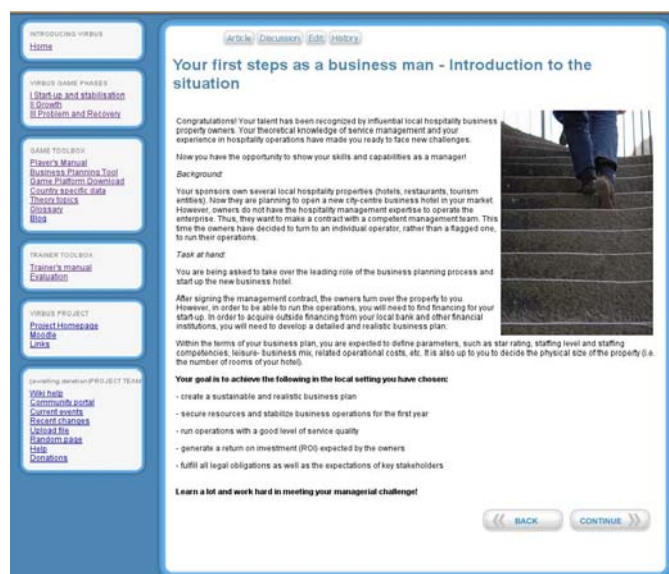


Figure 6: Student's motivation

VIRBUS engages students in simulative physical and social learning environment, which can be established in many organisational social modes, assisting students in the different needs.

VIRBUS simulation environment is designed by Mediawiki [26] and will be maintained and available for users by assistance of VIRBUS virtual community. VIRBUS includes: The Business Planning Tool in Microsoft Excel format; Country specific data from Finland, Slovenia, Germany and Estonia; Theory topic for planning, analysing and evaluation of business management; Hephaistos – Java-based generic simulation application; A glossary of concepts; VIRBUS community is a setting where teachers, students and other users of

VIRBUS simulation-game are able to develop their professional understanding and expertise in a relevant field. They form a virtual society of learning professionals in a process of learning deployment [14:623]. VIRBUS community provides opportunities for reflection, evaluation and exploration of new ideas. VIRBUS Evaluation instruments include questionnaires, for teachers and students (Figure 9).

VIRBUS assists many organisational social modes, which can be organised in a classroom or distributed (Figure 1):

- individual learning,
- small-group learning,
- multi-group learning.

The competition as a significant characteristic of game has in VIRBUS three major patterns: in the first phase player competes against virtual or dummy players, in the second phase player competes with other players in the virtual classroom and in the third phase player competes with players who are distributed globally in competing tourism destinations.

How VIRBUS is integrated into the course curriculum is up to the teachers and students, and depends on their respective conceptions of teaching and learning, as well as on a wider context, on the alignment of study aims, and teaching and learning methods with the assessment and interactions between the teachers and students. The possibilities for organizing group work are to be carefully considered and implemented within VIRBUS environment and in a context of the course [18].

How teachers use VIRBUS, depends on the course with its curriculum and intended learning objectives, on students with their characteristics, and on the teacher's teaching approach [21].

Accordingly, based on the Presage – Process – Product model of student learning by [21] and Biggs [2], the teaching and learning modes and methods are applied. Of major importance in the learning process is to connect students with their previous experiences of learning, prior knowledge, conceptions of learning and knowledge, approach to learning, to learning process and learning outcome.

1. Before the game or each phase of the game:
 - identifying student knowledge and understanding,
 - identifying student expectations,
 - identifying student readiness and interest for learning,
 - negotiating learning goals and their contextualisation within personal plans,

- negotiating transferable learning goals at the content and process levels.
2. During the game:
 - implementing learning conditions and learning methods which assist learning best,
 - evaluating learning outcomes during the learning process.
 3. After the game / each phase in the game:
 - reflection and evaluation,
 - integration of new knowledge, and understanding within a wider framework.

Teaching/learning methods, which best assist students, are interactive, experiential, peer-oriented, collaborative, and reflective.

Teacher's role and tutoring approaches are designed for each organisational mode and mode of delivery. Within organisational modes, teachers/trainers can plan various levels of tutor's support. Teacher/trainer can engage in the whole process, guiding the students through the game according to desired intensity. Students can play in a computer classroom synchronously or synchronously distributed.

Teacher/trainer guides and assists them during the lectures and tutorials with the assistance of web-tools providing the presentation, coaching, guidance and evaluation:

- introduction and implementation of VIRBUS in a course,
- forming groups and peer learning (to compare their outputs and products and to discuss the topics they engage in),
- assessment (diagnostic, formative and summative),
- evaluation (web-questionnaires and other methods).

Criteria in the decision-process, on how to apply the teacher's role, include the students' needs, students' knowledge, type of course, and availability of resources.

Assessment is one of the strongest motivators for learning. A student's perception of assessment – how students understand assessment requirements – impact on a student's learning. Assessment outcomes are resources for feedback on students' learning and knowledge. On this basis, the teacher may plan improvements in teaching and assisting students in their learning.

Quality assessment needs to be in line with the desired study outcomes and study contents. Characteristics of quality assessment are validity,

objectivity and reliability. In assessing a student's knowledge we aim at stimulating a student's deep approach to learning, as contrary to the surface approach to learning [21].

Characteristics of deep approach to learning include: student is learning so as to understand new knowledge and connect it to existing knowledge; student is learning and comparing new information, concepts and theories to the ones already known; student is focused on comprehension and meaning.

Characteristics of surface approach to learning include: student is trying to pass exams so as to comply with external demands; student is focused on memorising without deeper understanding; student is not making effort to connect to the already known. In making assessments of the desired outcomes this should be well kept in mind. If an assessment supports the surface learning, it cannot be supportive of deepened learning.

An assessment model is applied in VIRBUS for assessing generic competences, transferable skills and subject-specific competences. The intended competences are listed at the beginning of each phase.

For quality learning, assessment needs to be implemented within the entire learning process, starting at the beginning of the learning process (diagnostic assessment) with identification of existing knowledge (prior knowledge), continuing through the learning process (formative assessment) and evaluating the learning process and outcomes, and completing at the end of the learning process (summative assessment) with the final examination. In the VIRBUS model, specific focus is on the quiz-based formative assessment. The main aim of formative assessment is to facilitate a student's self-directed learning. And additionally, the students shall get feedback, not merely an evaluation of their learning outcomes [3, 24]. Formative assessment helps students to focus on learning and to establish readiness for learning, and enables the identification of a student's knowledge and understanding.

4 Need for educational change in higher education

4.1 Aim

VIRBUS can be applied in a variety of courses in vocational education, and in university undergraduate and postgraduate education, as well as in lifelong training courses. By promoting the internationalisation of education and training, VIRBUS facilitates quality learning experiences

within international environments with the assistance of real-life data from Finland, Slovenia, Germany and Estonia. Teachers can create learning environments depending on the learners' needs and learning conditions.

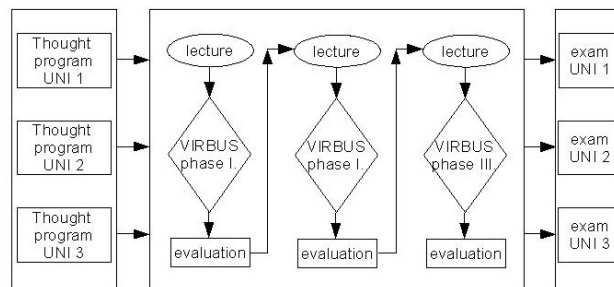


Figure 7: International collaboration

In Trainer's Manual (Figure 8), teachers are given the basic description of VIRBUS simulation regarding: aims, contents and student groups, and proposals on how to use VIRBUS in various ways so that the teacher has the opportunity to autonomously design his/her own teaching approach and to collaborate in a group of teachers. A precondition for quality teaching and learning is organizational culture that supports the facilitative/supporting role of the teacher and strengthens good relations between teachers and students [15].



Figure 8: Teaching arrangements are outlined in teacher's manual

Teachers can assist students when studying independently, or guide them within various teaching and learning methods. Teachers are further given ideas and instructions on how to apply their VIRBUS-assisted teaching in the different groups of students within international groups of teachers and how to form international groups of students. The

joint virtual environment fosters international collaboration of students and teachers in the frame of existing courses providing quality assurance guidance and instruments.

4.2 Quality assurance instruments research and development design and findings

Educational evaluation serves many needs at various levels of educational system, resulting in five major functions. They are related to decision-making, improvement, accountability, professionalism, and certification [19:443] of policy, programs and practices [17:4]. In a design process of instruments design a formative evaluation was conducted to improve ongoing activities [19:443] when instruments were finalised, the summative evaluation was used for accountability purposes [19:443].

Evaluation was conducted in order to assess the evaluation instruments for training courses conducted by VIRBUS. In formative evaluation, needs assessment was performed, relying on existing data sources and interviews. The actual design and implementation of instruments was conducted, using methods of examination of project documentation (minutes and observation of project meetings, reports) and managing game-based learning environment system across four countries and interviews. In summative evaluation, the impact evaluation was performed, using interviews.

Participants in evaluation were students, teachers, project group members and external experts across four countries. External experts from all four countries participated and were covering all the fields of expertise, as pedagogy, ICT, and tourism. Evaluation should not privilege one set of beliefs over others [25]. The evaluation process identified:

- who are the target groups of game-based simulation learning, to use evaluation instruments;
- what are the objectives of using instruments and, are they the same for all the user groups;
- how many instruments are to be implemented;
- how are instruments structured and, are they aligned with the applied learning theories: game-based simulation learning, e-learning, theories of higher education learning and adult education, constructivist conditions for learning.

Instruments were designed and developed in compliance with the methodology for the paper- and web-questionnaires, following the measure characteristics reliability and validity. Related work (see references) and other sources were used as basis in the design process. Instruments consist of numerical assessment scales and open questions. For quantitative statistical analysis, the web-questionnaire database is to be exported to SPSS or a similar statistical package.

Selected variables were connected to pedagogical theories applied in a game-based simulation learning environment (teaching and learning approaches in relation to intended study outcomes, methods, social modes, and modes of delivery used). Two instruments were developed and inserted into VIRBUS environment, one for teachers and trainers, and one for students. Both are structured as descriptive questions, content-specific questions focusing on intended learning outcomes, questions with the pedagogical approach in relation to the delivery mode, and questions as to technical solutions.



Figure 9: Evaluation instruments

5 Conclusion

Major changes in teaching and learning have been underway in higher education enabling students to learn and obtain experience within the international student and expert groups, at studying cases of real-life working practice from the different cultural environments around the globe.

In the European research project the simulation game-based virtual learning environment was developed. The aim of the learning environment is to provide an authentic learning environment to study hospitality and destination management for students and entrepreneurs in tourism and tourism related sectors. Simulation provided conditions for imitating real life business situations. Game

provided a physical and social learning space for students experiencing holistic learning integrating feelings and values. Students are able to combine diverse social modes when competing along different patterns with virtual players, and with fellow players in a virtual classroom and globally. VIRBUS aims at assisting students in acquiring competences which will enable them to autonomously involve in their professional fields at national, European and global tourism business environments. Instructional design of simulation game-based learning environment presented in a paper is designed for diverse learner groups in university education and lifelong learning, for hospitality, destination management and general business. According to contemporary need of international partnership among universities the model of planning and developing joint learning environments for international collaboration of students and teachers is presented. The model can be used autonomously and not depend on accreditation of joint courses or degrees providing quality assurance guidance and instruments. The methodology of quality assurance instruments design was addressing needs of higher educational courses in different national settings of Finland, Slovenia, Germany and Estonia.

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