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Desarrollo de una herramienta de software como soporte a pruebas de egreso de la licenciatura

Development of a Software Tool as Support for Graduation Test

Desenvolvimento de uma ferramenta de software para apoiar testes de saída de graduação

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Resumen

Como una estrategia de apoyo para el fortalecimiento de los conocimientos previos al examen general de egreso de la licenciatura, y como un medio de entrenamiento para la prueba, se desarrolló una herramienta de autoevaluación por computadora que considera los tipos de reactivos propuestos en la prueba EGEL. Se siguió la metodología orientada a objetos de James Rumbaugh para el desarrollo del software; también, se analizaron trabajos previos que evalúan conocimientos a través de herramientas informáticas, y se realizaron diversas pruebas con usuarios que permiten evaluar la funcionalidad y mejora futura de la herramienta propuesta. Los resultados de la utilización de la herramienta muestran las áreas del EGEL con mayores fortalezas y debilidades.

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Palabras claves: autoevaluación, desarrollo, EGEL, evaluación, metodología.

Abstract

As a support strategy for strengthening the knowledge prior to the general graduation exam, and as a means of training for the test, a computer self-assessment tool was developed that considers the types of reagents proposed in the EGEL test. A methodology was followed for the research project and software development; also, previous work evaluating knowledge through computer tools was analyzed, and several previous tests were carried out with users that allow the functionality and future improvement of the proposed tool.

Keywords: self-evaluation, development, EGEL, evaluation, methodology.

Resumo

Como estratégia de suporte para fortalecer o conhecimento antes do exame de saída geral do diploma e, como meio de treinamento para o teste, uma ferramenta de auto-avaliação foi desenvolvida por computador que considera os tipos de reagentes propostos no teste EGEL. A metodologia orientada para o objeto de James Rumbaugh foi seguida para desenvolvimento de software; Além disso, foram analisados os trabalhos anteriores que avaliam o conhecimento através de ferramentas de computador, e vários testes foram realizados com usuários que permitem avaliar a funcionalidade e a melhoria futura da ferramenta proposta. Os resultados do uso da ferramenta mostram as áreas do EGEL com maiores forças e fraquezas.

Palavras-chave: auto-avaliação, desenvolvimento, EGEL, avaliação, metodologia.

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Introduction

The knowledge acquired in any course, training or education is the result of what was really understood and mastered; This can be seen today not only in schools of any level, but also in the companies that arise every day. The knowledge and skills that are acquired can be evaluated through an instrument or tool, and with them measure the degree that is possessed of them. In this sense, some organizations or companies apply exams to assess knowledge, skills and even skills that are required for a particular job or to assess the knowledge acquired at the end of a professional training. Some ways of evaluating or self-assessing knowledge is through self-training software or computer evaluation software; These allow to evaluate or simulate a certain test, providing the results of the test in less time or feedback immediately.

One of the means to evaluate the quality of education in secondary and higher education institutions is the national entrance or exit tests. These tests are designed by organizations with wide recognition such as the case of the National Evaluation Center for Higher Education (CENEVAL). At the undergraduate level, one of the instruments of national recognition is the so-called general exit examination of the degree or EGEL; This instrument allows to identify if the graduates of a degree have the knowledge and skills for their professional practice. The results of outstanding or sufficient testimonies are considered indicators that are required as a means to access various resources that will help improve educational programs and the institution itself (Barrera Cámara, Herrera Sánchez, et al., 2016). That is why for some institutions the application of this test is mandatory. However, the results obtained in recent years are not very encouraging, since a large number of the supporters do not prove the test. Some of the approaches that can originate these results can be the complexity with which the supporters perceive the test, the lack of preliminary preparation, as well as the scarce suggested bibliography (Cámara, Sáenz and Pérez, 2016). The information presented in the guides is very general, the terminology is not understandable, there is not enough documentary material that serves as a means of reading or, well, that simulates the test or self-assessment tools or training prior to the actual test. On the other hand, one of the goals of the graduates of the Faculty of Information Sciences of the Autonomous University of Carmen is to prove the EGEL test, and thereby obtain their

professional degree; However, the preparation resources that the graduates have before the test is limited initially to the sustainability guide that corresponds to their profile and to the personal experiences of other supporters. The guide is available electronically in portable files on the CENEVAL website, and it shows the possible scenarios, types of reagents, areas and subareas, percentage by area and criteria for obtaining the testimony.

That is why, and derived from the problem posed by the institution and the applicant to obtain a favorable performance in the EGEL, which aims to support the student with a technological resource to prepare better and increase the chance of crediting the exam. The proposed resource is a computer software tool that will serve as a support to self-assess your skills and knowledge, receive feedback on the areas and topics that you should strengthen, increase your confidence and decrease the fear of testing. Some situations are: is the development of a customized software tool feasible? Does the evaluation by computer serve as a self-assessment tool?

Analyzed works

There are several areas where computer evaluation systems are applied, and some of these works are addressed below.

In the work of Mas and Lacosta (2001) an evaluation system is designed, which randomly assigns a series of problems stored in a database, which has been previously generated by the teacher. Problems present some difficulty and must be resolved in a certain period of time; at the end the students can consult the answers, since it is a system that allows the self-evaluation.

To streamline the design, update written assessments for the C # course, a software tool was developed that is applied progressively. This tool allows for monitoring, feedback and supports student learning (Corbalán, Delía, Cáseres y Hasperué, 2012).

The Universidad Veracruzana developed a self-assessment software to prepare the students that will support the Entrance Examination (AEXI), whose purpose is for students to have a tool that supports their study for the entrance exam to the Universidad Veracruzana. At the end of the exam, you can consult the results, review the questions, successes, errors; and compare with the results of students who aspire to enter the same career and in the same area (Casas Blanco, López Guerra and Rodríguez Hernández, 2013).

SECOMTEM (Ochoa Cabarcas and Dilbert ward, 2005) is a tool developed by Rafael Núñez University Corporation with the purpose of evaluating the administrative and teaching staff of all the faculties. The test evaluates basic technological competencies such as Office, Information Technology, Database and Internet. At the end, the system generates a report with qualifications and suggestions for the evaluated.

Web Daypo (García-García, Ruiz de Azcárate Varela and Casado Sánchez, 2012) allows the construction, testing, access, printing and free storage of various tests on the web. In addition, it allows to visualize the results, as the test is solved, obtaining the response time, the faults and percentages of each test.

SICODEX or Computerized Examination System is a software developed by the Autonomous University of Baja California, which takes advantage of the institution's infrastructure and the computer evaluation system. This allowed to administer the results of the tests applied in pencil and paper of the Exam of Skills and basic knowledge or EXHCOBA, and the creation of three centers of evaluation by computer to apply of constant form examinations to the aspirings to the university (Escudero, Morales, Ramírez, Reyna y Ariza, 2002).

In the work of Valenzuela Mendoza, López Sánchez and Arias Hurtado (2013), the use of the question module of the online learning system of the State University of Sonora is proposed, to be used as a means of training for the students that will sustain the EGEL-ISOFT test.

The institutional work allowed the University of Granada in Spain, Technological Institute of Chihuahua II and the Autonomous University of Chihuahua in Mexico to develop a friendly software that provides feedback to users, to practice and evaluate basic mathematical operations (Ornelas Contreras, Blanco Vega , Gastélum Cuadras and Muñoz Beltrán, 2013).

For the University of Salamanca (Rodríguez Conde, 2005), the incorporation and use of information technologies in the learning and evaluation process represents an element that makes a difference in the evaluation activities for the European education area.

In Peru (Ortiz and Abel, 2010), a software was developed that evaluates the performance in terms of competencies of any person in an organization or school; this evaluation is made based on the goal fulfillment model or 360 evaluation. In addition, it evaluates objectives, competencies, occupation, position or role performed by the staff. Multimedia technologies allow the development of a software application for the realization, edition, evaluation, automatic correction, generation of reports and graphs of test type exams. The application has three modules addressed: teacher, student and notes (Fernández Escobar, 2012).

Siette (Conejo & Guzmán, 2001) or Intelligent System of Evaluation by Test for Tele-education allows the creation and maintenance of banks of questions, the accomplishment of test and the pursuit of results, and it is a tool of collaborative learning and it is used as a means of preparation for an exam in the National Center of Evaluation for Higher Education.

Santos Virgen y Arcega Ponce (2007) They developed a simulator that has as objective that the supporter registered in any of the evaluation processes of the Professional Teaching Service becomes familiar with the application of a computer or online exam.

Evaluation

According to the Royal Spanish Academy, the evaluation consists of "Estimating the knowledge, aptitudes and performance of the students". In traditional practice, learning and development through feedback and self-evaluation do not appear, when in reality they are

closely related (Salim, Lotti de Santos and Macchioni de Zamora, 2012). You can distinguish or present several categories or types of educational evaluation (Table 1).

Table 1. Tipos de Evaluación Educativa.

Objetivo	**Tipo**	**Descripción**
Según su finalidad y función	Función formativa	Mejora el proceso de aprendizaje de forma continua, y así lograr objetivos y metas planteados.
	Función sumativa	Permite identificar el nivel de conocimientos adquiridos, al finalizar un proceso de aprendizaje.
Según su Extensión	Parcial	Da a conocer parte de los aprendizajes que se esperan en un periodo determinado.
	Global	Evalúa la totalidad de los aprendizajes esperados.
Según el momento de aplicación	Inicial	Te permite conocer los aprendizajes, al momento de iniciar un proceso de enseñanza- aprendizaje.
	Procesual	La valoración se realiza mediante un proceso continuo y sistemático, que apoya en la mejora de los resultados de aprendizaje.
	Evaluación final	Los datos son recogidos y valorados al finalizar la formación, para verificar, si el aprendizaje se obtuvo.
Agentes que Intervienen	Interna	Agentes internos evalúan el aprendizaje.
	Externa	Se evalúa el aprendizaje, mediante agentes externos.

Fuente: Gómez Rodríguez (2011).

Self appraisal

Self-evaluation is a type of evaluation linked to autonomous learning and throughout life, since it is done by the student himself and allows him to check his level of learning and, if necessary, reorient it (Cruz Núñez and Quiñones Urquijo, 2012) . Alverno College (College, 2017) defines it as: "The ability of a student to observe, analyze and judge her performance based on certain criteria and determine how she can improve it".

Reagents

For the CENEVAL (2015), the reagent "is an approach that demands a specific task for the individual, with the purpose of evidencing if one possesses the knowledge, skill or competence that is part of the measurement object of the exam". Each reagent has associated instructions, a score and times, the conditions of application and weighting (Mendoza and Maldonado, 2004).

The EGEL-INFO (Bachelor of Computer Science), EGEL-ISOFT (Software Engineering) and EGEL-ICOMPU (Computer Engineering) tests correspond to the Bachelor's programs in Computer Science, Computer Systems Engineering and Computer Engineering, which are They offer in the Faculty of Information Sciences of the Universidad Autónoma del Carmen. CENEVAL considers five types of reagents (Centro Nacional de Evaluación para la Educación Superior, 2017a, 2017b, 2017c):

- Questions or questions of direct questioning. One of the four response options is selected based on the criterion or indication that is requested in the statement, affirmative or interrogative, which is presented on the basis of the reagent.
- Ordering. They require ordering or ranking of a list of elements according to a certain criterion. The option in which the elements appear in the requested order must be selected.
- Selection of elements. A series of facts, concepts, phenomena or procedures are classified according to a specific criterion requested in the reagent base.

- Relation of columns. Two columns are presented, each with different contents, which must be related according to the criterion specified in the reagent base.
- Multi-reactive. Evaluates interrelated knowledge and skills, based on a common theme in a specific area of knowledge or the description of a specific professional situation or problem. First it presents the description of a situation, problem or case, which can include a text, a table, a graph, a map or a drawing followed by a series of reagents that must be answered considering the information presented initially. Each question is evaluated independently. If the answer to a question is unknown, the reagents or questions associated with the problem, of any of the types mentioned above, continue to be answered.

Methodology

The general idea arises within a research and software development project in order to determine if it is possible to develop a software tool that allows the student or graduate to perform a self-assessment before presenting the Exit exam, and to facilitate the analysis of the results as an instrument to identify the weaknesses or strengths prior to the presentation of the EGEL. The general steps proposed to carry out a project are:

- Carry out a theoretical study of extraction and collection of information on software tools that evaluated knowledge of entry or exit of the degree.
- Make a theoretical framework related to the general exit examination of the degree.
- Develop a software that allows to evaluate the level of knowledge acquired from the graduate of educational programs of the Academic Unit of Information Sciences.
- Conducting tests and software experiments.

For the development of the software, the object-oriented methodology of James Rumbaugh (Rumbaugh, 2000) was followed, which requires a conceptualisation stage where the tool requirements are described from different points of view and obtained from the domain of the problem:

- For the Analysis stage, it focuses on three essential models for software development: Object Model, Dynamic Model and Functional Model, which will serve as the basis for the Design stage.
- The design stage is divided into Design of the system and Design of objects, which is the refinement of the models made in the analysis stage.
- In the Development stage, the classes are encoded in a programming language.
- The Tests serve to verify how the classes that were described in the dynamic model work; the processes or rules for the application of a written test are considered, from its application stage to the results stage.
- The final stage of implementation is the start-up of the system.

Software

It is an application developed in java language where reagents are shown in a random way, with a series of possible answers of unique choice, in its first version. Which considers the areas, sub-areas and topics of the EGEL guide mentioned above. The access is limited by the administrator of the application, who will give access to the users prior to self registration or registration, as well as feeding the reagent bank. It consists of the following modules:

- Access. The user provides their credentials (User and Password) to enter the system and perform the evaluation test. The username and password is provided by the system administrator.
- Test selection. This is the main module, where you select the test you want to practice the graduate, these data are the most important because the system determines the items to select.
- Evaluation details. It establishes the data for the evaluation that the student selects. The module allows to set options of displacement and visualization of the time of the test.
- Application of the evaluation. Reagents and responses are displayed, with the specifications established in the evaluation details module. A time control of the test is recorded, but it is not restricted.

- Results. The results obtained are shown, the time it takes to be answered the evaluation, the total of answers answered correctly and the total of incorrect answers.
- Administration of the application. The loading of catalogs (Questions, Answers, Users, etc.), user preferences and security is configured.
- System preferences. It is the section of the system where the system parameters are modified, the System Tools is also available in the module.
- Security. The password of the system administrator is updated or modified; this is found in the security option of the toolbar.
- Reagent loading. The reagents are loaded with their respective answers and the characteristics of each one (type of reagent, name of the test).
- User Load. Allows the loading of users who can enter the system to perform an evaluation; the questions that will be displayed to the user are indicated.

Results and discussion

The developed software runs independently on personal computers or laptops that have the Java virtual machine pre-installed. The database is located on a remote server in the faculty that is accessed by software clients. The tests carried out with the users allow the authenticity of the users, connection to the reagents and visualization of results to the test; the speed of response varies according to the number of users and bandwidth, reaching some difficulties in some wireless access points. The tests were conducted with three groups of 14, 17 and 22 users who executed the application simultaneously, and on different days. In some machines the loading time of the reagents ranged between three and four seconds. The response time of each reagent varied per user and reagent. The tests have a duration time. The results of the test per group are shown in Table 2 and Table 3.

Table 2. Resultados de aciertos por Grupo y Área para Ingeniería en Sistemas Computacionales.

Participantes	Análisis de Información	Desarrollo e implantación de aplicaciones computacionales	Gestión de proyectos de tecnologías de información	Implementación de redes, bases de datos, sistemas operativos y lenguaje de desarrollo
17	69.41%	75.29%	76.47%	72.94%
22	73.73%	74.29%	82.76%	73.64%

Fuente: elaboración propia generada por la herramienta.

It shows better results in the areas of Management of information technology projects, Development and implementation of computational applications; and lower performance in Information Analysis, Network implementation, databases, operating systems and development language for Computer Systems Engineering.

Table 3. Resultados de aciertos por Grupo y Área para Ingeniería en computación.

Participantes	Selección de sistemas computacionales para aplicaciones específicas	Nuevas tecnologías para la implementación de sistemas de cómputo	Desarrollo de hardware y su software asociado para aplicaciones específicas	Adaptación de hardware y/o software para aplicaciones específicas	Redes de cómputo para necesidades específicas
14	74.29%	78.57%	70.47%	64.29	77.14

Fuente: Elaboración propia generada por la herramienta.

It shows weaknesses in the areas of Adaptation of hardware and / or software for specific applications, Development of hardware and its associated software for specific applications, Selection of computer systems for specific applications; and strengths in New technologies for the implementation of computer systems and computer networks for specific needs. For the software test, only students of computer systems and computer engineering careers were available; the students of degree in computer science were not present.

This preliminary information generated can be used by managers, management and academics linked to these educational programs. This represents a partial image of the knowledge possessed by the students who participated in the testing phase of the tool.

Conclusions

The works analyzed in the literature are not oriented to software tools that consider the general exit exam. However, they are used as tools for selecting or diagnosing candidates or for evaluating a specific subject or knowledge. A tool built to measure, considers specific elements not present in commercial products. You can support the training and preparation of non-computerized face-to-face evaluations such as EGEL. Making available to the supporter a means to carry out its preliminary self-assessment of prompt response, with the possibility of identifying the areas with deficiencies and strengths.

The tool must be fed with a greater number of reagents, which involves a greater number of people both in the feeding and design of reagents and in its use by potential supporters to an exit test. The tool does not guarantee that the supporters accredit the test or obtain notable performances, but a means of training possible scenarios.

The tool serves as an instrument that shows an X-ray of the knowledge of the supporters at a given moment. This leads to the development of a strategy that strengthens all areas of the test, especially those with lower or deficient results, which become areas of opportunity for the use of the tool. On the other hand, the software can be expanded at the institutional level by incorporating tests and reagents from other degree programs evaluated by CENEVAL through the EGEL test.

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