

# The International Journal of Engineering Education

## Contents

### Contributions in: Student Reasoning, Entrepreneurship, Innovation, Interdisciplinary Programs, Multidisciplinary Teams, Active Learning, Learning Styles, Teaching Practices, Outreach, Academia and Industry, Plagiarism Detection, Assessment, Design Process, Parallel Computing, Virtual Learning, Robotics, Digital Signal Processing, Wireless Programming, Radar and Radiolocalization, Chemical Engineering, Sociology

Ahmad Ibrahim

583 Editorial

Steven Zemke

584-597 Developing a Coding Framework to Analyze Student-to-Student Reasoning Based on Mental Models Theory

The use of active learning pedagogies, as well as research into their effectiveness, has increased greatly the past few decades. These pedagogies typically depend on student-to-student interactions to facilitate learning. Video recordings of student interactions provide excellent observational data from which to study the dynamics of these pedagogies in a naturalistic setting. However, these data are typically voluminous, include many potential features to follow, and as such make analysis difficult. One way to decrease the difficulty in analysis is to use a robust coding framework. This study develops such a coding framework using a well-established Mental Models theory of reasoning as a theoretical lens. Each element within the coding framework is analogous to an element in the mental models theory. This coding framework was applied to video recorded data of six student teams reviewing a peer team's prototype design in a classroom setting. The coding resulted in 567 transcription segments of which 68% related to the prototype review. All elements of the mental models theory are evident and code-able in the data and the general structure of the verbalized reasoning is identified. A rich description of the verbalized reasoning is provided. Furthermore, this reasoning structure appears constant across changes in student engagement and interaction purposes. As such, the identified structure of student reasoning, based on the mental models theory, provides a robust coding framework.

**Keywords:** mental models; coding framework; student reasoning

Qu Jin, Shannon K. Gilmartin,  
Helen L. Chen, Sara K. Johnson,  
Michelle B. Weiner, Richard M. Lerner  
and Sheri Sheppard

598-613 Entrepreneurial Career Choice and Characteristics of Engineering and Business Students

This paper measures the entrepreneurial intent and related characteristics of engineering undergraduates, as compared with business students. The purpose of this study is to describe and test the difference on entrepreneurial intent and related characteristics for engineering and business students with different career goals for both genders. Data were collected through the Young Entrepreneurs Study (YES) survey, which included 518 engineering and 471 business undergraduates from multiple institutions. Analysis of Variance with Tukey-Kramer tests and independent samples t-tests with Bonferroni corrections were conducted to test for differences across groups. The results showed that starters (participants who stated starting an organization as their career goal) reported significantly higher scores than did joiners (participants who stated joining an organization as their career goal) in several entrepreneurship-related characteristics. Although business students were more likely to cite entrepreneurship as their career goal than were engineering students, engineering and business students who had the same career goals showed similar characteristics that were related to entrepreneurial intent. Women and men starters, regardless of discipline, have similar entrepreneurship-related characteristics; however, business men have higher entrepreneurial intent than do engineering women. With similar entrepreneurship-related characteristics among engineering and business starters, entrepreneurial courses and programs for engineering and business starters could be structured similarly. Perhaps these courses could be multidisciplinary, serving both engineering and business starters, although engineering students in these types of courses should be encouraged to have more confidence in communicating their ideas. Curricula might be designed such that some groups, such as engineering women, with less salient intentions, could easily access resources and tools to develop their ideas.

**Keywords:** entrepreneurship; innovation; gender

Adrian Holzer, Isabelle Vonèche Cardia,  
Samuel Bendahan, Alexis Berne, Luca  
Bragazza, Antonin Danalet, Ambrogio  
Fasoli, Jérôme N. Feige, Denis Gillet,  
Siara Isaac, Ingrid Le Duc, Delphine  
Preissmann and Roland Tormey

614-624 Increasing the Perspectives of Engineering Undergraduates on Societal Issues through an Interdisciplinary Program

To tackle the challenges of the 21st century, future scientists and engineers have to understand the interplay between societal challenges and technical solutions as early as possible in their education. They also have to develop the communication and the teamwork skills required to be effective professionals. To address this issue, the Ecole Polytechnique Fédérale de Lausanne (EPFL) introduced a new Global Issues program to all 1800 first year engineering students. In this paper, we present this novel program and reflect on our experience. Our results suggest that student who showed positive attitude towards teamwork, benefited the most from the course and increase their perspectives on societal issues as measured by their moral reasoning after the course.

**Keywords:** engineering education; soft skills; global issues; interdisciplinary approach; teamwork; communication; climate; food; energy; health; mobility

Capstone courses are commonly employed in engineering curricula to prepare students for professional practice through a culminating design experience. A project-based experiential approach is typically employed, which gives rise to various issues concerning the methods and factors involved with the creation of effective student teams. This paper presents a unique methodology for assignment of students to multidisciplinary capstone projects and teams. The methodology described involves compilation and mapping of student interests, knowledge and capabilities needed to fulfill project requirements. In addition to describing the mapping process, data collected on 679 students over four semesters is used to explore the factors that have an impact on team effectiveness. These factors include academic performance, practical engineering experience, career interests, project preferences, personality, and technical skills.

**Keywords:** capstone design; team selection; multidisciplinary; project-based learning

**Nilanjan Raghunath and Timothy Li**

640–653 Unlearning Anxieties of the Unfamiliar: Teaching Advanced Sociological Topics to Engineering Students

Learning new concepts outside one's domain can be challenging due to the complexity of the content, the method of delivery, and the assessment process. However, learning new concepts is a necessary part of education and individual growth. This paper outlines this challenge in the context of undergraduate and engineering students taking a sociology course entitled, "Who Gets Ahead: Sociology of Social Networks and Social Capital". We review some of the existing literature focused around teaching new concepts to unfamiliar students, as well as discuss some of the literature around teaching the topic of sociology to engineering students. Finally we will describe our approach taken to teach a sociology course to engineers, as well as some of the observations taken during the course. The outcome of the course showed that many of the student's concerns of the course's requirements stay the same from the beginning to the end, however their perceptions of sociology change to a highly positive one when they are able to apply theories and concepts to real-life examples such as their internships or interpersonal relationships and concrete empirical studies. The challenge is to get them to consider multiple interpretations of social phenomena, as there is a tendency to look for one right answer. Eventually, the success of any sociological course is on how these concerns can be met through innovative teaching methods.

**Keywords:** sociology; concepts; engineering; education; interdisciplinary; pedagogy

**Baba Abdul, Olusola O. Adesope, David B. Thiessen and Bernard J. Van Wie**

654–669 Comparing the Effects of Two Active Learning Approaches

Theoretical and empirical studies suggest that learning is enhanced when instructors use pedagogical strategies that present information in multiple formats, and that such strategies engender more student engagement than passive lecture. Multimedia learning including multimedia-enhanced lecture (multimedia) and hands-on interactive group learning (hands-on) are two of such strategies that are believed to be more engaging than passive lecture. This paper describes a study in which hands-on with elements of other multimedia (or multimedia hands-on) and multimedia are compared. In a within-subjects experimental design, two groups (N = 19 in each group; hands-on and multimedia), alternated between being the control and treatment for either of two topics. Concept tests and worksheets were used to assess cognitive learning, and surveys for affective outcomes. The majority of participants agree that hands-on is more realistic and facilitates better cognition, professional preparedness, and acquisition of real-world experiences than multimedia. Surveys reveal high effect sizes in favor of hands-on. However, cognitive assessment scores did not produce any statistically significant differences between the two groups. No deleterious effects were perceived from hands-on and student comments suggest that it may be more beneficial than multimedia in terms of solidifying schema (longer term retention) and providing other benefits of competency-based education such as group skills, engaging learning and realism.

**Keywords:** student engagement; multimedia-enhanced lecture; hands-on learning; active learning

**Eutiquio Gallego, Virginia Díaz Barcos, Eva Cristina Correa Hernando, Elvira Sánchez Espinosa and Antonio Callejo Ramos**

670–681 Influence of the Perceived Workload of Students on the Academic Performance Rates

The new programs of studies developed according to the European Higher Education Systems are students—centered. In this sense, it is critical to properly set the workload a student must dedicate in order to reach the learning outcomes defined for each subject. This paper analyses the perception of students with regards to the difficulty and workload employed by them in the first course of two new degrees implemented at Technical University of Madrid (TUM). Several questionnaires were developed to gather the information required, which contained questions about the difficulty perceived or the time spent, among others. The total number of students that took part in the surveys ranged from 54 to 63, depending on the four months of the semester considered (February, March, April and May). In addition, statistical analyses were conducted to check the influence of the perceived difficulty and workload on the academic performance rates. A Principal Component Analysis (PCA) and a subsequent Hierarchical Ascendant Classification (HAC) were also accomplished to obtain the clusters representing the subjects considered in this work. The students usually perceive a higher difficulty in the study of the subjects than expected prior to their enrollment in University. Those subjects perceived by students to be the most difficult ones tend to show lower Efficiency and Success Rates. In addition, the students tend to abandon the study of any subject when they consider it is a difficult one. The results of this study suggest the difficulties found by students during their first academic course in University.

**Keywords:** innovation in education; ECTS; workload; learning outcomes; academic performance rates

**Agnieszka Szewczyk-Zakrzewska and Stanislav Avsec**

682–694 Predicting Academic Success and Creative Ability in Freshman Chemical Engineering Students: A Learning Styles Perspective

The purpose of the paper is to investigate the predictive validity of learning styles on academic achievement and creativity gain. For this purpose, freshman chemical engineering students from Cracow University of Technology were recruited (n = 100). An experimental research design was used in this study where 49 freshman students were enrolled in a two-day creativity training course while 51 students were enrolled in traditional Humanities course. To measure creative ability the Test of Creative Thinking-Drawing Production was used as pre- and post test. Students also completed a dynamic learning style inventory that measured learning orientation, processing information, thinking, perceiving information, physical and time learning preferences, sociological, emotional and environmental preferences of learning. Student performance was measured with grade point average (GPA) and normalized creativity gain (CG). Results show that 74% of the variance in GPA and 63% of the variance in CG can be explained by learning style predictors. Global and cluster thinking are the best positive correlated predictors in GPA while a need for authority figure and intuitive perceiving information are the best negative correlated predictors in GPA. Nonconformist and self-motivation are the best positive predictors in CG while a need for structure and sequential thinking are the best negative correlated predictors in CG. The practical implications are that engineering universities should collect learning style data on students at the outset and then help students accordingly to be more successful and creative. Highly concrete sequential learners and visual theorist who are organized and self-motivated might potentially be offered more challenging honours programs with corresponding special commendations on their projects and thesis, whereas students who are more intuitive, other-motivated would receive more structure through student study groups, frequent deadlines, shorter assignments, and clearly defined learning goals for passing examinations. Active global learners need more space for acting, demanding training objectives, and more nonconventional learning objects for exploiting their creative ability.

**Keywords:** academic success; creativity gain; chemical engineering; learning styles; predictive validity

**David B. Knight, Ian T. Cameron, Roger G. Hadgraft and Carl Reidsema** 695–711 The Influence of External Forces, Institutional Forces, and Academics' Characteristics on the Adoption of Positive Teaching Practices across Australian Undergraduate Engineering

This study investigates how academics' personal beliefs, perspectives on institutional forces, and perspectives on external influences relate to their teaching and learning decision-making.

Using a national-level survey of Australian engineering academics (n = 591; 16% of Australia's engineering academics), analyses investigate (1) how influences external and internal to the university environment vary across characteristics of academics, and (2) how academics' characteristics, organizational features, and external drivers relate to issues informing academics' teaching and their actual teaching practices. External and internal influences differed across academics based on their individual characteristics and university contexts, and academics' individual characteristics explained the greatest variability in their teaching considerations and practices. For external influences (e.g., accreditation), promoting awareness of educational goals for undergraduate engineering—as opposed to forcing outcomes into course planning—relates to more desirable teaching and learning practices. No internal institutional policy driver related to teaching practice variables. This study points to informed, professional development that seeks to capitalize on academics' personal interests and characteristics and assists in helping them understand how curricula and outcomes may better align to help student learning. Findings support working from a bottom-up model of change to improve the teaching and learning culture within engineering programs.

**Keywords:** teaching and learning; change; organizational influences

**Lorenzo Salas-Morera, María A. Cejas-Molina, José L. Olivares-Olmedilla, María S. Climent-Bellido and Laura García-Hernández** 712–725 Preparing Students for Success in Engineering Degrees: A Combined Strategy Between High School and University

A combined strategy for improving students' recruitment, academic performance and retention rate during the last year of high school and the first year of engineering programs, including Mechanical Engineering, Electrical Engineering, Industrial Electronics Engineering and Software Engineering, was conducted in collaboration with high-school teachers, university teachers, and peer-mentors. The entire working group included four high-school teachers, eight university teachers, four third-year university students, and sixty six last-year high-school students. During the first year of the experience, the working group analyzed the main weaknesses of the students in terms of knowledge and skills needed for their entrance to engineering degrees. Specific activities were designed and put into practice. During the second year, a mentoring and peer-mentoring strategy was established with the goal of giving students better information and advising about university services and resources as well as about the subjects of and strategies for studying. With this two-year combined strategy, the academic performance of freshmen was substantially improved, with significant differences in comparison with the students who did not participate in the project.

**Keywords:** outreach activities; peer-mentoring; tutoring; students retention; academic performance

**Peter D. Conradie, Cesar Vandavelde, Jolien De ville and Jelle Saldien** 726–737 Prototyping Tangible User Interfaces: Case Study of the Collaboration between Academia and Industry

Paradigms such User Experience (UX) based design approaches, along with the rise of Tangible User Interfaces, can present hurdles for traditional product manufacturers. Industry collaboration with university potentially allows exploration with such emerging themes, while students are exposed to design challenges from industry. In this paper, we discuss a course, Mechatronic Product Design, where students create Tangible User Interfaces (TUIs) in close collaboration with industry. An interdisciplinary design method is described with an emphasis on iterative prototyping—within a project-based learning approach. This includes the importance of (1) a network of industry, (2) a design method using project roadmaps and, (3) the availability of tools and platforms in an exploratory lab environment. Close collaboration between industry and academia made it possible to implement this approach with a total of 77 design cases. Students worked on realistic open-ended design problems using an iterative design approach, while working in multidisciplinary teams. Companies, in turn, are able to explore new ideas at low risk. We found our approach successful, with design cases that lead to novel research, technologies and commercial products. Four specific cases are presented in more detail, while the general insights and guidelines can be used to improve future development of TUIs.

**Keywords:** tangible user interfaces; project-based-learning; methodology; embodied interaction

**Marko Mišić, Živojin Šuštran and Jelica Protić** 738–748 A Comparison of Software Tools for Plagiarism Detection in Programming Assignments

Computing education usually involves intensive practical training through laboratory exercises, programming projects, and homework assignments. Those assignments are frequent targets for plagiarism. In this paper, we discuss social and educational aspects of the source code plagiarism in academic environment, and present an overview of software tools for source code similarity detection. We present our experiences with JPlag, Moss, and SPD tools, and compare them using simulated plagiarism based on programming assignment solutions produced after 1, 2, 4, and 8 hours of work on baseline version using more than 20 types of lexical and structural modifications that students use to hide plagiarism. We also compare results of the selected tools used on real-life student programming solutions from three different courses. The courses were attended by 100 to 300 students, and the programming assignment solutions varied in size and complexity from 50 to 1000 lines of source code. The results show that 5–10% of students plagiarized their solutions. In our experience, JPlag and Moss proved to be effective tools for plagiarism detection, as they clearly indicated cases of similarity which were manually confirmed by human code inspection.

**Keywords:** code similarity detection; JPlag; Moss; plagiarism detection; software tools comparison

**Pedro Company, Jeffrey Otey, Manuel Contero, Maria-Jesus Agost and Arnau Almiñana** 749–761 Implementation of Adaptable Rubrics for CAD Model Quality Formative Assessment

Evaluation rubrics are helpful as formative tools to convey quality criteria from the beginning of the training period of future mechanical CAD users. But rubrics should provide feedback and evolve dynamically to adapt to different learning paces. Computer-Assisted Assessment (CAA) tools can easily provide automatic feedback, although they are sometimes linked to general purpose educational tools, which may be complicated, costly and non-customizable, thus preventing teachers from adopting them. Hence, our main concern is finding CAA tools easy-to-use and compatible with adaptable rubrics. In this paper, a prototype of a spreadsheet-based adaptable rubric is designed and tested in three experiments, which involved until 43 mechanical engineering degree students. Results are analyzed to conclude that spreadsheet forms are unpractical, as its implementation requires expertise in spreadsheet programming, and extracting information from the spreadsheet-rubrics is time consuming. But the main conclusion from this proof of concept is that adaptable rubrics can be implemented, and allow students to evolve at different pace. Rubrics structured around different dimensions which are progressively developed in increasing levels of detail can be efficiently implemented as adaptable rubrics, by simply folding the low level details and allowing the user to freely unfold them under request.

**Keywords:** CAD model quality; formative assessment; adaptable rubrics; spreadsheets

The objective of this study was to investigate whether the use of computer-generated aids facilitates a greater variety of concept embodiments compared to the classical approach. A total of 60 participants were enrolled in the Design Methodology course. They were divided into a control group using the classical approach and an experimental group in which computer-generated aids were employed. The embodiments produced by the participants from both groups were assessed for variety, independently by two experts having both academic and industrial experience in the field of product development. The experts were not informed about the groups or any of the study details. Analysis of the results of this experiment indicates that computer-generated aids play a supportive role in concept embodiment.

**Keywords:** conceptual design; design process; product development; innovation; creativity

The need to promote parallel computing concepts is an important issue due to a rapid advance in multi-core architectures. This paper reports experiences in teaching parallel computing concepts to computer and software engineering undergraduates. By taking a practical approach in delivering the material, students are shown to grasp the essential concepts in an effective way. This has been demonstrated by implementing small projects during the course, such as computing the sum of the terms of a geometric series using pipelines, solving linear systems by parallel iterative methods, and computing Mandelbrot set (fractal). This study shows that, it is useful to provide real-life analogies to facilitate general understanding and to motivate students in their studies as early as possible via small project implementations. The paper also describes an overall approach used to develop students' parallel computing skills and provides examples of the analogies employed in conjunction with the approach described. This approach is also assessed by collecting questionnaires and learning outcome surveys.

**Keywords:** parallel computing; message-passing interface; speed-up factor; Flynn's taxonomy

Based on the Science Technology and Society (STS) teaching framework, a ubiquitous situated learning system was developed in this study using emerging man-machine interaction technologies, such as iBeacon and Quick Response codes (QR code), to teach the science, technology and society aspects of smart green buildings. After the teaching experiment, statistical analyses were conducted to explore the connections among the subjects' sex, prior knowledge levels, quiz scores, time spent in completing the quiz, confidence in their knowledge about smart green buildings, perceived usefulness of the system, and learning interest. The subjects in this study were 35 junior students of a department of architectural design at a university in Taiwan. Twenty-six of them were male and 9 female. According to the analysis of the results, the use of the system could help to significantly improve the students' learning results regardless of the differences in their prior knowledge levels. In addition, the interactive learning provided by the system was accepted by the students and it could help the students to effectively improve their test scores, knowledge confidence and learning interest.

**Keywords:** ubiquitous learning; iBeacon; science technology and society (STS); mobile learning; intelligent green building

Evaluation of virtual learning environments and integrated services provides valuable feedback to educators how to improve the quality of education and the provided services. Virtual laboratories are complex learning environments that include diverse hardware and software components. Due to the inherent complexity of these environments, their maintenance is a challenging and demanding task, but most often neglected. This article presents an approach to integration and qualitative evaluation of software change request services within a complex virtual learning environment based on a virtual network laboratory. The services were integrated with the aim to facilitate software maintenance activities in the learning environment. The evaluation of the services was conducted with the goal to discover their advantages, disadvantages, and based on them possible improvements. Based on the proposed research objective, qualitative research methods were selected. The evaluation was based on input from 22 final year undergraduates and nine graduate students at the Department of Information Technology. The collected data include participants' answers to open-ended questionnaire questions and field notes taken by the researchers. The detailed description of advantages provides the evidence of the services' usability, while discovered disadvantages form the basis for directing further improvements of the services and the learning environment. The detailed description of the research context, used methods, research process, as well as the research findings provides a guideline for conducting similar researches aimed at evaluating various types of services in learning environments.

**Keywords:** virtual learning environment; virtual network laboratory; software change request; software maintenance; qualitative evaluation

The purpose of the paper is to investigate whether a technology-intensive open learning that promotes constructivist approach has a significant effect on the student satisfaction, cognitive load, and psychomotor difficulty of the robotics course. A technology-intensive course must address the following outcomes: demonstrate a sound understanding of several technology concepts, systems, and operations, use a variety of technologies to access, evaluate, collect, and manage data, information, and datasets, understand the impact of technology on themselves and their culture, environment, and society, and practice legal and ethical behavior in the context of technology. For this purpose, four cohorts of middle school students were recruited ( $n = 267$ ). Two consecutive robotics-enhanced Summer School 2012 and Summer School 2013 were organized with experiential learning cycle followed by two consecutive performance of open learning of robotics at Technology Days, performed in 2014 and in 2015, using inquiry-based learning method in real-classroom settings. Open learning of robotics refers to minimal constraints on access, pace and method of study where direct manipulation environments are used very often to increase student success. Technology Days as compulsory part of curriculum are aimed to develop positive attitude towards technology and to advance technological literacy using mostly inductive strategies and approaches to learning. Multivariate analysis of covariance and regression analysis were performed to determine the contribution of predictor variables to students' cognitive, emotional and behavioural course outcomes as the important outcomes that influence a success of instructional intervention and the decision to continue or drop-out of a course. The results showed that composite variable of learning environment was a good predictor of student satisfaction and psychomotor easiness; learning material improves processing fluency; self-efficacy predicts satisfaction while self-regulated learning enables psychomotor easiness. Surprisingly, interactions among students and content did not significantly contribute to the predication of student satisfaction, nor to perceived course easiness. Additionally, experiential learning facilitates cognitive processing fluency, considering joint effects with variable of sex seemed to have influence on student satisfaction. The results of the study suggest to influence students' motivation and goals by adapting instruction accordingly.

**Keywords:** robotics; constructivism; student attitude; satisfaction; cognitive load; psychomotor difficulty

Resources in the robotics field are limited for a common user to access and demand deep knowledge of robot programming paradigm, so it is not often possible for students to become familiar in a practical manner with the programming and control of complex robotic systems. The aim of this new approach is to get high school students interested in the programming and control of robotic manipulators and to teach senior year students how to program control algorithms and to control complex robotic systems by using remote access to the robotic laboratory and a programming method that does not require deep knowledge of robot programming language. Additionally, the objective is to accomplish this aim by using widespread and inexpensive devices such as smartphones and tablets. To achieve these objectives, we have developed Robotics First—an Android OS (operating system)—based environment for simulation and remote control of robotic manipulators using mobile devices. The efficacy of Robotics First was evaluated from the point of view of 64 electrical engineering students, concerning its usability and usefulness.

**Keywords:** education; mobile learning; robotics; smartphone

**Jon Zarrajería and Begoña García Zapirain**

830–840 Using Actual Cases of Pathological Speech Improvement to Teach Digital Signal Processing

This paper introduces a software developed using MATLAB to help undergraduates gain a deeper understanding of the theoretical concepts of digital signal processing they learn in the class. The tool, ESO-Lab, demonstrates important theoretical concepts, such as filter model, windowing, signal modification, poles and zeros, and post-processing filtering, as they apply to real cases of pathological speech improvement. The tool was used by the students to conduct several laboratory exercises. Its impact on students' satisfaction was assessed through a survey in which 16 students participated. The approach seems to lead to satisfactory results in terms of learning and student motivation.

**Keywords:** MATLAB; project-based learning; digital signal processing; oesophageal speech

**Petre Ogrutan, Florin Sandu and Carmen Gerigan**

841–848 Using Students Own Mobile Phones in Teaching Wireless Programming Techniques Laboratory

This paper presents laboratory setups that were developed to familiarize students with the use of the AT command set which is a command language having a series of short text strings, that control operations such as hanging up, dialing and changing connection parameters for modems. The laboratory exercise focuses on applying programming techniques to wireless modules such as GPRS, Bluetooth, and ZigBee. To meet the objective of increased attractiveness, laboratory activities were designed to encourage students to use their own mobile phones for receiving SMS, making calls or data transfers - controlled by the AT commands. An impact study was carried out between 2009 and 2015 and involved a total of 149 students. The benefits of the new approach were assessed using questionnaires based on the Likert scale. An important expected educational profit was the increased acceptance of optional project modules in wireless interfacing.

**Keywords:** AT commands; mobile phones; student satisfaction; project based learning

**Yuri Álvarez López**

849–865 Innovative Approach to Teaching Radar and Radiolocalization Course

This contribution describes a set of actions devoted to increase the interest of the students on radar and radiolocalization-related courses, as well as covering the learning outcomes and competences defined for the course. After introducing the context of the radar course within a 5-year engineering degree, the course syllabus is detailed, focusing on the laboratory projects to be developed by the students, and proposed in the context of a teaching innovation project. Quality assessment mechanisms are defined to verify the effectiveness of the adopted actions. Besides, the transition to the new 4-year EHEA-like engineering degree (plus a 2-year master degree) is discussed, comparing the radar course in both degrees and the students' results. Although the course structure is conceived for a number of 15–20 students, this number was surpassed in some of the analyzed academic years, thus requiring an analysis of the problems derived from this situation. A brief description of radar courses taught at other higher education institutions is also provided in order to better put into context the proposed teaching innovation actions.

**Keywords:** radar course; teaching innovation action; laboratory project; quality assessment

866–867 Book Review

868 Guide for Authors