Revisión

Sistema informático para la gestión de la documentación de acreditación en la Universidad de Granma

Computer system for managing accreditation documentation at the University of Granma

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Abstract

The present article addresses the issue of the manual and fragmented management of accreditation process documentation for the Computer Engineering program at the University of Granma, Blas Roca Calderío campus. This situation, identified as a scientific problem, generates inefficiencies, risk of evidence loss, and difficulties in preparing for external evaluations, thereby compromising the overall quality of the process. The objective of the study is to develop a web-based information system to organize, preserve, and streamline access to such documentation. The research is grounded in a theoretical and contextual analysis of the

national accreditation process and is supported by agile software development methodologies, specifically Extreme Programming. As a result, a technological architecture based on React, Node.js, and MySQL is proposed, characterized by its web accessibility, robustness, and capacity to centralize information. This system, conceived as a support tool, has not yet been implemented or generalized in practice; therefore, its level of acceptance and validation by potential institutional users remains subject to future development and pilot testing stages.

Keywords: Accreditation; Self-assessment; National Accreditation Board; Web information system; Software

Resumen

El presente artículo aborda la problemática de la gestión manual y dispersa de la documentación del proceso de acreditación de la carrera de Ingeniería Informática en la Universidad de Granma, sede Blas Roca Calderío. Esta situación, identificada como un problema científico, genera ineficiencias, riesgo de pérdida de evidencia y dificulta la preparación para las evaluaciones externas, comprometiendo la calidad del proceso. El objetivo de la investigación es desarrollar un sistema informático web para organizar, preservar y agilizar el acceso a dicha documentación. Se fundamenta en un análisis teórico-contextual del proceso de acreditación nacional y se apoya en metodologías de desarrollo de software ágiles, específicamente la Extreme Programming. Como resultado, se propone una arquitectura tecnológica basada en React, Node.js y MySQL, caracterizada por su accesibilidad web, robustez y capacidad para centralizar la información. Este sistema, concebido como una herramienta de apoyo, aún no ha sido implementado ni generalizado en la práctica, por lo que su grado de aceptación y validación por los potenciales usuarios introductores está pendiente de futuras etapas de desarrollo y pilotaje institucional.

Palabras clave: Acreditación; Autoevaluación**;** Junta de Acreditación Nacional**;** Sistema informático web; Software

Introduction

University program accreditation constitutes a systematic quality evaluation process designed to verify the extent to which an academic program meets recognized academic, organizational, and social impact standards. Internationally, this process is managed by external public or private agencies that examine dimensions such as curriculum design, faculty qualifications, material and technological resources, research activities linked to training, and graduate employability. Typically, accreditation unfolds through interconnected stages: internal self-evaluation, external assessment, and issuance of a judgment granting quality categories or levels for a specified period (Baños y Michelena, 2021).

Numerous countries maintain national accreditation agencies recognized by global or regional bodies, such as the European Association for Quality Assurance in Higher Education in Europe or the Council for Higher Education Accreditation and its recognized agencies in the Americas. These entities promote compatible quality assurance frameworks that enhance academic mobility, mutual recognition of degrees, and interuniversity collaboration. Thus, accreditation emerges as a useful tool for transparency, accountability, and continuous improvement in higher education, aligned with the demands of an increasingly globalized and competitive environment (Eaton, 2020).

In Cuba, university program accreditation operates through a centralized system coordinated by the National Accreditation Board (JAN), affiliated with the Ministry of Higher Education. Like international models, as noted by Horruitiner (2007), the Cuban system relies on program self-evaluation, visits by external expert committees, and issuance of a judgment granting or denying accreditation, typically in categories reflecting achieved excellence levels.

Nevertheless, it incorporates distinctive features tied to Cuba's social project, including emphasis on training's social relevance, graduates' ideological and ethical commitment, study-work integration, and programs' tangible contributions to territorial and national development. Consequently, Cuban accreditation not only measures internationally comparable academic standards but also assesses each program's alignment with national strategic priorities (Horruitiner, 2007).

Within this framework, program accreditation at the University of Granma—particularly at the Blas Roca Calderío Campus in Manzanillo—functions as a formal, rigorous mechanism to ensure academic quality. According to Horruitiner (2007), the process adheres to JAN standards, aiming to certify that each university program meets excellence benchmarks demanded by the Cuban state and society, thereby guaranteeing graduates' professional competence and contributions to local and national development.

Established in 2015 through the integration of various territorial higher education institutions, the University of Granma currently serves thousands of students and distinguishes itself through its commitment to continuous improvement (Periódico Granma, 2015). Its engagement in accreditation processes has elevated several programs to national prominence, as evidenced by the *Licenciatura en Educación Español-Literatura and Licenciatura en Educación Preescolar* programs, both attaining Excellence status.

The University Career Evaluation and Accreditation System (SEA-CU) structures accreditation into six stages: external evaluation request, evaluability determination, evaluator commission formation, expert preparation, on-site verification, and final judgment issuance by the JAN. Programs may achieve categories such as Qualified, Certified, or Excellence based on outcomes.

The JAN Quality Pattern evaluates seven essential variables: program social relevance, institutional tradition and interuniversity collaboration, faculty quality, didactic and

administrative assurance, labor market scenarios and employability opportunities, student performance and outcomes, and curriculum relevance and updating (JAN, 2018).

Despite accreditation's strategic importance and a well-defined regulatory framework, the Blas Roca Calderío campus at the University of Granma faces persistent limitations, including manual, fragmented, and unsystematized management of process-related documentation. Information remains dispersed across multiple supports and formats, hindering organization, preservation, and timely retrieval during self-evaluation demands and external visits.

This situation creates workload overload, risk of evidence loss, and constraints on systematic result analysis, potentially undermining the accreditation process's efficiency and quality. Accordingly, this article identifies as its objective the description of theoretical references supporting the development of an information system to facilitate documentation management for career accreditation in the Faculty of Technical Sciences at the University of Granma, Blas Roca Calderío campus, Cuba.

Development

University accreditation serves as an essential quality assurance process, representing a systematic evaluation that verifies the relevance and efficiency of training programs. Eaton (2020) maintains that these systems confer public legitimacy by certifying compliance with international standards, thereby strengthening societal trust. Consequently, the documentation generated during accreditation becomes an institutional asset that requires secure digital management. In Cuba, Moscoso et al. (2022) note that modernizing higher education evaluation methods demands integration of technologies capable of recording evidence and reinforcing a quality culture. Aware of this challenge, the University of Granma promotes the creation of an information system ensuring traceability, efficiency, and continuous improvement.

The accreditation process for a university program structures itself into stages—planning, self-evaluation, and external evaluation—each with distinct objectives and procedures. Baños and Michelena (2021) assert that systematic evaluation of teaching and academic performance enables analysis of program efficacy and social impact. During planning, work teams define timelines, gather evidence, and establish indicators, delineating the scope of the self-evaluation report. According to the Ministry of Higher Education (2023), this phase requires rigorous organization with clear responsibilities and documentary control mechanisms. Digitalization optimizes it by centralizing data, reducing human errors, and enhancing coordination among university stakeholders through an information system.

During self-evaluation, the academic community conducts a comprehensive diagnosis assessing compliance with standards related to relevance, curriculum, resources, and student performance. Baños and Michelena (2021) emphasize that this institutional exercise fosters constructive self-criticism and sustained improvement. Horruitiner (2007) concurs that self-evaluation stimulates a participatory culture strengthening pedagogical quality. Manual evidence collection in this stage often produces dispersion and delays; thus, a digital system can automate document uploads, generate reports, and facilitate feedback. From my perspective as a student, technological implementation contributes to organizational self-transformation and deeper understanding of university quality processes.

External evaluation constitutes the definitive verification of the accreditation process. Experts from the National Accreditation Board (2018) visit campuses to cross-check information and observe the academic environment. Eaton (2020), highlights that external peer involvement ensures objectivity and global comparability. Horruitiner (2007) adds that this stage reinforces institutional accountability. At the University of Granma, evaluators conduct interviews, inspect laboratories, and analyze academic management. A document management system could

optimize preparation for these visits by providing remote, transparent access to indicators, plans, and results. This does not replace expert judgment but strengthens the empirical foundation upon which accreditation verdicts are constructed.

Evaluation criteria harmonize universal standards with contextual realities. The SEA-CU defines variables such as social relevance, faculty quality, didactic-administrative assurance, and student performance (JAN, 2018). Moscoso et al. (2022) indicate that this framework allows adaptation to territorial conditions without sacrificing rigor. In Computer Engineering, infrastructure, labor linkages, and curricular coherence receive particular scrutiny. According to Periódico Granma (2015), Cuban university integration reflects a territorial vision of scientific development. Thus, accreditation not only measures outcomes but drives continuous improvement of the training process. Digital indicator management enhances transparency and accelerates decision-making.

At the University of Granma, Blas Roca Calderío campus, the accreditation committee oversees evidence collection and SEA-CU standard compliance. Horruitiner (2007) underscores that this model articulates institutional self-evaluation with external assessment, ensuring comprehensive academic performance oversight. According to the Ministry of Higher Education (2023), the Cuban approach rests on equity and social relevance principles. Process digitalization via an information system would facilitate document preservation and information traceability. From personal reflection, such a tool not only simplifies administrative work but reinforces collective commitment to educational excellence.

Manual accreditation document management poses a recurrent challenge in Cuban universities. Moscoso et al. (2022) warn that physical deterioration and record duplication undermine institutional efficiency. Informatization emerges as a viable solution, as digitizing files, reports, and protocols improve evaluator access and promote accountability. Eaton (2020) posits that institutions must adapt document management to global quality assurance standards.

Accordingly, the University of Granma seeks to lead digital transformation through a system enabling structured evidence storage and retrieval. This step consolidates foundations for modern, efficient university governance.

Designing a digital accreditation system requires applying appropriate software development methodologies. Pressman (2010) states that a methodology defines phases, activities, and deliverables in the software life cycle. Sommerville (2016) concurs that methodologically sound planning enhances product reliability. In university contexts, selecting the optimal methodology balances technical quality and usability. For instance, an overly rigid system might limit document management flexibility. Conversely, agile methodologies—such as Scrum or XP—facilitate continuous adaptation. Thus, software engineering transcends mere technical development, constituting a strategic action oriented toward institutional sustainability.

Traditional methodologies, like the waterfall model described by Fowler (2006), emphasize sequentiality and exhaustive documentation, suiting stable requirements. However, Beck (2005) advocates agile approaches like Extreme Programming, promoting communication, simplicity, and constant feedback. Schwaber and Sutherland (2020) explain that Scrum enables incremental deliveries through sprints, ensuring transparency and continuous review. For developing an accreditation management system, an agile focus would permit function adjustments as implementation progresses. As a student, I perceive this dynamism fosters participation, drives academic innovation, and minimizes technological stagnation risks.

Extreme Programming, proposed by Beck (2005), exemplifies a paradigm for educational software projects. It promotes iterative development practices, pair programming, and automated testing, ensuring high code quality. Pressman (2010) considers this approach ideal when requirements change frequently. At the University of Granma, adopting Extreme Programming would foster collaborative development involving students and faculty actively. Extreme

Programming 's communication and respect philosophy aligns with higher education values prioritizing shared learning. Moreover, integration with version control systems guarantees improvement traceability, coherent with accreditation's inherent continuous evaluation logic.

The framework concept proves crucial during technological implementation. Fowler (2006) defines frameworks as reusable structures accelerating development through standardized components. Bosi (2015) argues that frameworks integrated into Visual Studio Code enhance productivity and collaboration. In academic settings, frameworks ensure design coherence and reduce maintenance costs. Pressman (2010) suggests these tools facilitate software modularity and scalability. Thus, employing frameworks in the document management system maintains consistency and eases periodic updates required by accreditation processes. Ultimately, they provide a solid foundation for constructing sustainable solutions.

Web applications, grounded in the architecture proposed by Fielding and Taylor (2000), currently represent the most efficient avenue for institutional information management. Their client-server model enables simultaneous remote interaction via browsers, eliminating local installation needs. Eich (1995) introduced JavaScript as a scripting language for interactivity, later enhanced by performance-optimizing frameworks. Resig (2006) notes that Ajax techniques enabled dynamic data access and instantaneous content updates. For accreditation processes, these features improve evidence management and communication among stakeholders, aligning with institutional accessibility and transparency principles.

React, created by Walke (2013) and refined by the Facebook Core Team (2023), has established itself as one of the most effective libraries for developing interactive interfaces. Abramov and Perer (2015) affirm that JSX usage facilitates integration between visual and logical components, optimizing user experience. At the University of Granma, this tool would enable intuitive platforms where program managers upload documents or consult reports. Additionally, its

reusable component structure favors visual coherence and system maintenance. In practice, React combines efficiency and flexibility—essential values for a university application sustaining long-term operations without proprietary software dependence.

Node.js, introduced by Dahl (2009) and popularized by Tilkov and Vinoski (2010), revolutionized web development by enabling server-side JavaScript execution. Holowaychuk (2010) notes that frameworks like Express simplify route, session, and API creation. For the accreditation document management system, Node.js would handle database connections and authentication processes, ensuring high performance with minimal latency. Widenius et al. (1995) highlight that MySQL's relational model offers transactional integrity and scalability. This technological integration forms a robust, flexible architecture. From the authors' viewpoint, consolidating this technological environment reinforces university autonomy and contributes to digital sustainability.

System visual design draws on languages and standards established by the W3C (2014). Hickson (2007) states that HTML5 provides web applications' semantic structure, while CSS2 and its updates (Bos et al., 1998; W3C, 2023) define responsive graphical presentation. Wathan (2019) proposes Tailwind CSS as a modern framework accelerating development through utility classes. Its use ensures coherence, reduces custom code volume, and facilitates system adaptation across devices. In educational environments, these visual tools provide accessibility, clarity, and consistency—indispensable traits for applications serving both faculty and institutional managers involved in accreditation.

The development and maintenance phase can be managed effectively with contemporary tools like Visual Studio Code. Bosi (2015) describes this environment as a specialized editor integrating debugging, version control, and task automation. Combined with Git, it enhances progress monitoring and programmer collaboration. Pressman (2010) underscores that integrated

tools favor quality and reduce software delivery timelines. In academic settings, Visual Studio Code stimulates students' practical and professional training, exposing them to real industry standards while contributing to institutional strengthening.

Developing a document management system for university program accreditation integrates educational and technological domains toward a common purpose. Moscoso et al. (2022) assert that administrative digitalization strengthens institutional responsiveness and consolidates quality culture. Sommerville (2016) and Pressman (2010) agree that properly applied software engineering can optimize complex social processes like academic evaluation and certification. For the University of Granma, this project merges innovation with social commitment. Reflectively, implementing this tool entails not only technical efficiency but also ethical responsibility, placing technology at the service of public education.

In summary, creating an information system to manage accreditation documentation at the University of Granma responds to the institution's commitment to elevating educational quality through intelligent use of emerging technologies. Eaton (2020) asserts that quality assurance must be conceived as a living process, not an isolated event. Similarly, Baños and Michelena (2021) emphasize that process digitalization strengthens administrative transparency and efficiency. Integrating tools, methodologies, and institutional values enables the university to advance toward a continuous improvement culture. Ultimately, technology-education convergence solidifies a modern, sustainable vision of university management in Cuba.

Discussion

The theoretical and contextual analysis conducted in this study enables discussion of the relevance and feasibility of developing a web-based information system for managing accreditation documentation in the Faculty of Technical Sciences at the University of Granma,

Blas Roca Calderío campus. The discussion centers on the convergence between the identified institutional need and the proposed technological solutions, informed by consulted references.

First, it confirms that manual, fragmented, and dispersed documentation management constitutes a tangible obstacle to accreditation process efficiency and effectiveness, as evidenced by described operational limitations. This situation, common in contexts with incipient administrative digitalization, generates risks of evidence loss, workload overload, and difficulties in comprehensive analysis, potentially affecting evaluation outcomes. Therefore, the objective of developing a system to organize, preserve, and streamline information access is grounded in a concrete need for quality management improvement.

Second, the discussion validates that selected methodologies and technologies provide an appropriate framework to address this need. Adopting agile approaches, such as Scrum or Extreme Programming, aligns with the iterative and participatory nature required for such a project in a university setting. As highlighted by Beck (2005) and Schwaber and Sutherland (2020), these methodologies enable continuous adaptations and foster active collaboration among involved stakeholders (students, faculty, administrators), consistent with the self-evaluation and continuous improvement ethos inherent to accreditation.

Likewise, the proposed technological architecture—based on web applications with React for dynamic interfaces, Node.js for server logic, and MySQL for data management—constitutes a modern, robust, and scalable stack. This combination, supported by web standards (HTML5, CSS) and development tools like Visual Studio Code, enables conception of an accessible, high-performance system with sustainable maintenance. Its web-based nature facilitates remote and simultaneous access, crucial for self-evaluation committees and external experts, thereby optimizing preparation for evaluation visits and process transparency.

Nevertheless, the discussion must also acknowledge implicit challenges. Successful implementation transcends technical development; it requires a cultural shift in document management, staff training, and sustained institutional commitment to adoption and continuous updating. As warned by Moscoso et al. (2022), digitalization serves to strengthen quality culture, not as an end in itself. Thus, the system must be conceived as a tool supporting academic and evaluative processes, never as a substitute for critical and expert judgment.

Conclusions

This research demonstrates the viability and relevance of developing a web-based information system for managing accreditation documentation at the University of Granma. The proposed technological solution, grounded in agile methodologies and a modern architecture (React, Node.js, MySQL), directly addresses the identified issues of manual, fragmented, and risky management. This system would not only optimize evidence organization, preservation, and access but also enhance transparency, expedite preparation for peer visits, and reduce administrative overload. Thus, it aligns with SEA-CU and JAN principles, promoting a more efficient, evidence-based quality culture.

System implementation represents a strategic step toward university management modernization, integrating technological innovation with Cuban higher education's social commitment. However, its success extends beyond the technical realm, depending on organizational cultural change, continuous staff training, and firm institutional support. Ultimately, this project positions the University of Granma at the forefront of digital transformation in quality assurance processes, contributing to sustainability, accountability, and educational excellence from a contextualized, proprietary perspective.

References

Abramov, D., & Perer, C. (2015, December 18). Introducing JSX. React Blog. https://react.dev/blog/2015/12/18/react-components-elements-and-instances

Baños Martínez, M. A., & Michelena Fernández, E. (2021). El proceso de acreditación de carreras. Revista Cubana de Educación Superior, 40(1). http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0257-43142021000100012&lng=es&tlng=es

Beck, K. (2005). Extreme programming explained: Embrace change (2nd ed.). Addison-Wesley.

Bos, B., Çelik, T., Hickson, I., & Lie, H. W. (1998). Cascading style sheets, level 2 (CSS2) specification. World Wide Web Consortium (W3C). https://www.w3.org/TR/CSS2/

Bosi, E. (2015, April). Visual Studio Code: The editor for modern web development. Microsoft Build Conference.

Dahl, R. (2009). Node.js: Anatomy of server-side JavaScript. NodeConf Presentation. https://nodejs.org/en/about

Eaton, J. S. (2020). Quality assurance in higher education across the world. Council for Higher Education Accreditation.

Eich, B. (1995). LiveScript: Embedding a scripting language in Netscape Navigator. Netscape Communications.

Facebook Core Team. (2023, March 29). React 18 release notes. React.dev. https://react.dev/blog/2022/03/29/react-v18

Fielding, R. T., & Taylor, R. N. (2000). Principled design of the modern web architecture. ACM Transactions on Internet Technology, 2(2), 115–150.

Fowler, M. (2006). Patterns of enterprise application architecture. Addison-Wesley.

Hickson, I. (2007). HTML 5: A vocabulary and associated APIs for HTML and XHTML. WHATWG.

Holowaychuk, T. (2010). Express: High performance Node.js web framework. GitHub Repository. https://expressjs.com/

Horruitiner Silva, P. (2007). El modelo de acreditación de carreras de la educación superior cubana. Revista de la Educación Superior, 44(2), 113–132. https://doi.org/10.35362/rie4422252

Junta de Acreditación Nacional. (2018). Manual de implementación del Sistema de Evaluación y Acreditación de Carreras Universitarias (SEA-CU). Ministerio de Educación Superior. https://instituciones.sld.cu/fatesa/files/2022/06/Manual-de-implementaci%C3%B3n-SEA-CU-2018-Perfeccionado.pdf

Ministerio de Educación Superior. (2023). Resolución No. 160/2023: Sistema de Evaluación y Acreditación de la Educación Superior (SEAES). La Habana, Cuba.

Moscoso Bernal, S., Quintana Santiago, Y. M., & Vizuela Carpio, J. F. (2022). Sistema de aseguramiento de la calidad en Cuba: Fortalezas y limitantes. Killkana Social, 6(1), 1–12. https://doi.org/10.26871/killkanasocial.v6i1.919

Periódico Granma. (2015, septiembre 4). Abre sus puertas Granma a la integración universitaria. https://www.granma.cu/cuba/2015-09-04/abre-sus-puertas-granma-a-la-integracion-universitaria

Pressman, R. S. (2010). Software engineering: A practitioner's approach (7th ed.). McGraw-Hill.

Resig, J. (2006). Ajax: A new approach to web applications. jQuery Blog.

Schwaber, K., & Sutherland, J. (2020). The Scrum guide. https://scrumguides.org/scrum-guide.html

Simoneau, J. (2019). The curse of JavaScript fatigue. Smashing Magazine.

Sommerville, I. (2016). Software engineering (10th ed.). Pearson.

Tilkov, S., & Vinoski, S. (2010). Node.js: Using an event-driven model for your next web project. O'Reilly Media.

W3C. (2014). HTML5 recommendation. World Wide Web Consortium.

W3C. (2023). CSS snapshot 2023. World Wide Web Consortium.

Walke, J. (2013, May). React: A JavaScript library for building user interfaces. JSConf US.

Wathan, A. (2019). Tailwind CSS v1.0. Tailwind Labs. https://tailwindcss.com/docs

Widenius, M., Axmark, D., & Duun, A. (1995). The MySQL reference manual. MySQL AB Documentation.