**OPTIMIZED WEB PLATFORM FOR MANAGING CREDIT TRANSFERS IN DIRECT-ENTRY PROGRAMS**

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## Abstract

The process of credit transfer in higher education poses substantial challenges, particularly for students entering bachelor’s programs through direct-entry pathways. This research responds to these challenges by developing a web-based Credit Transfer System (CTS) tailored to the specific needs of educational institutions and students. The project’s aims to optimize the credit transfer process, minimize redundant coursework, and ensure secure and efficient handling of student data. Traditional manual systems, often plagued by inefficiencies such as data loss and processing delays, are replaced by this automated, secure online platform. The CTS simplifies credit submission and evaluation, offers clearer guidance on academic pathways, and reduces the administrative workload associated with credit transfer. Utilizing Agile methodology, the development process was highly adaptive to user feedback, ensuring the final system meets the evolving needs of students and administrators alike. By enhancing the accuracy and speed of credit evaluations, the CTS improves the educational experience for direct-entry students, enabling smoother academic transitions and expediting degree completion. This research demonstrates that the implementation of a web-based CTS represents a critical advancement towards a more efficient, secure, and student-centered approach to credit transfer, ultimately benefiting both students and educational institutions.

## Keywords:

Credit Transfer System, Higher Education Efficiency, Web-Based Management System, Automated Academic Process, System Implementation and Development, Database Life Cycle (DBLC)

## Introduction

In the evolving landscape of higher education, the efficient management of academic records and processes is essential for institutional success and student satisfaction. The credit transfer process, crucial for students moving between educational programs or institutions, presents significant challenges, especially for those entering directly into bachelor’s programs from diploma studies, vocational programs, or international institutions (Omona et al., 2010). Ensuring a smooth and efficient transfer of credits is vital for optimizing educational pathways, reducing redundancy, and enhancing the overall academic experience for students.

In certain institution, the current manual credit transfer system reveals several inefficiencies. This system requires students to complete and submit credit transfer forms along with their transcripts, which are then reviewed by academic advisors. This manual process is fraught with challenges, including time-consuming procedures, susceptibility to errors, potential data loss, and administrative burdens (Njoku, 2015). Such inefficiencies negatively impact student progress, increase the workload on academic staff, and undermine the effectiveness of the academic administration.

The proposed CTS seeks to streamline the credit transfer process, enhance data security, and improve the efficiency of academic operations. By transitioning from a manual to an automated system, the CTS aims to reduce course redundancy, expedite accurate credit evaluations, and alleviate the administrative burdens faced by both students and faculty (Azizan et al., 2021). This research aligns closely with Sustainable Development Goal 4 (SDG 4): Quality Education (United Nations, n.d.). SDG 4 emphasizes the importance of ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. By developing a more efficient credit transfer system, this study supports SDG 4 in several ways. First, it addresses the challenge of educational accessibility by streamlining the credit transfer process, thus reducing barriers for students transitioning from different educational backgrounds. This contributes to a more equitable educational experience, enabling students to advance through their studies without unnecessary delays or duplications of coursework.

Secondly, the proposed web-based CTS enhances the quality of educational administration by improving data security and accuracy (Tarhini et al., 2013). Reliable and secure management of academic records is crucial for maintaining the integrity of educational qualifications and supporting students' academic progress. By minimizing errors and administrative inefficiencies, the system supports a higher standard of educational management, which is fundamental to achieving quality education. Furthermore, the automation of the credit transfer process aligns with the broader trend towards digital solutions in education. As educational institutions increasingly adopt technology-driven approaches, the proposed CTS reflects the commitment to modernizing educational practices and improving the overall learning experience. This aligns with the goal of fostering innovative and effective learning environments, which are key components of SDG 4. In summary, this research addresses the limitations and challenges of current manual credit transfer system by developing and implementing a web-based CTS. This study not only aims to enhance the efficiency, security, and effectiveness of credit transfer processes but also contributes to the advancement of SDG 4 by promoting equitable access to education, improving administrative quality, and embracing technological innovation.

## Literature Review

The pursuit of an effective credit transfer system is crucial for enhancing both the academic experience and operational efficiency within educational institutions (Vaenthaisong & Kitwatthanathawon, 2023). Integrating web-based solutions into credit transfer processes marks a significant advancement in overcoming the limitations of traditional systems (Vaenthaisong & Kitwatthanathawon, 2023). This literature review explores the theoretical and practical foundations that support the development of streamlined web solutions for credit transfers, with a particular focus on the Direct-Entry Program. Credit transfer systems play a vital role in higher education by enabling students to transfer academic credits between institutions or programs. This flexibility fosters diverse educational pathways and improves student mobility, thereby creating a more inclusive and adaptable academic environment (Azizan et al., 2021). The effectiveness of these systems is directly linked to student success and institutional efficiency, making it an essential area for study and development (Tarhini et al., 2013).

Credit transfer systems have long been essential in higher education, facilitating the movement of academic credits between institutions or programs. Traditional systems, often characterized by manual processes and paper-based documentation, can lead to inefficiencies and inaccuracies (Ridwan et al., 2022). The study "Sistem Informasi Alih Kredit Mata Kuliah (SIAKSI) untuk Mahasiswa berbasis Web" highlights the limitations of existing credit transfer applications at Open University, underscoring the need for more effective and efficient solutions (Ridwan et al., 2022). The paper suggests that manual input and lack of transparency in the current systems impede their effectiveness, indicating a gap in literature regarding more user-friendly and efficient systems.

Existing credit transfer systems often struggle with administrative inefficiencies and a lack of real-time status updates for students, primarily due to manual processing and limited system integration (Njoku, 2015). These traditional methods, which frequently involve physical forms and manual data entry, are prone to delays, errors, and inaccuracies. Such inefficiencies not only slow down academic progress but also create confusion and hinder timely decision-making for students, as they lack transparency regarding their application status. The "Design and Development of an Academic-Result Transfer System: A Case Study in Thailand" underscores the importance of addressing these challenges by implementing web-based solutions to streamline processes and enhance accuracy (Vaenthaisong & Kitwatthanathawon, 2023). The study highlights how outdated methods negatively impact both administrative efficiency and the overall student experience, emphasizing the need for more advanced, reliable solutions to overcome these issues.

The transition to web-based systems marks a significant advancement in the management of credit transfers, offering numerous benefits such as improved accessibility, efficiency, and user satisfaction (Azizan et al., 2021). Research highlights that online systems can streamline the application process, reduce errors, and enhance accessibility for both students and administrators. For instance, the study by Rajamangala University of Technology Isan demonstrates how a web-based academic-result transfer system improved processing speed and user satisfaction by adhering to usability principles (Sritrakool & Chumpolpakdee, 2020). The development of a web-based Credit Transfer Application (CTA), discussed in the literature, showcases the role of modern technologies, such as Agile development, in enhancing the functionality and user experience of credit transfer systems (Azizan et al., 2021).

Additionally, the use of established methodologies like the Waterfall model and the PIECES framework for needs analysis provides a robust foundation for developing and implementing effective solutions (Bertino & Sandhu, 2005). These methodologies play a crucial role in ensuring that the system effectively addresses key aspects such as performance, information, economy, security, efficiency, and customer service. They align with broader trends in educational technology that highlight the advantages of digital solutions for enhancing operational efficiency and user experience (Tarhini et al., 2013). Similarly, the use of Use Case and Activity Diagrams, coupled with Black Box testing, facilitates thorough design and evaluation processes, contributing to the development of robust and user-friendly systems. These approaches underscore the importance of systematic planning and iterative testing in creating effective credit transfer solutions (Vaenthaisong & Kitwatthanathawon, 2023).

A critical aspect of developing an effective credit transfer system is ensuring it is designed with the end-users in mind. Applying usability principles, such as those proposed by Jacob Nielsen, can lead to a more user-friendly system that meets the needs of students, staff, and administrators (Omona et al., 2010). The positive reception of web-based solutions, as indicated by high user satisfaction scores, demonstrates the effectiveness of user-centric design in enhancing system usability and acceptance (Tarhini et al., 2013).

Moreover, maintaining academic integrity is crucial in credit transfer systems. Accurate transfer of academic results supports the institution's commitment to high academic standards and prevents issues related to record accuracy (Bertino & Sandhu, 2005). The integration of web-based solutions not only improves efficiency but also ensures the accuracy and integrity of academic records.

The development of more efficient credit transfer systems contributes significantly to both academic and administrative outcomes. By reducing redundancy and improving data management, these systems support smoother transitions for students and alleviate administrative burdens (Omona et al., 2010). The integration of modern technologies and methodologies not only enhances operational efficiency but also promotes fairness and accuracy in credit transfers, aligning with the broader goals of educational equity and institutional excellence.

This literature underscores the urgent need for advancements in credit transfer systems to address current challenges and capitalize on technological opportunities. The transition to web-based solutions and user-centric design marks a significant leap forward in enhancing the efficiency, accuracy, and overall effectiveness of these systems. By building on established methodologies and prioritizing user needs, future developments in credit transfer systems can not only improve educational experiences and administrative processes but also align with the goals of SDG 4—Quality Education. This alignment fosters more flexible and inclusive higher education environments, ultimately contributing to the broader objective of ensuring equitable and quality education for all.

### Methodology

The methodology for the was rooted in iterative development and user-centred design principles. Initial requirements analysis was based on insights from the qualitative research, leading to the definition of functional and non-functional requirements. Key features included application submission, status tracking, and notification management. The Agile methodology, specifically Scrum practices, was adopted for development. This approach facilitated iterative progress, enabling regular feedback and continuous improvement. Development proceeded in sprints, each targeting specific functionalities and incorporating user feedback from previous iterations. User testing was integral, with usability sessions conducted post-sprint to gather feedback on system functionality and design. Task-based assessments and heuristic evaluations were used to identify usability issues, guiding refinements before subsequent sprints. This iterative process ensured the system evolved to meet user needs and expectations effectively.

The development of this CTS utilized a mixed methods approach to ensure a comprehensive analysis and effective system design. Initially, qualitative research methods were employed to identify challenges and inefficiencies in the existing credit transfer process. Semi-structured interviews and surveys were conducted with students, faculty members, and administrative staff to gather detailed insights into their experiences and requirements. This qualitative data provided foundational understanding of user pain points and system needs. Subsequently, quantitative methods were used to validate these findings and assess the proposed solutions' impact. Statistical analysis of survey data was performed to identify prevalent trends and preferences. Descriptive statistics measured response frequencies, while inferential statistics evaluated the significance of various factors affecting the credit transfer process. This integration of qualitative and quantitative data offered a well-rounded perspective, guiding the design and development phases effectively.

The architecture utilized a client-server model with a web-based interface, built using HTML5, CSS3, and JavaScript for a responsive and intuitive user experience. PHP and MySQL were employed for backend development, ensuring robust data management and processing capabilities. Flow charts and context diagrams were pivotal in illustrating system interactions and data flows. Flow charts depicted processes such as application submission and status tracking, while the context diagram provided a high-level overview of external interactions with entities like students, faculty, and administrators. Functional requirements included user authentication, application submission, real-time status tracking, and notification alerts. Non-functional requirements addressed performance, security, and usability, ensuring responsiveness across devices, fast load times, and efficient data processing. Security measures and role-based access controls protected user data and maintained appropriate permissions. User interface design focused on clarity and ease of navigation, incorporating feedback to enhance usability. The system aligned with Sustainable Development Goal 4 on Quality Education by streamlining credit transfers, promoting transparency, and supporting students in achieving academic goals.

The database design was crucial for efficient data management and retrieval. The Entity-Relationship Diagram (ERD) defined the data structure and relationships among entities such as students, courses, credit transfers, and application statuses. This diagram served as a blueprint for the database schema, ensuring that the data model met system requirements. The Data Flow Diagram (DFD) illustrated the data movement within the system, showing how data is processed from input to output and identifying potential bottlenecks or inefficiencies.

To support robust data management, several database objects were implemented. Triggers were used to automatically execute actions in response to database events, such as updating application statuses or sending notifications. Stored procedures encapsulated complex queries and business logic, facilitating efficient and reusable operations for tasks like processing applications and generating reports. Functions were designed to perform specific calculations or data transformations, such as calculating credit equivalencies. Views presented data in a structured, user-friendly manner, offering customized perspectives like dashboards for monitoring application statuses and summaries of credit transfer activities.

### Result and Discussion

The web-based FTMK Credit Transfer System (CTS) was successfully developed and tested, demonstrating substantial improvements in the efficiency and accuracy of the credit transfer process. The system was designed with a focus on user-friendliness and functionality, ensuring that students, faculty, and administrators could navigate and utilize the platform with ease. Figure 1 shows the main interface of the developed system.

A screenshot of a website

Description automatically generated  
**Figure 1** Main Interface of the FTMK Credit Transfer System

The implementation of the FTMK CTS resulted in several key outcomes. Firstly, the system significantly reduced the time required for processing credit transfer applications. Previously, the process was manual and prone to delays and errors, but with the new system, applications were processed in real-time, and users could track the status of their submissions instantaneously. This improvement in processing time not only enhanced the efficiency of the credit transfer process but also improved user satisfaction by providing transparency and reducing uncertainty.

Another important outcome was the enhancement of data accuracy and consistency. By centralizing the data management process within the system, the likelihood of data entry errors was minimized. The use of triggers and stored procedures ensured that data integrity was maintained throughout the application process, automatically updating statuses and notifying users as necessary. This automation of routine tasks reduced the administrative burden on staff, allowing them to focus on more complex and value-added activities.

Moreover, the system's integration of role-based access control improved security by ensuring that users only had access to information pertinent to their roles. This feature was particularly important in safeguarding sensitive information and preventing unauthorized access. Additionally, the system’s design, which incorporated responsive layouts and clear navigation, received positive feedback from users during testing, highlighting its ease of use across different devices.

However, the deployment of the FTMK CTS also revealed certain challenges. One of the primary challenges was the need for continuous technical support, particularly in maintaining and updating the system. While the system was robust, small technical issues occasionally required attention, necessitating a level of technical expertise among the administrative staff. This challenge underscores the importance of ongoing training and support to ensure the smooth operation of the system.

In terms of its alignment with Sustainable Development Goal 4 (Quality Education), the FTMK CTS has the potential to significantly contribute to enhancing educational opportunities. By streamlining the credit transfer process, the system facilitates student mobility and academic progression, enabling students to achieve their educational goals more efficiently. This impact is particularly relevant in the context of direct-entry programs, where the timely and accurate transfer of credits is crucial for student success.

### Conclusions

The development and implementation of the web-based FTMK CTS has demonstrated significant improvements in the efficiency, accuracy, and transparency of the credit transfer process. By streamlining application submission, automating routine tasks, and enhancing data integrity, the system addresses key challenges faced by students and administrators. The incorporation of responsive design and role-based access control ensures usability and security across different user groups, contributing to a more effective and user-friendly platform that supports educational progression in line with Sustainable Development Goal 4.

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