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Xhevrie Mamaqi, Jesús Miguel and Pilar Olave	1257–1265	What Impact Does Training Have on Employment Stability?

As consequence of constant changes and rapid expiration of knowledge that occur at all levels of the current information society, the education, training and selection of a profession is not a single decision for life which ends accessing at the first job, but a continuous process too. People who are seeking education and training try to take advantage of maximum benefit of their formation. In this context the aim of this paper is to provide empirical evidence of the effects of continuous training on Employment Stability in the Spanish labor market. The dependent variable includes two situations of the active workers: continuous and discontinuous employability. To distinguish between them an Employability Index Stability was calculated taking into account two factors: employed time and job security. The data obtained from a survey of a nationwide sample of 918 employed individuals has been analysed through a binary logit model. The coefficients estimated have revealed a positive and significant relationship between the probability of employment stability and continuous vocational training received. The results obtained in this study showed that the whole process of education of people influences the career choices and work-life. So it is important to redefine the role of educators and trainers, and adapt new teaching-learning methods to promote awareness and capacity building and skills that enable workers to enter and stay in a new working environment conditioned by important changes in techniques of education and economic and social systems.

Keywords: continuous training; employment stability; Spanish labor market; binary logit model

Hesham A. Al-Twaijry, Mejahed C. Mekhallalati, Hamid R. Abachi and Ghulam Muhammad	1266–1273	A Rubrics Based Quality Improvement Methodology for ABET Accreditation
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Accreditation is one of the leading techniques used by academic institutions to ensure the delivery of quality educational programs. One of the leaders in providing technical accreditation is ABET. They provide a set of criteria that was developed by technical professionals to ensure the quality of the programs that are accredited. These criteria should be assessed by the institution applying for accreditation. ABET does not specify how the institution should demonstrate its adherence to its criteria. This paper presents an overall framework that uses rubrics that can be systematically applied in a short time frame. This methodology was applied by the computer engineering department at King Saud University. The methodology will highlight where the institution is able to meet the ABET criteria. It provides a set of remedy actions that could satisfy the expected outcomes.

Keywords: ABET; rubrics based methodology; student outcomes; learning objectives; continuous improvement

Santi Caballé	1274–1287	Evaluation and Validation of the Virtualization of Live Collaborative Learning Sessions
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On-line collaborative learning is a mature research field that benefits from collaborative activities, which can increase learning efficacy. However, collaborative learning approaches are still not beneficial in every e-learning experience because they require people's presence and collaboration is frequently difficult to achieve. It is remarkable that collaborative learning resources still suffer from endemic problems, such as the lack of authentic interactivity, user empowerment, social identity and challenge, thus having a negative effect in learner motivation and engagement. To overcome these and other limitations and deficiencies, in previous research, a new type of learning object named Collaborative Complex Learning Object (CC-LO) was proposed to support the virtualization of collaborative learning with the aim to leverage the knowledge elicited during live sessions. During the CC-LO execution, the collaborative sessions are animated so learners can observe how avatars discuss and collaborate, how discussion threads grow and how knowledge is been constructed, refined and consolidated. The system produced from this research was naively tested to validate the notion and nature of the CC-LO. In this paper we proceed with an exhaustive empirical study of the system in a real context of learning in order to validate the impact of CC-LOs on complex dimensions of the collaborative learning process. The research reported in this paper is currently undertaken within a FP7 European project called 'Adaptive Learning via Intuitive/Interactive, Collaborative and Emotional systems' (ALICE).

Keywords: on-line; collaborative learning; collaborative complex learning object; virtualized collaborative sessions

Eugenijus Kurilovas and Silvija Serikoviene 1288–1293 New TFN Based Method for Evaluating Quality and Reusability of Learning Objects

The aim of the paper is to present a new TFN (Triangular Fuzzy Numbers) based method for the expert evaluation of the quality and reusability of learning objects (LOs). This novel method consists of the consecutive application of Fuzzy numbers theory to establish the ratings (values) of the LO quality criteria, a new TFN based method to establish the weights of the LO quality criteria, and MCEQLS (Multiple Criteria Evaluation of the Learning Software) approach to create the LOs quality model and obtain the final evaluation results. Several practical examples of LOs alternatives have been practically evaluated against the proposed method. Research results have shown that the proposed TFN based method is quite objective, exact and easy to use while selecting qualitative reusable LOs alternatives in the market.

Keywords: triangular fuzzy numbers; learning objects; quality, expert evaluation; reusability; multiple criteria decision analysis

Igor Schagaev, Nebojsa Folic, Nicholas Ioannides and Elisabeth Bacon 1294–1300 Multiple Choice Answers Approach: Assessment with Penalty Function for Computer Science and Similar Disciplines

A new assessment technique, the Multiple Choice Answers Approach (MCAA) with several right and not mutually exclusive answers from a larger set of answers, is introduced. MCAA, even though is developed as an assessment technique, it also facilitates the formation of reliable coverage of subject curricula. The rigorous formation of assessment becomes an essential segment of curriculum design and development, follow-up of our previous papers. Levels of applicability are explained showing the practical effectiveness of the proposed approach. A trial application in a real module of computer science showed promising results. Schemes of student progress assessment are introduced including analysis of success and protection from guessing, using penalty functions. Schemes of further development and directions for further research are discussed.

Keywords: multiple choice answer approach; computer science; penalty function; curriculum design; curriculum development; theory of classification; formalisation

Laura Varela-Candamio and Maria Teresa Garcia-Álvarez 1301–1308 Analysis of Information and Communication Technologies in Higher Education: A Case Study of Business Degree

The aim of this study is to analyze the role of information and communication technologies (ICTs) in the development of new teaching methods that allow the acquisition of new skills by students. In the current context European High Education Area, developed with Bologna Declaration, higher education institutions must adapt to it by promoting innovative experiences in the teaching-learning processes, changes in teaching strategies of teachers and communication systems distribution of learning materials. It supposes a special emphasis in the learning where an approach based on an active and dynamic role of students is necessary. The development of educational software, with an appropriate teaching strategy, becomes an essential support in the formation of future graduates in Business degree in both classroom education and distance education. The final idea is to create an educational larger environment of general character with an easy access and the use of ICTs to promote student motivation.

Keywords: European high education area; information and communication technologies; teaching based on learning

Eugenijus Kurilovas and Inga Zilinskiene 1309–1315 Evaluation of Quality of Personalised Learning Scenarios: An Improved MCEQLS AHP Method

The aim of the paper is to investigate and present a comprehensive scientific model and a novel method of consecutive four steps application of Analytic Hierarchy Process (AHP) for the expert evaluation of the quality of learning scenarios. The paper pays a special attention to learning scenarios suitability to particular learner groups (i.e. learning styles). Solution of learning scenarios quality evaluation and optimisation problems could help educational institutions to select suitable learning scenarios for the particular learner groups. Several well-known scientific principles are applied to create a comprehensive quality model (criteria system) for evaluating learning scenarios. The research results will be implemented in iTEC—a four-year, pan-European research and development project focused on the design of the future classroom funded by EU 7FP. Several practical examples of iTEC learning scenarios have been evaluated against the proposed model and method. The research results have shown that a novel method of four steps application of AHP both for establishing weights and ratings (values) of the quality criteria is suitable to solve learning scenarios multiple criteria evaluation and optimisation tasks for particular learning styles.

Keywords: learning scenarios; Analytic Hierarchy Process; expert evaluation; multiple criteria decision analysis; optimisation methods; quality criteria; learning styles

Yves Wautelet and Manuel Kolp 1316–1325 e-SPM: An Online Software Project Management Game

Today's software development has become a complex task and no one has the required skills or time to solve a sophisticated problem on his own. Software development needs the involvement of different roles and people having to use concepts and ideas for which they need to share a common understanding. In such a context, several software development methodologies have appeared in the last thirty years. Those methodologies use different development life cycles, one of the most famous being the iterative one notably used by the Unified Process (UP) and agile methods. To teach software project managers and computer science students the required skills to deal with such development processes few approaches exist. Indeed, nowadays one mostly learns from ex-cathedra courses and books or on an empirical basis when involved into 'real life' projects. Both learning approaches have major flaws since 'theory-only' fails to highlight the practical dimension and empirical learning exposes the organization to damageable mistakes. e-SPM is an online multi-users game simulating the tasks of a software project manager facing user requirements, development planning, human resources allocation, budget constraints, risk and quality management within a UP/UML project in the steel industry. The originality of the game resides in its design based on the documentation and experience of previously performed real-life projects. The game mainly focuses on hard (technical) skills for project managers but also introduces random events showing to the player which soft skills are required in practice; it has been validated using the competencies framework of a business school.

Keywords: software project management; e-learning; unified process; game modeling

Constanta-Nicoleta Bodea, Maria-Iuliana Dascalu and Miltiadis D. Lytras 1326–1333 A Recommender Engine for Advanced Personalized Feedback in e-Learning Environments

The paper presents an educational recommender engine, which is fired by the feedback module of an e-assessment application for the project management domain. The recommendations consist in web pages related to the knowledge gaps of the students who took an e-test. The authors argue that using a recommender engine within the e-assessment would increase the formative values of the e-assessment, transforming it into an innovative educational instrument, which gives the students the opportunity to take control of their own learning and actively participate in the learning process. A short evaluation of the utility of the recommendations is also provided.

Keywords: educational recommender systems; personalized feedback; e-learning, e-assessment; project management

Web 2.0 tools have redefined the meaning of learning. Students do not need to learn in the same place at the same time, listening to a teacher. This paper explores an innovative educational use of wiki as a learning tool: during the week, outside the classroom, students have to read and investigate terms and concepts, publishing the wiki what they have learned and read and comment other classmates posts. In the classroom we work in little groups or collectively debate different points of view. A full quantitative and qualitative analysis of the outcomes of this case study is presented, as well as some recommendations to improve its use in future courses.

Keywords: wikis; flipped classroom; knowledge building; postgraduate education

Xi Zhang, Patricia Ordóñez de Pablos and Yixiang Zhang 1341–1346 The Relationship between Incentives, Explicit and Tacit Knowledge Contribution in Online Engineering Education Project

Knowledge contribution is a very important issue in online engineering education. This study investigates how to encourage knowledge contribution in a large Asia online engineering education project. Based on long-term empirical research, we found economic incentive is more critical to facilitate explicit knowledge contribution, while social incentive is more important in encouraging tacit knowledge contribution. Moreover, we also found incentives may have different effects due to students' individual difference, e.g., personal value. That is, economic incentive may have positive effect on some students, but none or negative to others. These findings provides some theoretical contributions on e-learning and knowledge management, and also provides some implications for choosing technology in online engineering education system, and designing incentive mechanism.

Keywords: incentives; explicit knowledge contribution; tacit knowledge contribution; online engineering education project

Marc Alier Forment, Nikolas Galanis, Maria Jose Casañ, Enric Mayol, Jordi Pigullim Poch, Francisco Garcia Peñalvo and Miguel Angel Conde 1347–1352 Didactical Patterns for the Usage of Wikis in Educational and Learning Activities

Wikis have been established as primary online tools for collaborating and for gathering, sharing and organizing knowledge. Wikipedia is an overwhelming proof of this. Introducing a wiki as a learning tool in a classroom poses as a very promising idea. This paper introduces a collection of didactical patterns for the usage of wikis in educational and learning activities that intended as guidelines in the learning design for successfully incorporating wikis in a virtual classroom.

Keywords: Wiki; education; e-learning; learning design

Ghada Al-Hudhud 1353–1359 Intelligent System Design Requirements for Personalizing e-Learning Systems: Applications of AI to Education

Personalized learning aims at recognizing learner's cognitive skills and learning preferences in the learning environment. Personalized learning offers flexibility in learning as blended learning. Modeling personalized learning involves identifying learners' styles and offering the learning options in any learning environment and associated learning management system (LMS) in use. In this context, learning management system design involves considering heterogeneous learners' capabilities and styles. In traditional classroom format, a teacher modifies content-related activities based on the various levels of learners' capabilities and learning preferences. However, due to the lack of adaptive interaction tools in the current LMSs, LMSs do not learn the users' learning styles whilst the teacher does. The work presented in this paper includes a study of producing design requirements for an intelligent learning shell to be implemented, with the learning technology in use, which adapts learners' learning styles. The study aims at recording the effective multi communications that are related to the curricular activities. Among these activities are: obtaining e-object, assessment, assignments, group projects. These activities were performed using modern approaches like peer-to-peer learning, cooperative work and filling in the knowledge gaps. The study introduces recommendations related to both learning styles that help in personalizing the LMS associated and the tools that employ these modern approaches. In this paper also there is a quantitative study outcome.

Keywords: blended learning; interaction with e-learning systems; adaptive LMS

Maria Pavlis-Korres 1360–1365 The Role of the Communication Tools in the Development of the Learning Group in an Online Environment

The use of the appropriate communication tools throughout the development of the learning group can improve interaction between the members of the learning community. Interaction lies in the heart of online learning experience as it affects directly the engagement of learners in the educational process and the quality of learning. Most of the existing Learning Management Systems offer a variety of communication tools, as e-mail, chat, forum, drop box, calendar, working groups, wikis, blogs, dictionaries, discussion board etc. all of which can be used in order to enhance group development. Matching the strengths of each specific tool to the learning objectives of each course at the right time results to the engagement of learners in the learning process and motivates them towards successful learning.

Keywords: group development; e-learning; communication tools; interaction

Athanasios S. Drigas and Rodi-Eleni Ioannidou 1366–1372 Artificial Intelligence in Special Education: A Decade Review

Artificial Intelligence (AI) technology has developed computer tools for carrying out a number of tasks, simulating the intelligent way of problem solving by humans. AI techniques have also been identified as one of the most valuable applications in the field of special educational needs (SEN). The goal of these tools is to enhance the way children interact with their environment to promote learning and to enrich their daily life. Due to the implicit characteristics of special educational needs, the diagnosis has been an issue of major importance. At the same time intervention strategies need to be highly individualized to be effective. In this report we introduce some of the most representative studies over the last decade (2001–2010), which use AI methods in making accurate diagnosis and prompt intervention action.

Keywords: artificial intelligence; special educational needs; diagnosis; intervention

Nicola Capuano, Giuseppina Rita Mangione, Anna Pierri and Saverio Salerno 1373–1379 Learning Goals Recommendation for Self Regulated Learning

In the knowledge society the ultimate goal of education is not only to make learners learn but mostly to grow a correct learning behaviour that creates the best conditions for them to reach learning goals in a controlled and directed way. In many cases, a lack of self-regulatory skills is the main obstacle to adequate regulation and a new class of learning tools, named metacognitive tools, is needed. In this work we present a novel solution for self-regulated learning that tries to solve this issue by recommending feasible learning goals covering explicit and implicit learning needs and by generating individualized learning experiences based on recommended goals.

Keywords: recommender systems; self regulated e-learning; intelligent tutoring systems

Roberto Sepúlveda Lima, Cornelio Yáñez Márquez, Itzamá López Yáñez and Oscar Camacho Nieto 1380–1387 A Novel Solution to the Secure Exchange of Environmental Engineering Education Data

The rise and evolution of the knowledge society has brought evident advantages for humans; however, at the same time, new risks and threats to the integrity of the information that flows constantly from one community to another have appeared too. This situation leaves at risk a very important aspect of contemporary life: knowledge transmission. Thus, the search for methods that enable secure information exchange has become a relevant topic of current scientific and engineering education research, which is closely related to the ethic values of modern society. In the current paper, a novel solution to the secure exchange of engineering education data, in the context of environmental pollution research at Mexico City, is presented.

Keywords: secure data exchange; environmental engineering education; data transmission

Xi Zhang, Patricia Ordóñez de Pablos and Heliang Zhu 1388–1392 The Impact of Second Life on Team Learning Outcomes from the Perspective of IT Capabilities

3D virtual world has been widely applied in e-learning project, as its several advantages like 3D avatar, rich communication channels. This study focuses on a case of famous virtual world (i.e., Second Life, SL) application in on-line engineering education project. Based on the theory of IT capabilities, we investigated how SL provides value for on-line team as improving their knowledge work outcome. The findings suggested that SL may influence team leaning from two levels. First, at individual level, SL generally positive related to the individual knowledge work, including coding language skills, and personal creativity. Second, at team level, SL positively influence the team learning, by providing rich social resources, social networks, and efficient team dynamics. However, SL also has some disadvantages which may disturb the team learning, like advertising information's, gambling, and sex. We suggest the project must provide some rules to limit students to access information's unrelated to class objectives.

Keywords: second life; team learning outcome; tacit knowledge; IT capabilities; digital options

Yulier Núñez Musa, Roberto Sepúlveda Lima, Sergio Cuenca Asensi, Itzamá López Yáñez and Luis Octavio López Leyva 1393–1398 A Non-Deterministic Self-Checking Mechanism to Enhance Tamper-Resistance in Engineering Education Software

Obfuscation and code encryption applied to ensure confidentiality achieve some degree of tamper resistance due to the complexity of the analysis required to break these protection schemes. However, there are very few proposals that combine high integrity and confidentiality levels at the same time. In the context of engineering education software, this article presents a new mechanism for increasing the software tamper resistance applications based on non-deterministic integrity self-checking network.

Keywords: software piracy; engineering education software; software tamper-resistance; integrity; confidentiality; integrity self-checking network.

Mario Aldape-Pérez, Cornelio Yáñez-Márquez, Oscar Camacho-Nieto and Amadeo J. Argüelles-Cruz 1399–1405 A New Tool for Engineering Education: Hepatitis Diagnosis using Associative Memories

Classification is one of the key issues in medical diagnosis. In this paper, a new tool for engineering education is presented: it is an automatic hepatitis diagnosis system based on associative memories. The characteristic of this approach is twofold: first, learning the fundamental set of associations in order to get an associative memory; second, computing a differential associative memory in order to get a threshold value for each unknown input pattern to be classified. Hepatitis disease dataset, taken from UCI machine learning repository, was used as medical dataset. Classification accuracy of the proposed approach is 82.67% and it was assessed using stratified 10 fold cross-validation. The correct diagnosis performance of the proposed approach is validated not only using classification accuracy, but also performing sensitivity and specificity analysis. The results presented in this paper demonstrate associative memories potential for automatic medical diagnosis systems.

Keywords: associative memories; engineering education; decision support systems; machine learning; pattern classification

