



# Development of a Web Application for MLIS and BLIS Library Academic Resources

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## ABSTRACT

This research focuses on developing a web application to address challenges in utilizing e-resources in academic libraries, specifically for the MLIS and BLIS programs at Saint Columban College, Pagadian City. As academic libraries transition to hybrid models integrating physical and digital collections, traditional Online Public Access Catalogs (OPACs) often fall short in providing seamless access to full-text e-resources, including unpublished and published research papers, and in offering data visualization tools. The web application developed in this study addresses these challenges by incorporating mechanisms to ensure effective access to e-resources, providing personalized recommendations, and utilizing data visualization tools. Guided by the Technological Acceptance Theory (TAT) and Diffusion of Innovation Theory (DOI), and utilizing a user-focused design approach, the application integrates modern content platform methods, offering full-text access, links to additional resources, and insights into user preferences.

The application's effectiveness was evaluated against ISO/IEC 25010 standards, demonstrating a 97.48% effectiveness rate, with high scores in usability, reliability, and security. The results indicate that the web application significantly enhances the library user experience, providing valuable data for informed decision-making and service optimization. Future research should focus on integrating OPAC functionalities, cataloging capabilities, citation generation, and extending the application to all academic library resources. This study underscores the potential of tailored web applications in transforming academic libraries to meet the evolving needs of their patrons.

**Key words:** E-resources, E-resources Access, MLIS and BLIS E-resources, Data Visualization, Web Application for E-resources, Engagement Metrics, Data Visualization Tools

## 1. INTRODUCTION

This manuscript introduces the development of a web application designed to address the challenges of utilizing

e-resources in academic libraries and optimizing its usage. As the influence of Information and Communications Technologies continues to reshape traditional library functions, the need for effective management of both physical and digital collections becomes paramount [1]. Academic libraries are transitioning from physical to hybrid models, integrating electronic resources such as e-books, e-journals, databases, and multimedia, to meet the evolving preferences of users who increasingly rely on digital sources for their academic and research needs [2]. OPACs often fall short in offering seamless access to full-text e-resources, such as unpublished and published research papers from the institution's repository. Additionally, they lack data visualization tools [3; 4; 5].

Today's academic landscape reflects the ubiquity of gadgets like mobile phones, tablets, and laptops, signifying a lifestyle shift that blends style with practicality in sync with technological progress [6]. Recognizing these changes, higher education institutions in developed Western nations view these gadgets as an opportunity to seamlessly integrate technology into education, underlining the vital role of academic libraries in creating user-friendly learning spaces [7].

The web application developed in this research not only enhances the ability to monitor user engagement but also provides detailed data on user interactions, resource utilization, and patron monitoring [8]. This data-centric approach empowers libraries to make informed decisions, refine promotional strategies, and optimize services based on user preferences [9].

The application introduces innovative features to improve the library user experience, including a robust search and retrieval feature with clear navigation icons for accessing full-text journal articles and abstract-only resources within the library's subscriptions. Moreover, it seamlessly integrates with additional online resource content, such as proquest.com, Google Scholar, and SCC Panagdait Journal, encompassing academic databases, online journals, and e-books.

Additionally, the application provides personalized recommendations based on users' engagement or search

history and utilizes data visualization to help librarians gain insights into user preferences and make informed decisions for future initiatives [8; 9].

By tracking engagement metrics and utilizing data visualization tools, libraries can measure the impact of promotional efforts, optimize services, and better meet the needs of their community [10; 11]. This research not only improves the user experience but also empowers libraries to adapt and thrive in the digital age.

The development of this web application is based on user-focused strategies that prioritize user experience design and tailor services to meet the needs and preferences of library patrons [12]. The application's development aligns with Technological Acceptance Theory (TAT) principles, focusing on perceived usefulness and ease of use to encourage user adoption and engagement [13].

Furthermore, the application's adoption and diffusion among library patrons are explored through the lens of Diffusion of Innovation Theory (DOI), considering factors influencing the rate of adoption, such as relative advantage, compatibility, complexity, trialability, and observability [14].

Building upon insights from technological integration theories, this research introduces an application that not only monitors and scrutinizes user engagement but also provides detailed data on user interactions, resource utilization, patron monitoring, and report generation [8]. The application serves as a tool for effective marketing, elevating information literacy, and offering personalized services based on user engagement history.

The theoretical framework underscores the dynamic nature of library services, emphasizing the need for continuous assessment and adaptation based on user engagement data. ISO/IEC 25010, a standard that provides guidelines and recommendations for evaluating software product quality, is employed to further support the theoretical framework and answer questions in the study. This standard assists in evaluating the developed web application's accessibility, recommendation effectiveness, and utilization with electronic resources in an academic library context.

This research provides a comprehensive basis for the proposed research, addressing the challenges and opportunities presented by the evolving landscape of academic libraries.

This study aims to develop a web application that integrates modern content provider methods, search interfaces, and data visualization, introducing innovations to enhance the library user experience. Specifically, the research seeks to answer the following questions:

1. What modern content platform method can be adopted in the development of a web application with the following features?
  - a. Full-text access for journal articles and abstract-only resources;
  - b. A mechanism to link additional online resource content;
  - c. Personalized recommendations based on user engagement or search history;
  - d. Data visualization mechanism to understand user preferences, identify successful strategies, and make informed decisions for future initiatives?
2. What web application can be developed based on the adopted modern content platform?
3. How effective is the developed web app in terms of accessibility?
4. How effective is the developed web app in terms of recommendation?
5. How effective is the developed web app in terms of utilization with electronic resources in an academic library?

## 2. METHODOLOGY

This chapter delves into the methodology employed in the study, encompassing aspects such as research design, research environment, the participants involved, the instruments utilized for research, the procedure for gathering data, the analysis of data, and ethical considerations governing the research process. It details the research design employed to investigate the development and implementation of a web app for MLIS and BLIS academic resources.

## 3. RESULTS

The Design and Development of this research was completed by adopting a research design aligned with a software project-based approach, synthesizing principles from the Software Development Life Cycle (SDLC) and embracing the Agile model for iterative development. Recognizing the imperative need to enhance the library user experience in the context of modern content providers, the research design strategically positions itself to address the challenges articulated in the statement of the problem.

### 3.1 Requirements Specification

Defining requirements is a crucial step in software system development. This process involves clearly articulating and formally documenting both functional and non-functional

requirements to ensure alignment with the software's intended goals and user expectations. During this phase, data was meticulously collected from primary users of the web application, including school librarians, BLIS and MLIS students, and faculty members. The information gathered from these key stakeholders significantly shaped the direction and focus of the web application development.

### 3.2 Planning

The planning phase of this study was critical in ensuring the successful development and implementation of the web application for MLIS and BLIS academic resources. This phase involved several key activities, all aligned with the Agile model, particularly the Scrum framework, to provide a structured yet flexible approach to project management.

#### 3.2.1 Initial Planning

**Product Backlog Creation:** The planning began with creating a comprehensive product backlog. This involved the school librarians and the researcher collaborating to prioritize items on the system backlog, which was a dynamic list of desired features derived from user stories and requirements. Essential design outputs, such as the use-case diagram, ERD, Class Diagram, UML Activity Diagram, and Data Dictionary, were developed during this phase. These outputs defined the project scope and broke down features into manageable user stories.

#### 3.2.2 Sprint Planning

**Sprint Planning Meetings:** Before each sprint, a detailed sprint planning meeting was held where the system user/owner presented the top backlog items. The use-case diagram, ERD, Class Diagram, UML Activity Diagram, and Data Dictionary were referenced to determine the tasks for the upcoming sprint. This ensured that each sprint had clear objectives aligned with the overall project goals.

#### 3.2.3 Backlog Refinement

**Backlog Refinement/Grooming:** At the end of each sprint, a backlog refinement session was conducted. The researcher and librarian reviewed the backlog to ensure it was ready for the next sprint. This involved removing irrelevant user stories, creating new ones, reassessing priorities, and breaking down larger stories into smaller tasks. Feedback from the sprint informed updates to the design documents.

#### 3.2.4 Daily Scrum

**Daily Scrum Meetings:** Daily Scrum meetings were an essential part of the planning process, providing a forum for discussing progress, goals, and challenges. These short, focused meetings ensured that the development stayed aligned with project objectives and addressed any issues promptly.

#### 3.2.5 Sprint Review and Retrospective

**3.2.5a Sprint Review:** At the end of each sprint, a sprint review was conducted where completed work was presented. Live demonstrations were preferred over reports to show the actual progress. The use-case diagram, ERD, Class Diagram, UML Activity Diagram, and Data Dictionary were used to verify that the developed features met the initial design and requirements.

**3.2.5b Sprint Retrospective:** Following the sprint review, a sprint retrospective was held to reflect on the effectiveness of the Scrum process. This session involved discussing successes, challenges, and areas for improvement. Any feedback related to design outputs was incorporated into planning future sprints.

#### 3.2.6 Iterative Development

The planning phase was structured around the iterative nature of the Agile model. Each sprint contributed to the continuous improvement of the web application, ensuring that development remained responsive to the evolving needs of library patrons. This iterative approach allowed for regular reassessment and adaptation, facilitating effective resource utilization and alignment with user requirements.

The planning phase set the foundation for a systematic and adaptable development process. By leveraging the Agile model and Scrum framework, the project ensured a high level of collaboration, continuous improvement, and alignment with the needs of MLIS and BLIS library users. The detailed planning activities, from initial backlog creation to iterative sprint reviews and retrospectives, were crucial in navigating the dynamic landscape of software development within academic libraries.

### 3.3 Designing

The design phase of this study was meticulously planned to translate the initial requirements and user stories into detailed system specifications and visual models. Drawing on the Agile model's iterative approach and leveraging the Scrum framework, the design activities focused on creating comprehensive and adaptable design outputs. These outputs, including use-case diagrams, Entity-Relationship Diagrams (ERDs), Class Diagrams, UML Activity Diagrams, and Data Dictionaries, served as foundational tools to guide the development process. The design phase ensured that the web application's architecture was robust, user-centered, and capable of evolving with the project's dynamic needs.

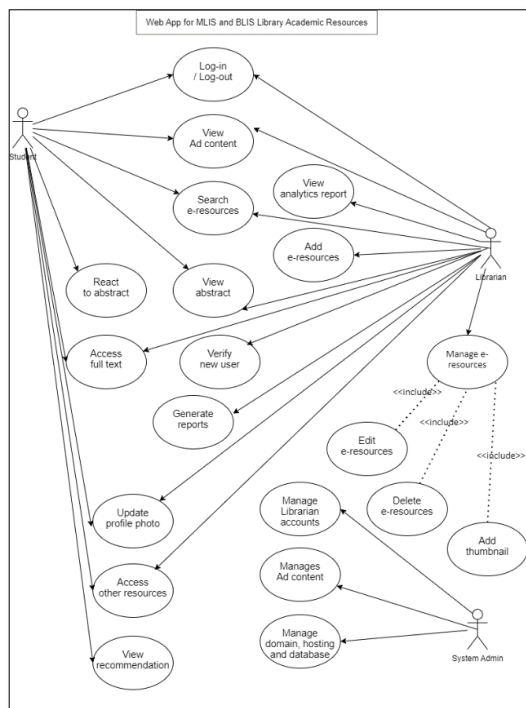
#### a. Technical Specification

The technical specification for the web application was designed to ensure a robust and user-friendly system. The stack included HTML, CSS, and JavaScript for the front-end, with SQL for database management. JSON was used for data interchange between the client and server. The application

was deployed on a reliable hosting platform, ensuring accessibility and scalability. Security measures included the use of HTTPS for secure communication and proper validation of user inputs. The design emphasized creating an intuitive and accessible

### b. Use-Case Diagram

A Use Case Diagram illustrates the various interactions between users, or "actors," and the system to achieve specific objectives or tasks. This diagram includes actors, use cases, and their relationships, offering a clear and concise depiction of the system's functionality.



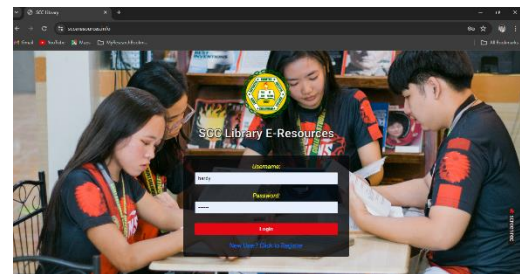
**Figure 1:** Web App for MLIS and BLIS Library Academic Resources

Figure 1 illustrates the Use-Case Diagram for the Web Application designed to cater to the academic resource needs of MLIS and BLIS students. This diagram outlines the various interactions between users and the system, including the actions users can perform and the system's responses. It provides a visual representation of the functional requirements of the web application, helping to clarify the system's behavior and its intended functionality.

### c. Interface Design

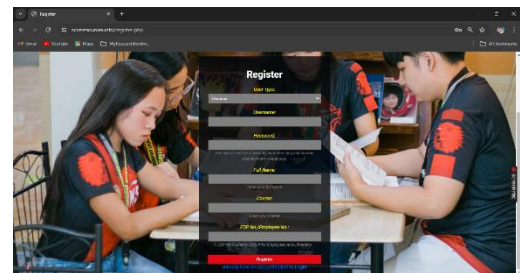
The interface design is paramount in shaping the usability and efficacy of the Development of a Web Application for MLIS and BLIS Library Academic Resources. It entails the meticulous arrangement of visual components, such as buttons, icons, and navigation menus, to elevate user engagements and overall experience. The objective of interface design is to streamline efficient and enjoyable

interactions between users and the system, with considerations for aesthetics, usability, and accessibility. Furthermore, the interface must cater to users of all technological proficiencies, ensuring inclusivity across diverse user groups.



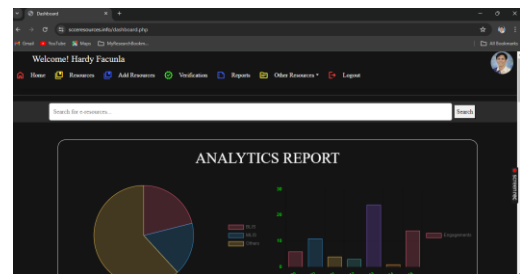
**Figure 2:** Login page for both users and administrators

Figure 2 shows the login page of the web application, catering to all verified users and administrators of the system.



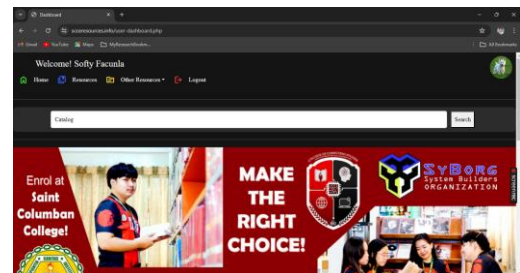
**Figure 3:** New user's registration page

Figure 3 shows the registration page for library patrons and staff who wish to create a new account.



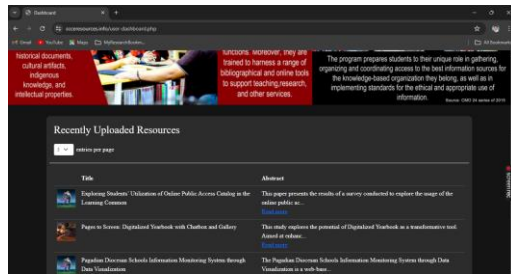
**Figure 4:** Dashboard for librarians with visualizations

Figure 4 presents the dashboard of a school librarian who serves to as the administrator, where reports and data visualizations are presented in the form of graphs and analytics.



**Figure 5:** Dashboard for library users

Figure 5 displays the dashboard of a student or teacher who wishes to access an electronic resource.



**Figure 6:** Dashboard for library users with recent resources

Figure 6 shows the dashboard of a student or teacher who wishes to access an electronic resource.

### 3.4 Development Implementation

#### 3.4 Development Implementation

During this phase, the web application for MLIS and BLIS Library Academic Resources undergoes its tangible creation and coding. Drawing upon the user-focused design approach guided by the Technological Acceptance Theory (TAT) and Diffusion of Innovation Theory (DOI), developers meticulously translate the detailed design specifications into functional code, marking the concrete realization of the envisioned functionalities and features. Leveraging a stack of technologies, including HTML5, PHP, MySQL, JavaScript, Bootstrap, and CSS, the system takes shape as a dynamic, web-based platform.

Developed in response to the challenges faced by academic libraries in managing educational resources, particularly for MLIS and BLIS programs at Saint Columban College, Pagadian City, the web application aims to revolutionize resource utilization and user experience. It addresses the limitations of traditional Online Public Access Catalogs (OPACs) by seamlessly integrating full-text e-resources, unpublished and published research papers, and content from the institution's repository, while also incorporating intuitive data visualization tools.

The system not only streamlines administrative login processes but also enhances data monitoring capabilities, empowering librarians with a centralized view of resource utilization and user engagement metrics. By providing personalized recommendations based on user engagement history and employing data visualization techniques, the platform offers insights into user preferences, facilitates informed decision-making, and optimizes services to meet the evolving needs of library patrons.

Through innovative features such as robust search and retrieval functionalities, clear navigation icons, and integration with additional online resource content like proquest.com, Google Scholar, and SCC Panagdait Journal, the web application enhances accessibility and expands the scope of available resources. Moreover, its adherence to

ISO/IEC 25010 standards ensures high effectiveness rates in usability, reliability, and security, further validating its role in transforming academic libraries into dynamic, user-centric learning spaces.

### 3.5 Testing

The testing phase of the web application for MLIS and BLIS Library Academic Resources was conducted to ensure adherence to established specifications from the planning phase. Testing procedures were executed in line with ISO/IEC 25010 standards to assess both functional and non-functional aspects of the system. The results of the testing phase indicate:

**Functional Pass/Fail Summary:** The system achieved an impressive total effectiveness rate of 97.48%.

**ISO/IEC 25010 Functional Test Results Summary:** Detailed tests were conducted for various user functionalities and librarian-specific features, with scores ranging from 89.52% to 97.53%.

**Functional Summary or Overall System Efficiency & Effectiveness:** The system demonstrated a 97.48% bug-free performance, reflecting exceptional stability and reliability.

**ISO/IEC 25010 Non-Functional Test Results Summary:** Non-functional aspects such as functional stability, reliability, portability, usability, performance efficiency, security, compatibility, and maintainability were evaluated, with scores ranging from 88.75% to 93.00%.

**Discussion of Results:** The testing phase revealed that the developed web application performs well in terms of functionality, reliability, usability, and security, meeting the requirements set by ISO/IEC 25010 standards. Specific functionalities such as user registration, login/logout, dashboard, resources menu, and page tests performed excellently, with scores above 90%.

**Suggestions for Future Research:** Based on the findings and limitations of this study, recommendations for future research include integration with OPAC, implementation of cataloging capabilities, addition of citation generation capability, and further enhancement of the user interface and experience based on user feedback.

### 3.6 Deployment

Deployment of the web application for MLIS and BLIS Library Academic Resources involved the systematic release and installation of the software in the production environment. The deployment process ensured seamless transition from development to live operation, with careful consideration of system requirements, compatibility, and user accessibility. Key activities during deployment included:

Configuration of server environments: Setting up servers and configuring necessary software components to support the web application.

Installation of the web application: Uploading application files to the server and configuring databases and dependencies.

Testing in production: Conducting final tests to ensure proper functionality and performance in the live environment.

User training and support: Providing training sessions and resources to users to familiarize them with the web application and address any questions or concerns.

Monitoring and optimization: Continuously monitoring the deployed application for performance issues and optimizing as needed to ensure smooth operation.

Overall, the deployment phase ensured that the web application was successfully installed and operational in the production environment, ready to serve the needs of MLIS and BLIS academic libraries.

### 3.7 Maintenance

#### 3.7.1 IT Experts and Students Evaluation of the Web Application for MLIS and BLIS Library Academic Resources

The maintenance phase of the web application for MLIS and BLIS Library Academic Resources involves ongoing support, updates, and enhancements to ensure its continued functionality and effectiveness. Key activities during the maintenance phase include:

Bug fixes: Addressing any reported bugs or issues to maintain system stability and reliability.

Software updates: Implementing software updates and patches to address security vulnerabilities and improve performance.

Feature enhancements: Introducing new features or improving existing ones based on user feedback and evolving requirements.

System monitoring: Continuously monitoring system performance and usage patterns to identify potential issues or areas for improvement.

User support: Providing ongoing support and assistance to users to address any questions or concerns related to the web application.

The maintenance phase ensures that the web application remains up-to-date, secure, and responsive to the changing needs of MLIS and BLIS academic libraries.

The evaluation of the web application for MLIS and BLIS Library Academic Resources involved gathering feedback from various stakeholders, including BLIS, MLIS, BSIT, and BSCS students, teachers, and librarians. Key aspects evaluated included usability, functionality, performance, and overall satisfaction with the application. Feedback was collected through surveys, interviews, and user testing sessions, with results analyzed to identify strengths and areas for improvement. The evaluation process provided valuable insights into user perceptions and preferences, guiding future enhancements and optimizations to the web application.

### 4. CONCLUSION

The development and implementation of the web application for MLIS and BLIS Library Academic Resources represent a significant advancement in addressing the challenges faced by academic libraries in managing digital resources and providing a seamless user experience. Through adherence to ISO/IEC 25010 standards and incorporation of user feedback, the application has demonstrated high functionality, usability, reliability, and security.

The testing phase confirmed the application's robust performance, achieving an impressive bug-free rate of 97.48% and meeting ISO/IEC 25010 standards across various functional and non-functional aspects. Deployment ensured smooth transition to the production environment, while ongoing maintenance guarantees continued support and optimization.

Feedback from BLIS, MLIS, BSIT, and BSCS students, teachers, and librarians provided valuable insights, guiding further enhancements and improvements to the application. Despite its success, there are areas for future research and development, including integration with OPAC, implementation of cataloging capabilities, addition of citation generation functionality, and ongoing enhancement of the user interface and experience.

In conclusion, the web application for MLIS and BLIS Library Academic Resources has significantly contributed to enhancing resource accessibility, user engagement, and overall effectiveness of academic libraries in the digital age. By leveraging modern technologies and user-centric design principles, the application is poised to continue meeting the evolving needs of library patrons and supporting academic research and learning initiatives.

### REFERENCES

1. Makate, M. G. (2022). **Usage of library electronic resources by students at North West University, Vaal Triangle Campus, South Africa.** <https://core.ac.uk/download/541098932.pdf>.
2. Murugan, M., & Jeyshankar, R. (2021). **Problems faced by physically challenged students in accessing and utilizing the library resources and services of college**

- students in India.** Productivity, 61(4), 470-484. doi:<https://doi.org/10.32381/PROD.2021.61.04.10>.
3. Adeoye, A. A., & Olanrewaju, A. O. (2019). **Use of technology acceptance model (TAM) to evaluate library electronic information resources use by undergraduate students of Lead City University, Ibadan, Nigeria.** Library Philosophy and Practice, 1-24.
  4. Kay, J. (2019). **Improving access to e-resources for users at the University of Derby: enhancing discovery systems with Library Plus 2.0.** Insights, 32(1).
  5. Doliente, C. J. O., Tual, D. X., Paglinawan, Z. B., Naparan, J. A., & Facunla, H. L. (2023). **Exploring Students' Utilization of Online Public Access Catalog in the Learning Common.** International Journal, 12(4).
  6. Julianingsih, D., Prawiyogi, A. G., Dolan, E., & Apriani, D. (2021). **Utilization of gadget technology as a learning media.** IAIC Transactions on Sustainable Digital Innovation (ITSDI), 3(1), 43-45.
  7. Sejane, L. (2017). **Access to and use of electronic information resources in the academic libraries of the Lesotho Library Consortium** (Doctoral dissertation).
  8. Kim Schildkamp (2019) **Data-based decision-making for school improvement: Research insights and gaps,** Educational Research, 61:3, 257-273, DOI: 10.1080/00131881.2019.1625716.
  9. Atkins, Adam, Wanick, Vanissa and Wills, Gary (2017) **Metrics Feedback Cycle: measuring and improving user engagement in gamified eLearning systems.** International Journal of Serious Games, 4 (4), 3-19, [1]. (doi:10.17083/ijsg.v4i4.192).
  10. Mark Eaton (2017) **Seeing Library Data: A Prototype Data Visualization Application for Librarians,** Journal of Web Librarianship, 11:1, 69-78, DOI: 10.1080/19322909.2016.1239236.
  11. Zipayao, L. R. L., Sorabia, J. S., Cañete Jr., R. P., Encarnacion, P. C., Facunla, H. L. (2024). **Pagadian Diocesan Schools Information Monitoring System through Data Visualization.** International Journal, 12(5).
  12. Kenneway, M. (2007). **Marketing the library: using technology to increase visibility, impact and reader engagement.** Serials: The Journal for The Serials Community, 20, 92-97.
  13. Davis, F. D. (1989). **Perceived usefulness, perceived ease of use, and user acceptance of information technology.** MIS quarterly, 319-340.
  14. Sahin, I. (2006). **Detailed review of Rogers' diffusion of innovations theory and educational technology-related studies based on Rogers' theory.** Turkish Online Journal of Educational Technology-TOJET, 5(2), 14-23.