

Improving Academic Processing Systems to Support Outcome-Based Education Module (OBEM) Implementation at KMUTT

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The Kyoto Conference on Arts, Media & Culture 2025
Official Conference Proceedings

Abstract

King Mongkut's University of Technology Thonburi (KMUTT) has promoted outcome-based education (OBE) across all levels of study. This approach emphasizes flexibility in learning design, with courses developed as modular learning units under the Outcome-Based Education Module (OBEM) framework. The objective is to create flexible learning experiences that allow students to develop their abilities through modularized learning pathways. To achieve this educational initiative, KMUTT recognized the need to enhance its academic information system, known as the New Academic Information System (New ACIS), to fully support registration, grading, and academic processing aligned with modular course structures. As a result, the OBEM Grading System—referred to as AVATAR—was developed to integrate with the Learning Environment version B2 (LEB2) and the New ACIS. This enabled the management of learning outcomes, grading, academic status tracking, Buffer Class administration, and reassessment processes. The implementation showed that the system could support OBEM-based grading and processing with 90% accuracy, compared to the 100% target. However, limitations remain, particularly in system integration, real-time data synchronization, and flexibility in updating “In Progress” (I) grades, which may impact students' academic progress. Recommendations for system improvements include developing a seamless and fully integrated OBEM platform, enhancing risk-tracking functions for at-risk students, and creating a Credit Bank system to store all forms of learning outcomes. These efforts aim to improve administrative efficiency, ensure accurate assessments, and provide timely academic feedback aligned with students' actual learning achievements.

Keywords: outcome-based education, OBEM, academic processing system, modular learning, AVATAR, learning outcomes, new ACIS, reassessment

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Introduction

King Mongkut's University of Technology Thonburi (KMUTT) has implemented a policy to promote and support Outcome-Based Education (OBE). This approach aims to enhance flexibility in teaching and learning, including responding to the need for skills and knowledge in the 21st century. OBE has been commonly recognized internationally as a significant mechanism for improving educational quality by focusing on learners' outcomes (Biggs & Tang, 2011; Harden, 2007). KMUTT has adopted this concept by designing courses in modular formats, known as Outcome-Based Education Modules (OBEM), to provide opportunities for students to develop their potential and to integrate knowledge across various learning modules.

This initiative aligns with KMUTT Strategic Plan No.13 (2025–2029), which clearly defines its strategic objectives. These objectives focus on developing human resources in science, technology, and innovation. The plan also provides high-quality education based on learning innovation, promoting openness and inclusiveness for all learners, and strengthening the university's capacity to adapt to future changes and uncertainties (KMUTT, 2025).

There were several critical limitations initially implemented by the OBE, especially the New Academic Information System known as New ACIS. The New ACIS could not directly process grading based on learning outcomes (LOs) for modules. The system was designed to link with the traditional structure of course listings in the official curriculum. This brought about inconsistencies between the intended OBEM assessment framework and the actual operational system. Data exchange and synchronization among the New ACIS, the university's online learning platform (Learning Environment B2: LEB2) platform, and the OBEM Grading System (AVATAR), and were not seamless. This caused delays and confusion in recording and transferring students' LOs, particularly when mapping results between modules and core courses. The problem was especially evident among students receiving grade I (In Progress). It could not be solved within a single semester and sometimes required up to a full academic year. This was affecting students' academic status and progression.

KMUTT developed the AVATAR, to support modules under the OBEM framework. The system connects modules and core courses through integration with LEB2 and the New ACIS. This is similar to the Integrated Educational Management Tool (IEMT) at Adamson University, which successfully combined examination, grading, and curriculum management functions (Doctor, 2017). The AVATAR aims to provide seamless data linkage and automated academic processing aligned with KMUTT's OBE framework.

The goal is to create a unified system for assessing student LOs and ensuring continuous linkage among the AVATAR, LEB2, and New ACIS systems to effectively support OBEM implementation at KMUTT. This aligns with the system integration principles described by Kushari and Septiadi (2022).

Methodology

The development of a supporting system for teaching and learning under the OBEM framework was designed to effectively link and synchronize data among the LEB2, AVATAR, and New ACIS platforms. This includes supporting student learning through the Buffer Class mechanism with reassessment opportunities for improving individual LOs. The development process was carried out as follows.

Planning and Coordination

A systematic implementation plan was established with the initial step of developing an academic information system to support the OBEM. A working group was formed comprising representatives from key units - the Education Development and Services (EDS), the Education Technology Development and Service (ETS), the Gifted Education Office (GEO), the Computer Center, and the Registrar's Office. The team collaboratively defined the framework for developing and integrating the information systems to enable effective data linkage across units.

The AVATAR was designed by focusing on accurate mapping between modules and core courses. The system connects seamlessly with both the LEB2 and the New ACIS. This planning stage emphasized cross-functional integration among academic, technological, and registration units to ensure consistent system development and effective implementation of teaching and learning under the OBEM framework.

Roles of Key Units

The development of the AVATAR relied on collaboration among multiple units across the university, each playing a distinct and essential role as follows:

- The EDS provided training and guidance to faculties and schools in designing courses and modules aligned with the OBE framework.
- The Computer Center and the ETS developed the AVATAR to ensure seamless integration with the LEB2 platform and the New ACIS.
- The Registrar's Office planned and structured the linkage of registration and grading data across systems, verified workflow accuracy among the LEB2, AVATAR, and New ACIS systems, and monitored academic record processing and student status. The office also coordinated with system developers to address operational issues and improve functionality.
- The GEO managed the Buffer Class system, prepared students for continued learning, and supported Teaching Assistants (TAs) in facilitating learning within modules.

System Design and Development

The design and development of the AVATAR focused on creating a technical architecture that enables efficient data integration and automated grading processes. The system serves as a centralized platform for recording students' LOs in each module and synchronizing data with New ACIS and LEB2 through a secure integration layer.

The development included database design, data synchronization mechanisms, and user authorization management to ensure that both instructors and students could access the system effectively. This structure allows academic and administrative processes to operate seamlessly within the OBEM framework. The system was developed using the Django framework (Python) and operates with Nginx as the web server to ensure scalability and reliability. While OBEM employed PostgreSQL as its database engine, AVATAR 2.0 utilized Microsoft SQL Server (MSSQL) to enable faster query execution and improved interoperability with the New ACIS database. This upgrade addressed performance bottlenecks from the prototype phase (AVATAR 1.0) and established a more stable and secure data-exchange framework across platforms.

Workflow of OBEM Implementation

The implementation of teaching and learning under the OBEM framework consisted of four stages as follows:

Figure 1

Overview of the OBEM Management Process



OBEM Design

The OBEM design process was developed under the OBE framework, focusing on defining clear LOs that are directly aligned with learning activities and assessment methods to ensure that students achieve the intended program competencies. The university supported their instructors through training sessions, consultations, standardized templates, and hands-on module design workshops. The support included LO and rubric consultation teams, standardized module proposal forms, and structured feedback. These activities helped instructors to understand the OBEM process and to accurately submit course information to the New ACIS.

Assess LO

This stage lets instructors access and link courses' LO and rubrics with learning activities and assessments through the LEB2 platform. This system connects the program-level Ultimate LOs with the module-level LOs, ensuring that teaching design and assessment processes are systematic and verifiable. Moreover, the data gained from this system will be used to report student's competency.

Submit LO Result and Course Grade

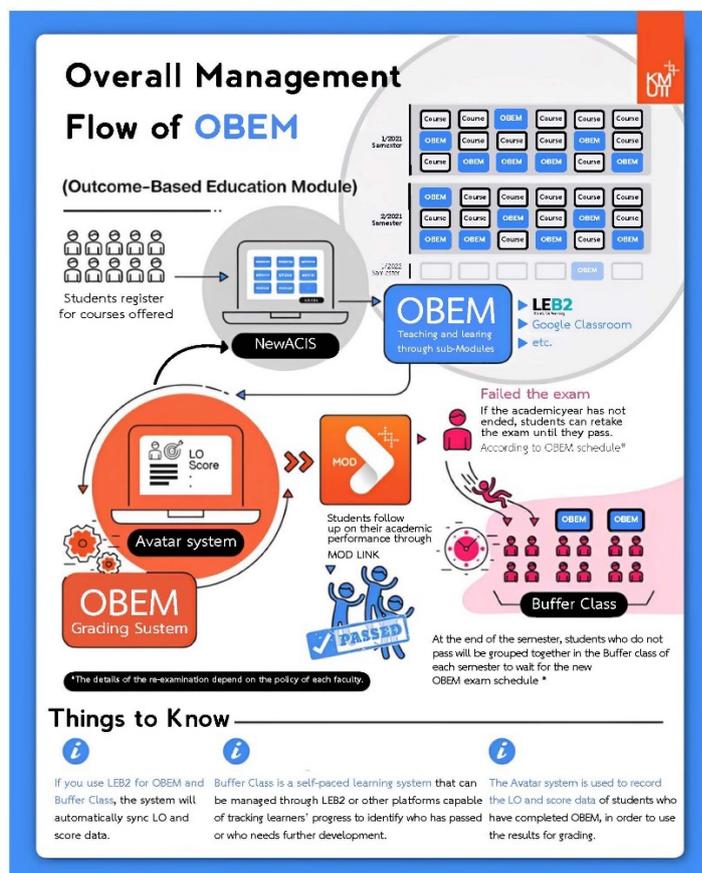
The Registrar's Office is responsible for the submission of LO results and course grades to ensure that both modules and core courses are evaluated in accordance with the OBEM framework. The process covered these various key stages: planning and setting grading criteria, recording LO results, processing course and student status data, summarizing final grades, and monitoring In-Progress (I) cases. The evaluation process became systematic, transparent, and consistent with OBEM quality standards through the integration system.

Take Care of Buffer Classes

Buffer classes were established and were a mechanism that allowed students to achieve the required LOs of a module. The process included re-registration within the buffer system, reassessment, grade recalculation, and progress tracking until the results were announced. This approach enabled students to complete the required LOs systematically without effecting their core course registration or academic progression. If students failed to complete or achieve the targeted LOs within the assigned semester, the university processed the best available results as their final grade.

This process was developed to integrate seamlessly with the university's information systems to ensure efficient processing and monitoring of students' LOs, illustrated in Figure 2.

Figure 2
Overall Management Flow of OBEM



Pilot Testing and Improvement

Several faculty members conducted pilot testing in selected courses to evaluate the AVATAR system's performance and ensure accurate data integration with the New ACIS and the LEB2. Feedback from instructors, students, and administrative staff was then collected to improve system functionality and ensure readiness for full-scale university implementation.

Results and Discussion

The integrated OBEM system (AVATAR–LEB2–New ACIS integration) was implemented in two phases, covering the period from Semester 1/2021 to Semester 1/2023. The first phase (Semester 1/2021–2/2022) known as AVATAR 1.0, focused on testing the prototype system to verify data accuracy and the processing of learning outcomes (LOs). The second phase (Semester 1/2023–2/2023) called AVATAR 2.0, emphasized improving and expanding the system to fully support teaching and learning under the OBEM framework.

Phase I: Initial Implementation (Semester 1/2021–2/2022)

The first phase of developing AVATAR 1.0 aimed to test data linkage among the LEB2, AVATAR 1.0, and New ACIS systems. The focus was to ensure accurate and complete

recording of LOs and grading for modules.–The results showed that the accuracy and completeness of LO data processing reached an average of 90%, which was close to the target (100%) but still below the expected standard.

The number of OBEM courses from the academic years 2021–2022 equaled 127 and consisted of 423 modules, with a total of 94,005 module enrollments. Among these, the total number of module enrollments resulting in students being assigned to Buffer Classes was 6,327, as shown in Table 1.

Table 1

Number of OBEM Courses and Module Enrollments (Academic Years 2021–2022)

Academic Semester	Courses	Modules	Student Enrollment (Modules)	Students Assigned Buffer Class (Modules)
1/2021	9	35	25,911	1,282
2/2021	38	128	18,904	1,032
1/2022	36	118	29,068	1,640
2/2022	44	142	20,122	2,373
Total	127	423	94,005	6,327

The Results Revealed Several Key Limitations

1. Data exchange among the LEB2, the AVATAR, and the New ACIS was not fully synchronized, causing confusion in the assessment of LOs.
2. Student lists in LEB2 were not updated in real time, especially in cases related to grade I (In Progress) adjustments.
3. Grade I corrections could not be completed within a single semester; in some cases, they took up to one academic year, which affected students' academic status and progression.

Table 2

Accuracy and Completeness of Data Processing Results

Issue Type	Description	No. of Records	Percentage
Incomplete Synchronization	Partial linkage between AVATAR and New ACIS	289	4.57%
Duplicate Data Submission (Student lists)	Lack of pre-submission checking process	150	2.37%
Grade I corrections	Timing mismatch between Buffer Class and New ACIS	171	2.70%
Total Errors		610	9.64%
Accurate & Complete Records		6,327	90.36%

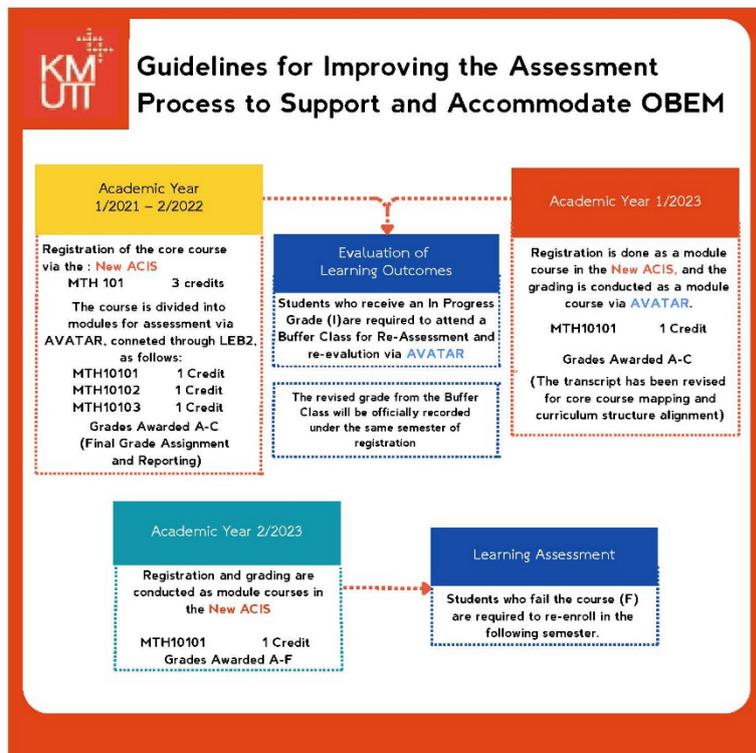
The results indicate a data accuracy rate of 90.36%, which is close to the required institutional rate of 100%. The most frequent issue was Incomplete Synchronization. This highlights the need for enhanced system integration and real-time validation mechanisms.

Based on these issues, the university has upgraded the system in several areas, including data processing, module design, and course separation. These make the assessment of LOs clearer and reduce delays in grade management. Additionally, the university developed the Guidelines

for Improving the Assessment Process to Support and Accommodate OBEM. The guidelines outline a sequence of system enhancements and data integration among the AVATAR, LEB2, and New ACIS systems, as illustrated in Figure 3.

Figure 3

Guidelines for Improving the Assessment and Data Integration Process to Support OBEM

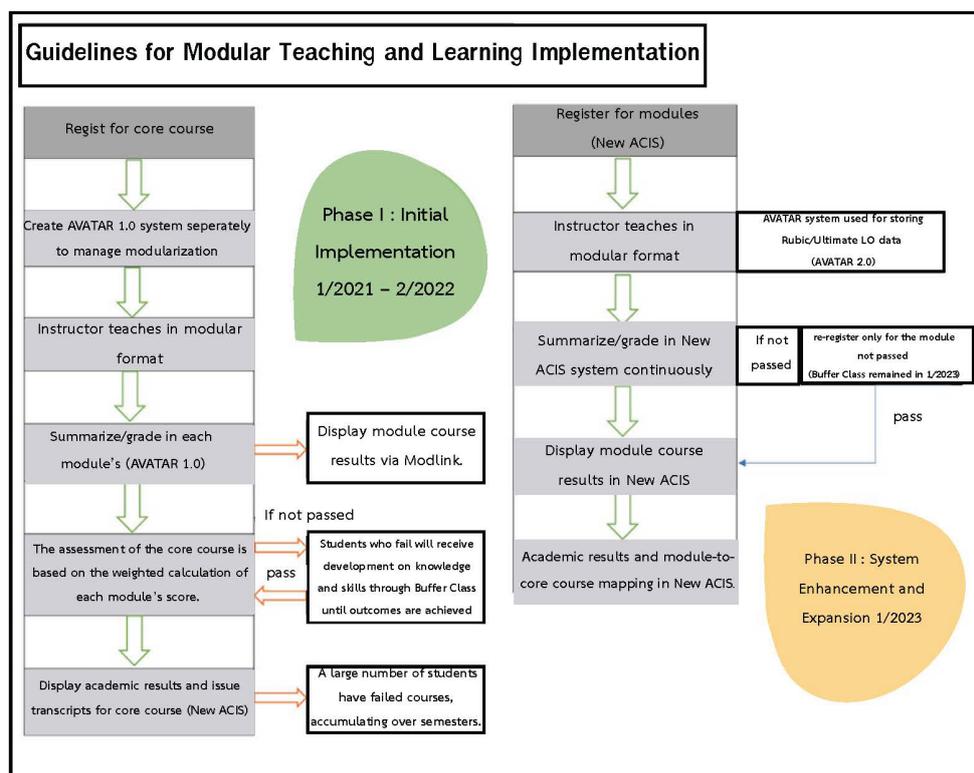


Phase II: System Enhancement and Expansion (Academic Year 2023)

The second phase was the continuous improvement of the system to enable real-time data integration among the AVATAR 2.0, LEB2, and New ACIS platforms. The results showed that the integrated OBEM system successfully supported the mapping between modules and core courses. This made the assessment of LOs more accurate and efficient.

The following figure shows the comparison between system development and implementation in Phase I and Phase II. It illustrates the process of the Modular Teaching and Learning approach between Academic Years 2021–2022 and the revised implementation that began in Academic Year 2023, as shown in Figure 4.

Figure 4
Modular Teaching and Learning Before and After System Improvement



After the system was developed, all core courses were restructured into modular formats under the OBEM framework. In the first semester of Academic Year 2023, a total of 59 modules were offered with 19,394 enrollments. However, the integrated OBEM system could not yet fully support module-based course registration, as it was still undergoing system adjustments. As a result, some students continued to receive In Progress (I) grades due to incomplete synchronization across systems.

In the second semester of Academic Year 2023, there were 88 modules, an increase from 59 modules in the first semester. The total number of students slightly decreased to 15,146, and there were no Buffer Class records this semester. This means most students were able to finish their LOs within the assessment period. It also shows that the system worked more smoothly and efficiently. Overall, the improved OBEM system not only supports module-based registration but also helps automate academic processes and reduces extra work for instructors, as shown in Table 3.

Table 3
Number of Module Enrollment via New ACIS (Academic Year 2023)

Academic Semester	Courses	Modules	Student Enrollment (Modules)	Students Assigned Buffer Class (Modules)
1/2023	-	59	19,394	3,088
2/2023	-	88	15,146	-

The results also revealed that the management of Buffer Classes and the reassessment process provided greater opportunities for students to continuously improve their learning

performance. Moreover, the new transcript system can transparently and accurately map module courses to core courses, ensuring clarity and traceability in the evaluation process.

Discussion

This project demonstrates an approach of continuous improvement when developing integrated academic systems to support OBE implementation at KMUTT. The integrated OBEM system demonstrates steady progress from the initial testing phase to full-scale implementation. The first phase focused on system testing and data refinement, while the second phase achieved stable data integration and practical utilization in managing teaching and learning processes under the OBEM framework.

Conclusion

The integrated OBEM system has made the process of recording and processing LOs more accurate and systematic. The first phase of implementation helped identify technical and data-structure issues that required improvement, while the second phase demonstrated significant progress in system integration, Buffer Class management, and flexible, transparent grade processing.

Overall, the systems as developed have proven capable of supporting teaching and learning under the OBEM framework and they serve as a model for developing integrated academic management systems at the university level.

Recommendations

The following recommendations were developed based on the findings and implementation results of the AVATAR. They focus on improving system integration, user understanding, and institutional readiness to ensure the success of outcome-based education across KMUTT. To ensure the sustainability and scalability of KMUTT's OBEM implementation, several key recommendations are proposed including the following:

Continuous Development of AVATAR and New ACIS

The AVATAR and New ACIS systems should be continuously improved to enable real-time data synchronization and enhanced reporting capabilities through a dashboard feature. This will allow ongoing and accurate monitoring of students' LOs.

Strengthening Users' Understanding of the System

Training and capacity-building sessions should be organized to enhance shared understanding among faculty members, administrators, support staff, and system developers. This will ensure consistent usage and alignment in recording and managing LOs across the university.

Expansion of OBEM Implementation

The integrated OBEM System should be expanded to cover all faculty and academic programs, along with revisions to the curriculum to align with the modular approach. This will support flexible and outcome-based teaching and learning across the university.

Integration With Other University Information Systems

The integrated OBEM system should be connected to other information systems within the university including the quality assurance and research information systems. This will enable comprehensive and seamless data utilization across all platforms.

In the next developmental phase, KMUTT plans to extend system capabilities with risk-tracking features and a Credit Bank system to support lifelong learning and competency accumulation.

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