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Closing the loop: Strengthening course quality of Pharm.D. program via applying a comprehensive four-step review approach

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ABSTRACT

This study explores the course review process implemented by the College of Pharmacy at King Saud University for its Pharm.D. program. Through a qualitative research design, a dedicated course review committee was established to oversee the evaluation process. The committee gathered and analyzed data from various sources, including course reports, student evaluations, and exam center reports, to achieve a holistic understanding of each course's effectiveness. The evaluation process was structured into a Four-Step Course Evaluation Approach: data collection, data review and recommendations, taking appropriate action, and communicating the outcomes. The "closing the loop" stage ensured that recommendations were effectively implemented, and course evaluation data were systematically archived for future reference. The results of this study, based on the evaluation of 25 courses, revealed significant improvements in course quality, alignment with program learning outcomes, and adherence to accreditation standards. Key findings included the identification of gaps and discrepancies, leading to targeted interventions and enhanced course content. Overall, this study highlights the effectiveness of a structured course review process in enhancing the quality of education and ensuring continuous improvement within the college. The committee focuses on refining evaluation criteria, conducting workshops, and providing training to stay current with emerging accreditation standards and best practices. This systematic course review process demonstrates the College's commitment to providing high-quality education and preparing students for successful careers in pharmacy, with significant implications for the improvement of pharmacy education and the overall student learning experience.

1. Introduction

The pursuit of excellence in higher education is a continuous process that necessitates rigorous evaluation and refinement of course content and delivery. This need is particularly evident in the field of pharmacy, where the rapid evolution of the profession demands a curriculum that is both current and comprehensive (Austin and Ensom, 2008; Bader and Bates, 2017). In response, the College of Pharmacy at King Saud University (KSU) has implemented a comprehensive course review process. The primary objective of this process is to enhance the quality of courses and ensure their alignment with program learning outcomes (PLOs), as well as the stringent standards set forth by the National Commission for Academic Accreditation and Assessment (NCAAA) and the respected Accreditation Council for Pharmacy Education (ACPE) (Aljadhey et al.,

2017; Fathelrahman et al., 2022).

The College of Pharmacy has successfully obtained the approval of these two accreditation agencies, signifying its commitment to meeting and exceeding the firm criteria established by these esteemed bodies. The international agency, ACPE, and the national agency, NCAAA, have both recognized the College's dedication to excellence in pharmacy education (Aljadhey et al., 2017; Almaghaslah and Alsayari, 2021). By adhering to the guidelines and standards set by these accreditation agencies, the College of Pharmacy at KSU ensures that its curriculum remains at the forefront of contemporary pharmacy education.

Within the context of higher education, the concept of quality is multifaceted and intricate. The effectiveness of an educational program is reflected in the knowledge, understanding, and skills students acquire upon completion of the curriculum (Harvey and Green, 1993;

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Horsburgh, 1999). Therefore, the monitoring of quality should be centered around enhancing and advancing student learning experience. This can be achieved by identifying clear course outcomes and employing effective teaching and learning strategies that align with these objectives (Biggs, 1996).

To ensure the delivery of high-quality education that equips students with the necessary knowledge, skills, and values to thrive in their professional careers, the College of Pharmacy has implemented a four-step course review process, which the college has aptly named "Closing the Loop". This cyclical and iterative approach involves collecting course data, reviewing the data to identify necessary recommendations, taking appropriate action based on the recommendations, and communicating and following up on those improvement actions. This comprehensive process is designed to foster a culture of continuous improvement and ensure that the college's courses remain relevant, effective, and aligned with the evolving needs of the pharmacy profession (Persky et al., 2012).

The course review process places particular emphasis on foundational aspects of teaching, learning, and assessment. This includes evaluating the presence of appropriate learning objectives, the degree of learning-centered activities, assessment methods that align with the learning objectives, and the overall alignment of course objectives and goals (Boud and Falchikov, 2006; Persky et al., 2012). By focusing on these key elements, the course review process ensures that courses are designed and delivered in a manner that promotes effective teaching, active learning, and meaningful assessment (Kirwin et al., 2019).

This research article aims to explore the design and implementation of the comprehensive course review process at the College of Pharmacy, its impact on course quality, and how it has helped the institution maintain its position as a leading institution in pharmacy education. The article will also discuss the challenges encountered during the process and the strategies employed to overcome them, providing valuable insights for other institutions seeking to enhance their own course review processes.

2. Methodology

This study employed a qualitative research design to comprehensively investigate the course review process implemented by the College of Pharmacy at KSU. To ensure a thorough evaluation, a dedicated course review committee was appointed to oversee the entire process. This committee played a crucial role in gathering and analyzing data from various sources, including course reports provided by the course directors, student feedback, and exam center reports. By incorporating multiple perspectives, the committee aimed to achieve a holistic understanding of each course's effectiveness in meeting program learning outcomes and maintaining accreditation standards.

2.1. Participants and committee structure

The Pharmacy Education Unit, appointed by the Dean of the College of Pharmacy, plays a pivotal role in overseeing the successful development, delivery, assessment, and continuous improvement of the curriculum. This unit ensures the achievement of program learning outcomes, coordinates curriculum harmonization, implements education-related policies and standards, documents curriculum information, promotes research in pharmacy education, and designs faculty development initiatives. Under the umbrella of the Pharmacy Education Unit, the course review committee was established to ensure the quality and effectiveness of the courses offered. The committee operated with two distinct subspecialties: the scientific subspecialty comprised of members from the Clinical Pharmacy, Pharmacognosy, Pharmaceutics, Pharmacology and Toxicology, and Pharmaceutical Chemistry Departments, bringing their academic and professional expertise to the course review process. Additionally, a representative from the quality unit was integrated into the committee, forming the quality subspecialty. Each committee member, whether from the scientific or quality

subspecialty, was assigned specific roles and responsibilities within the course review process. This structure allowed for a thorough and detailed review of each course, ensuring alignment with both academic standards and quality requirements.

2.2. Roles and responsibilities

The quality representative played a crucial role in reviewing the course reports, specifically using the NCAA course report form, and ensuring that all courses adhered to the quality standards set by the college and the accreditation agencies. If a course report failed to meet the quality standards, the quality representative had the authority to send it back to the course director for revisions until the required quality standards were fulfilled. Once a course report passed the quality check, it was forwarded to the scientific members representing the five departments. These scientific members were responsible for examining each course using a four-step approach.

2.3. Course evaluation process

The College of Pharmacy has updated its Pharm.D. program, which was gradually introduced starting in the academic year 2021–2022. Over the past two academic years, we have collectively evaluated a total of 25 courses using this methodology, applying a comprehensive four-step assessment approach to evaluate the courses since the implementation of the updated Pharm.D. program.

2.4. Four-Step course evaluation approach

The Four-Step Course Evaluation Approach implemented by the scientific committee was a comprehensive and meticulous process that ensured a thorough assessment of each course offered by the College of Pharmacy (the course evaluation form is provided in the supplement). This approach involved multiple stages, starting with data collection, followed by data review and recommendations, taking appropriate action, and communicating the outcomes (Fig. 1).

2.4.1. First step: Data collection

In this step, the scientific committee gathered all relevant information about the course including course reports, student feedback, and exam center reports. Course reports provide detailed insights into the course content, objectives, and teaching methods employed. Student feedback offer valuable insights from the learners' perspective, highlighting the strengths and weaknesses of the course. To ensure a comprehensive evaluation, the committee has implemented two methods of student feedback ("A Step-by-Step Guide to Conducting Student Feedback for Course Evaluation" is provided in the supplement file). The first method involves conducting a survey with specific questions to gather input from students about their experience with the course. This allows the committee to collect quantitative data and feedback on various aspects of the course. The second method includes focused group discussions, where a representative from the Pharmacy Education Unit holds a meeting with two students representing both Male and Female campuses. These discussions provide an opportunity for students to share their thoughts, concerns, and suggestions regarding the course. In addition to student feedback, the Pharmacy Education Unit also gathers feedback from teaching faculty to gain insights into the course delivery and effectiveness using two primary methods. First, direct methods include written course reports, where the course director provides detailed reflections on course content, teaching methods, and challenges faced on behalf of the teaching faculty. Additionally, the Pharmacy Education Unit distributes surveys at the end of each semester to gather specific feedback on curriculum effectiveness and teaching experience. Exam center reports also play a role in the data collection phase, providing students' performance data that helps assess the alignment between course objectives and student outcomes. By

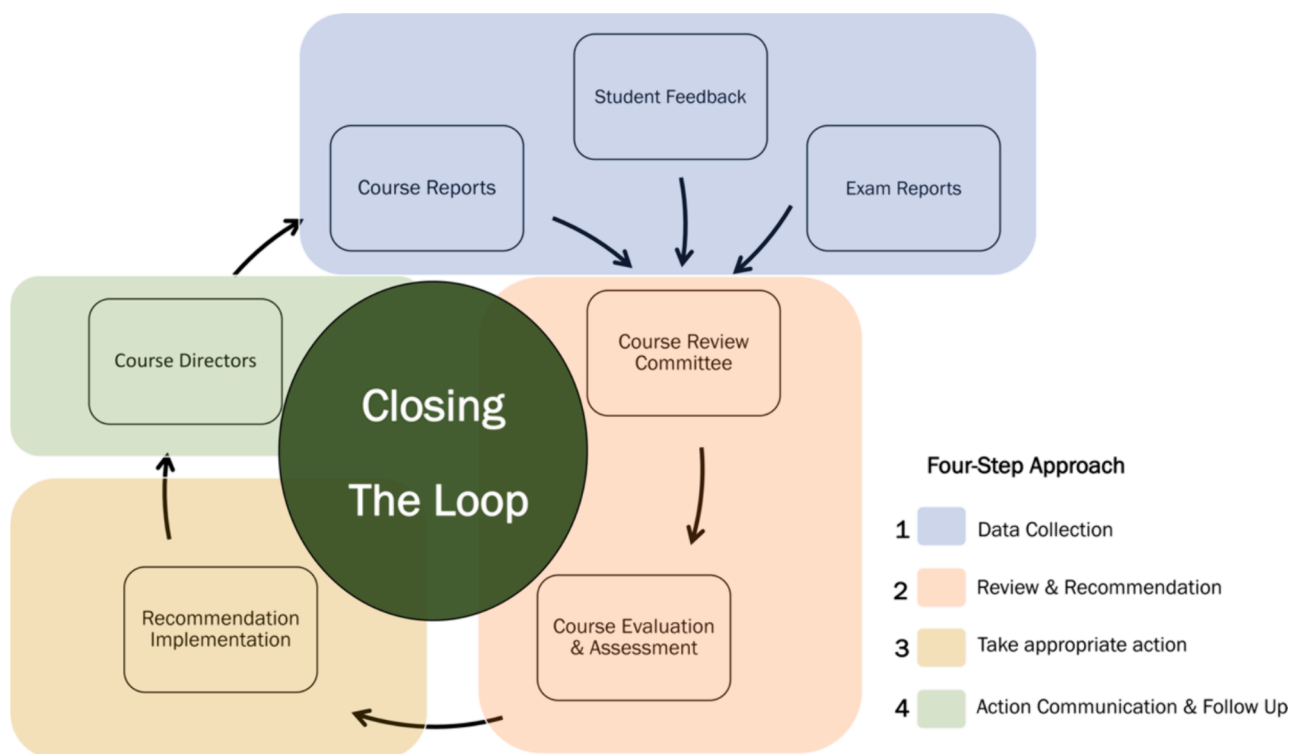


Fig. 1. Overview of the Four-Step Course Evaluation Approach leading to the “Closing the Loop” phase.

comparing course reports with exam center reports, the committee gains insights into the effectiveness of the course in preparing students for assessments and achieving desired learning outcomes.

2.4.2. Second Step: Data review and recommendations

Once the data was collected, the committee moved on to the second step, which is data review and recommendations. In this stage, the committee members analyzed the collected data to identify the strengths and weaknesses of the course. They carefully reviewed the course reports, student feedback, and exam center reports to gain a comprehensive understanding of the course’s effectiveness. During the Data Review and Recommendations phase, the course review committee ensured that the courses were aligned with their learning objectives and goals. They assessed the achievement of these objectives by analyzing student performance, feedback, and examination results. If the committee identified that a specific percentage of students were not meeting the objectives, they proposed corrective actions to enhance the course. Based on data analysis, the committee formulated recommendations for improvement. These recommendations that may include modifications to the course content, teaching methods, assessments, or any other aspect that can enhance the course quality.

2.4.3. Third Step: Take appropriate action

In this step, the committee worked closely with the course directors or other stakeholders to implement the recommended changes. This may involve revising the course syllabus, updating teaching materials, incorporating new instructional strategies, or providing additional resources such as providing the necessary laboratory equipment to support student learning. Therefore, each course had its own specific demands for modification, and the committee carefully evaluated the unique needs of each course. For example, if outdated content was identified, the course syllabus would be revised to include the latest topics. If student feedback suggested a need for more interactive learning, new instructional strategies such as flipped classrooms or problem-based learning were introduced. Additionally, if a course required laboratory equipment or materials, the committee facilitated the acquisition of

necessary resources by officially requesting the college administration to procure them. The committee ensured that the course director understood the rationale behind the recommendations and collaborates effectively to implement the necessary improvements.

2.4.4. Fourth Step: Communicating the action

The final step of the process was communicating the action taken. The committee informed the course director and other relevant stakeholders about the changes made and their expected impact on the course. This communication ensured transparency and accountability in the evaluation process. It also allowed for ongoing dialogue and collaboration between the committee and the course director, fostering a culture of continuous improvement.

2.5. Closing the loop

The “closing the loop” phase served as the final and crucial part in the course assessment cycle, ensuring a comprehensive evaluation and improvement process for each course. In this stage, the course review committee took on the responsibility of following up with all relevant stakeholders to ensure that the recommendations provided by the committee had been effectively implemented and that all modifications to the course were ready for the upcoming semester. The committee initiated this process by engaging with the course directors, who play a pivotal role in implementing the recommended changes. Through regular communication and collaboration, the committee ensured that the course directors understood the rationale behind the recommendations and actively worked towards their implementation. This involved reviewing and assessing the updated course materials, evaluating the revised teaching methods, and examining any modifications made to the course assessments. The committee also monitored the progress of the implementation, providing guidance and support as needed. By actively participating in this ‘closing the loop’ stage, the committee ensured that the feedback and recommendations were not only delivered but also effectively acted upon, contributing to the continuous improvement and overall quality of education provided by the College of Pharmacy. This

systematic approach guaranteed that each course underwent a thorough evaluation, resulting in a more refined and effective educational experience for the students.

2.6. Course evaluation archiving

Following the "closing the loop" stage in the course assessment cycle, course evaluation data were archived. This process involved the systematic archiving of all course-related documents, including course reports, student evaluations, exam center reports, feedback, recommendations, and records of changes made to the course, in the Pharmacy Education Unit's cloud storage system. The rationale behind this archiving process was to ensure easy accessibility of all course-related data at any given time, which is crucial for updating course materials, reviewing past evaluations, and tracking changes made to the course over time. This archived data serves as a historical record, providing valuable context that can inform future course improvements and allowing course directors and the scientific committee to revisit past evaluations and recommendations. Moreover, the archived data serves as a rich resource for improving program learning outcomes. By analyzing this data, the committee can identify trends and patterns in course evaluations over time, providing insights into the effectiveness of past changes and their impact on student performance. This analysis can also highlight areas that require further improvement, guiding the development of strategies to enhance program learning outcomes. Thus, the 'course evaluation archiving' process is an integral part of the course assessment cycle, ensuring the preservation and ready availability of all course-related data for review and analysis. This systematic approach to data archiving contributes to the continuous improvement and overall quality of education provided by the College of Pharmacy, underscoring the committee's commitment to transparency, accountability, and excellence in education.

3. Results

This study conducted a four-step course review process to evaluate a total of 25 Pharm.D. courses taught over the last two academic years. The outcomes of this comprehensive evaluation have revealed notable advancements across multiple domains. Particularly, the process has resulted in significant improvements in the quality of the courses, assuring their alignment with program learning outcomes and accreditation agency prerequisites. In our assessment, we identified various areas within each course that required strengthening. These course evaluation findings were categorized into different domains, and the results along with proposed recommendations for improvement were summarized in [Table 1](#).

The course review process is crucial for maintaining and improving the quality of our Pharm.D. program. Through systematic evaluation of each course, we help ensure that the curriculum remains relevant, comprehensive, and aligned with program learning outcomes. This evaluation includes a thorough examination of course content, structure, and alignment, along with feedback from faculty and students. The insights obtained are instrumental in pinpointing areas for enhancement and guiding targeted interventions. The following sections elaborate on the outcomes derived from implementing the four-step approach.

3.1. Identification of gaps and discrepancies

Through the course review process, a few courses were identified to have gaps or discrepancies in their content, structure, or alignment with program learning outcomes. These findings provided valuable insights into areas that needed improvement and allowed for targeted interventions to address these gaps. Course directors and the course review committee worked collaboratively to identify the root causes of these issues and develop effective solutions. Additionally, students feedback played a crucial role in this process, providing valuable

Table 1

This table categorizes course evaluation findings, identifies common assessment defects, and proposes recommendations to address them, offering a structured approach to enhancing course quality and effectiveness.

Assessment Category	Assessment Results	Proposed Recommendation
Course Design and Content	<ul style="list-style-type: none"> - Outdated information - Redundant topics - Content overlap - Inconsistencies - Gaps in content - Misalignment between lecture content and lab activities 	<ul style="list-style-type: none"> - Perform a detailed analysis of all course materials, including lecture slides, textbooks, online resources, and supplementary materials. - Identify areas where information is outdated, incomplete, or inconsistent. - Gather feedback from teaching faculty and students through surveys, focus groups, one-on-one interviews. - Systematically compile and categorize feedback from surveys, focus groups, and interviews to identify common themes and specific areas where gaps and discrepancies are most prevalent. - Work with the course director to address feedback and make required adjustments, ensuring that all modifications meet educational standards and align with course objectives and program requirement. - Ensure that all changes are reviewed and approved by Pharmacy Education Unit. - Implement the revised course content in the upcoming academic term.
Teaching effectiveness	<ul style="list-style-type: none"> - Traditional lecturing - Lack of clarity - Insufficient feedback 	<ul style="list-style-type: none"> - Incorporate active learning techniques such as group discussions, problem-solving activities, and hands-on exercises. - Break down information into smaller, manageable segments and regularly check for student understanding through quick assessments or Q&A sessions. - Provide detailed, constructive feedback on assessments, highlighting both strengths and areas for improvement. - Implement these recommendations by course directors and seek review and approval from the pharmacy education unit to ensure their effectiveness and alignment with educational standards.
Learning Objectives	<ul style="list-style-type: none"> - Outdated objectives - Misalignment - Lack of measurability 	<ul style="list-style-type: none"> - Clearly define learning objectives using specific, action-oriented verbs (e.g., "analyze," "evaluate," "create") to articulate what students should be able to do by the end of the course. - Align assessments directly with learning objectives to ensure that what is being tested accurately reflects the course goals. - Regularly review and update assessments to maintain alignment with the learning objectives and course content. - Course directors should implement these

(continued on next page)

Table 1 (continued)

Assessment Category	Assessment Results	Proposed Recommendation
Assessment Methods	<ul style="list-style-type: none"> - Lack of alignment - Timing and frequency - Limited feedback 	<p>recommendations and seek review and approval from the Pharmacy Education Unit to ensure their effectiveness and alignment with educational standards.</p> <ul style="list-style-type: none"> - Develop detailed rubrics and grading criteria that align with the learning objectives, providing transparency and consistency in evaluation. - Create a balanced assessment schedule in course syllabus that distributes exams evenly throughout the course. - Prepare the course syllabus and distribute it at the beginning of the academic year.
Coordination	<ul style="list-style-type: none"> - Overlapping Exam Schedules - Redundant or Conflicting Assignments - Poor Communication of Expectations 	<ul style="list-style-type: none"> - Establish regular meetings and communication channels between course directors and teaching faculty to ensure alignment of course content, assessment methods, and learning objectives as written in the course syllabus. - Clearly communicate expectations to students through syllabi, course materials, and regular updates on any changes or important information. - Encourage and facilitate interdisciplinary collaboration among faculty members and students, and arrange faculty office hours so students have plenty of chances to get help.
Course Resources and material	<ul style="list-style-type: none"> - Outdated or Irrelevant Materials - Lack of Accessibility 	<ul style="list-style-type: none"> - Regularly review and update course materials to ensure they reflect the latest knowledge. - Course directors should conduct a needs assessment to identify required resources and materials. - Collaborate with Pharmacy Education Unit to ensure all course materials are accessible through the university library resources. - Encourage teaching faculty to ask students if they have access to the course materials.

perspectives and further validating the identified gaps or discrepancies in the course content.

After reviewing the course data, the committee might identify several specific gaps and discrepancies that need to be addressed to enhance the curriculum's coherence and effectiveness. One notable issue was that certain courses did not have course objectives that accurately reflected the content being taught. For example, in one course, the learning objective was to evaluate knowledge and understanding of enzymes, whereas the actual course content covered other biomolecules such as proteins and lipids. This misalignment between the course objectives and the content indicated a clear need to revise the course learning objectives to ensure they accurately reflect what is being taught. Addressing these discrepancies help improve the coherence and effectiveness of the curriculum, ensuring that students achieve the intended learning outcomes. Additionally, the committee might identify redundancy in course content across different courses that needs to be carefully addressed. For instance, similar topics might be covered in

multiple courses without adding new perspectives or depth, leading to unnecessary repetition. By streamlining and clarifying the content, the committee aims to eliminate these redundancies and provide a more focused and efficient learning experience for our students. This will not only optimize the use of time but also ensure that students are exposed to a broader new range of topics and skills.

To address content-related gaps, the course directors conducted a thorough review of the existing curriculum, identifying any missing or outdated information. They then incorporated new and relevant materials, such as updated textbooks, research articles, and online resources, to bridge these gaps and ensure that students have access to the most current and comprehensive knowledge in their field of study. Additionally, adjustments were made to the course structure to enhance its logical flow and coherence, ensuring a seamless progression of concepts and topics throughout the curriculum.

To maintain central control and prevent duplication of courses, course directors should send the updated course to the Pharmacy Education Unit for review and approval. This process ensures that all courses align with the intended program learning outcomes and prevents any deviation from the established curriculum. The collaborative efforts between course directors and the course review committee are driven by a shared commitment to excellence in education. They carefully review and revise course objectives, ensuring they are aligned with program learning outcomes. By addressing identified gaps and discrepancies, the courses continuously evolve to become more comprehensive, coherent, and better aligned with the intended learning outcomes.

3.2. Improved course design and content

The course review process has not only led to improvements in course design and content but has also encouraged the incorporation of soft skill activities, which are evaluated through a student portfolio developed by the Soft Skill Unit. The feedback and recommendations provided to course directors during the course review process have prompted significant revisions in course structure, aligning course objectives, content, and assessments with program learning outcomes. As a result, courses have become more comprehensive and robust, better equipping students for their professional careers. Additionally, the course review process has facilitated the integration of new resources, such as textbooks, research articles, and online materials, enriching the learning experience and ensuring students have access to up-to-date knowledge and skills. Course directors have also been able to assess and adjust their teaching methods and instructional strategies based on feedback, catering to diverse learning styles and preferences, fostering greater student engagement, and creating a dynamic learning environment. By incorporating soft skill activities and evaluating them through the student portfolio, the course review process promotes the development of essential non-technical skills that are crucial for success in the pharmacy profession. Overall, the course review process ensures that courses remain relevant, up-to-date, and responsive to the evolving needs of the pharmacy profession, ultimately enhancing the quality of education and student success.

3.3. Optimized course learning objectives

The application of the recommendations from the course evaluation to revise and communicate clear learning objectives to students has the potential to greatly enhance pharmaceutical education. By updating learning objectives, course directors can ensure that students are equipped with the most relevant knowledge and skills in a field that is constantly evolving. This proactive approach acknowledges the rapid changes in the pharmaceutical sciences and allows course directors to provide students with up-to-date information and prepare them for the challenges they will face in their careers. Clear and aligned objectives help students develop a comprehensive understanding of pharmaceutical principles, drug interactions, patient care, and other essential

concepts, preparing them for their future roles as clinical pharmacists or pharmaceutical professionals. To ensure alignment between assessments and course objectives, course directors are responsible for matching each exam question with the intended learning outcomes, with questions peer-reviewed by expert faculty. Post-exam, the Exam Center provides detailed reports on student performance for each question, including recommendations for improvement. Course directors then communicate these findings to faculty to make necessary adjustments to exam questions and overall assessment methods. This process ensures continuous alignment between assessments and course objectives, ultimately enhancing the quality of education and student learning outcomes.

3.4. Enhanced student engagement and satisfaction

The course review process has significantly enhanced students' engagement and satisfaction by incorporating students' evaluations and feedback into the evaluation of their educational experience (Fig. 2). This student-centered approach has fostered a more inclusive and participatory learning environment, where students' voices are not only heard but are instrumental in identifying areas of improvement and shaping the overall course quality. Students have been given a platform to express their opinions and provide feedback on various aspects of their courses, which has been invaluable in informing faculty members about the effectiveness of their teaching methods, course content, and overall learning experience. By aligning courses more closely with the needs and expectations of students, satisfaction levels have increased. Furthermore, this approach has fostered a sense of ownership and investment among students in their learning, leading to a more fulfilling educational experience. The course review process has also facilitated

continuous improvement and ongoing dialogue between students, course directors and faculty members, ensuring that the educational program remains responsive to the evolving needs and expectations of students. In essence, the course review process has transformed the educational experience by placing students at the center of the evaluation and improvement process, leading to increased engagement, satisfaction, and overall student success.

3.5. Collaboration with exam center

The collaboration with the exam center has played a pivotal role in providing a comprehensive assessment of students' performance in each course. This partnership has facilitated a thorough evaluation process, enabling a detailed analysis of students' academic progress and achievements. By comparing course reports with exam center reports, an accurate cross-examination of data was conducted, ensuring the integrity of the evaluation process. The exam center reports generated through this collaboration contain various parameters not typically found in course reports or student feedback, such as the average exam mean, reliability coefficient, breakdown of questions by difficulty level and percentage of the total group, identification of non-functional distractors, discrimination index, and recommendations for improving the exam. These reports offer valuable insights for course directors to enhance the quality of assessments and customize teaching strategies to improve student learning outcomes. For instance, recommendations based on mid-term performance data may include suggesting additional measures like more tests to determine grades and identifying question items that could be improved. This collaborative effort has not only ensured the accuracy and reliability of the evaluation process but has also provided a holistic view of students' achievements and areas for

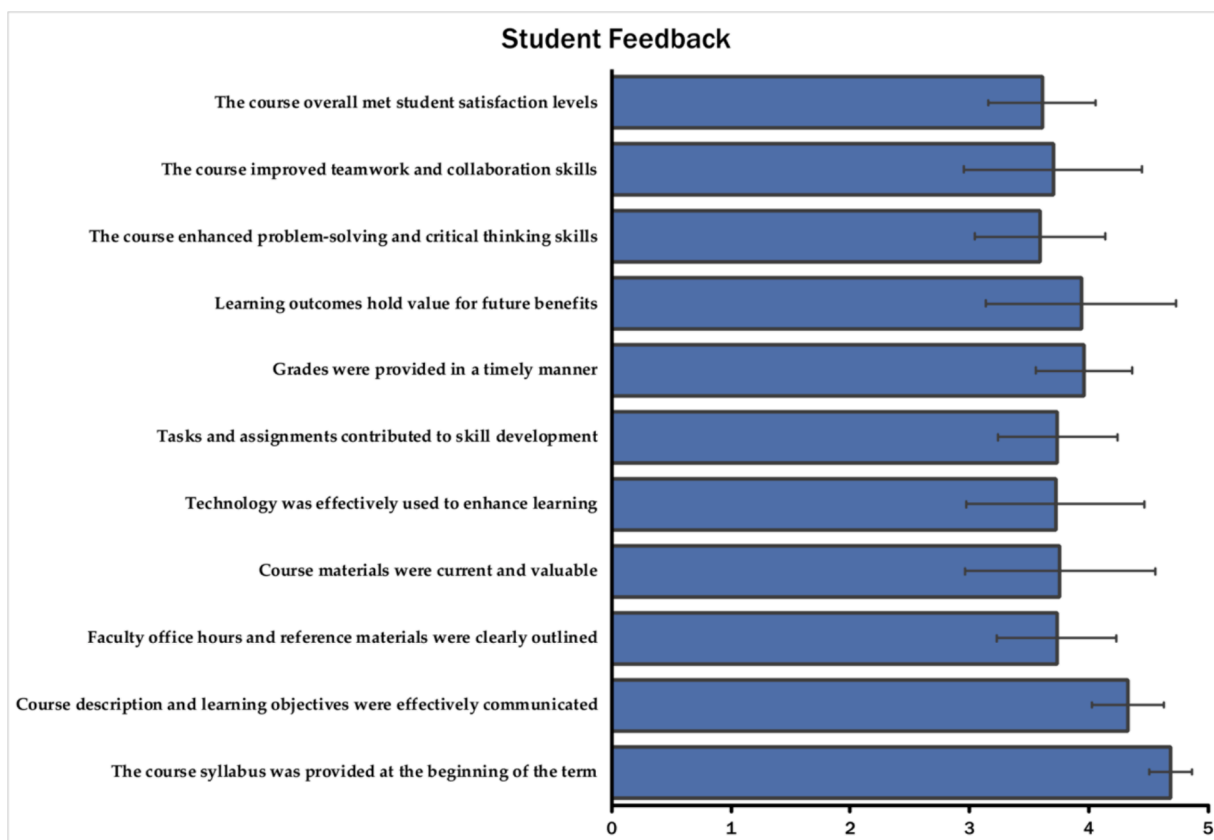


Fig. 2. Analysis of Student Satisfaction with Their Pharm.D. Courses. This figure illustrates the results of a student feedback survey conducted over two years, targeting undergraduate students enrolled in the Pharm.D. program. The survey aimed to measure the levels of satisfaction among students regarding various aspects of 25 distinct courses offered within the program. Satisfaction levels were quantified using a 1 to 5 scale, where a score of 1 represents 'very dissatisfied' and a score of 5 signifies 'highly satisfied'.

improvement.

3.6. Continuous improvement culture

The course review process has fostered a culture of continuous improvement within the College of Pharmacy (Fig. 3). The committee's commitment to refining evaluation criteria, conducting workshops, and providing training sessions has contributed to the professional development of course directors and committee members. This continuous improvement aims to keep the course review process relevant and in line with evolving accreditation standards. This approach, characterized by a refinement of evaluation criteria and feedback loops, seeks to keep the course review process relevant and in line with evolving accreditation standards. Alongside this, KSU through its Deanship of Skill Development, emphasizes the importance of continuous learning and skill development. Workshops and training sessions, designed for course directors and committee members, cover a range of topics from teaching methods to assessment strategies and professional development. Reflection and improvement are seen as integral to this process. Feedback from the course review process, including student evaluations and faculty input, is analyzed and considered for incorporation into the refinement of evaluation criteria. This feedback loop is intended to help enhance and refine the courses based on evolving educational needs. The primary goal of this continuous improvement culture is to develop a course that is adaptable, responsive, and aligned with the changing needs of students and the dynamic landscape of pharmaceutical education.

3.7. Faculty collaboration and interdisciplinary interaction

The course review process has created a valuable platform for faculty members to engage in meaningful discussions, share best practices, and exchange ideas, leading to a more integrated and aligned approach to course design and content. Each course in the updated Pharm.D. program is taught by different faculty members either within the department or across departments, fostering a collaborative environment that enhances the quality of education and leverages diverse expertise.

Interdisciplinary interaction was strategically integrated into courses like Pathophysiology, Drug Action, and Therapeutics (PDAT courses), where various experts including pharmacologists, therapeutics specialists, medicinal chemists, and other faculty with specific domain knowledge came together to provide a comprehensive learning experience. This deliberate approach ensures that our students receive a well-rounded education that prepares them for success in their future careers.

Through this process, faculty members have identified and addressed misalignments between theoretical and practical sections, often caused by limited communication and coordination. Recommendations have been made to improve communication and coordination among faculty, ensuring close alignment between theoretical concepts and practical applications. Additionally, the integration of interdisciplinary perspectives has enriched course design, providing students with a broader understanding of the subject matter and its real-world applications. This interdisciplinary approach has bridged the gap between theory and practice, enhancing the overall quality of education and offering students a holistic learning experience.

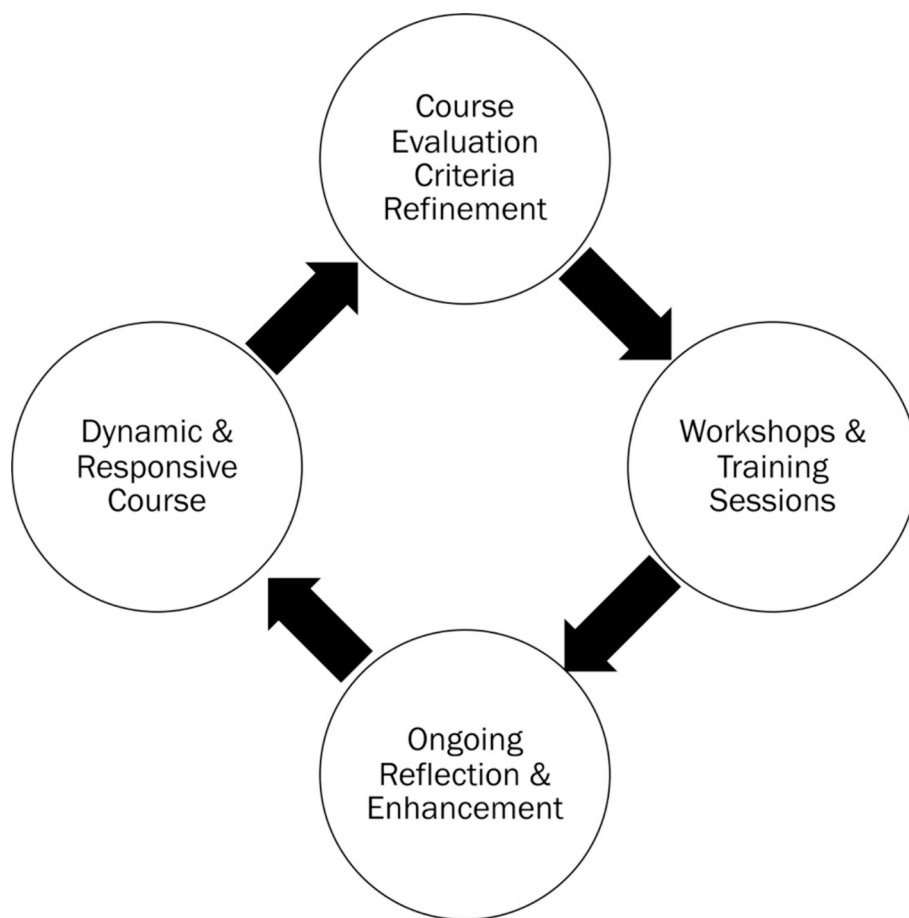


Fig. 3. Continuous Improvement Cycle in Course Review Process. This figure showcases the key components of the continuous improvement cycle within the course review process. It highlights the refinement of course evaluation criteria, the importance of conducting workshops and training sessions, ongoing reflection and enhancement, and the ultimate goal of developing a dynamic and responsive course. The cycle continues as feedback and insights from the course review process inform further refinements, ensuring continuous improvement and alignment with evolving educational needs.

4. Discussion

The course review process implemented by the College of Pharmacy at KSU has demonstrated its potential effectiveness in enhancing the quality of courses and ensuring alignment with program learning outcomes and accreditation agency requirements. The findings and outcomes of this process have several implications for the improvement of pharmacy education and the overall student learning experience.

One of the key strengths of the course review process is its comprehensive nature. By evaluating the content, structure, and alignment of each course, the committee ensures that all aspects of the curriculum are thoroughly assessed. This holistic approach allows for a more accurate evaluation of the courses and provides a solid foundation for targeted improvements. The identification of gaps and discrepancies in course design and content has been instrumental in guiding course directors towards making necessary revisions to enhance the alignment with program learning outcomes (Larkin and Richardson, 2013).

The inclusion of student evaluations in the course review process is a significant strength that underscores the importance of student engagement and involvement in shaping their educational experience (Amerstorfer and Frein von Münster-Kistner, 2021). This student-centered approach not only empowers students but also provides valuable insights into the effectiveness of courses from the learners' point of view (Mohd Yusof et al., 2022). The feedback loop between students and course directors fosters a collaborative environment that promotes continuous improvement and enhances the clarity and alignment of learning objectives (Chen and Hoshower, 2003). Actively seeking feedback from students allows course directors to gain valuable insights into how well the learning objectives are understood and met, identifying areas for further clarification or adjustments to course content and assessments as needed (Chen and Hoshower, 2003; Nelson et al., 2021). This feedback loop allows course directors to make informed decisions and improvements to ensure that the learning objectives are effectively communicated and achieved.

In the context of pharmaceutical education, the improvement of course learning objectives can have far-reaching benefits (Farland et al., 2018). This clarity empowers students to have a clear understanding of the course's purpose and their learning trajectory, enabling them to set appropriate goals and engage more effectively with the material (Almusaed et al., 2023). Moreover, aligning course content and assessments with the updated learning objectives ensures that teaching materials and evaluation methods directly support the intended outcomes. When the content and assessments are well-aligned, students can see the immediate relevance and applicability of what they are learning, fostering a deeper understanding and retention of pharmaceutical concepts (Gleason et al., 2011). This alignment also helps teaching faculty to maintain consistency in their teaching approach and assessment practices, promoting fairness and transparency in evaluating student performance. By regularly updating course learning objectives, pharmaceutical education can adapt to the dynamic nature of the field and better equip students for success (Pires and Cavaco, 2019). Clear and aligned objectives help students develop a comprehensive understanding of basic biomedical and pharmaceutical principles, patient care, and other essential concepts (Wolters et al., 2021). This, in turn, prepares them for their future roles as clinical pharmacists or pharmaceutical professionals, ensuring they possess the necessary knowledge, skills, and value to provide safe and effective healthcare services (Aljadhey et al., 2017; Fathelrahman et al., 2022).

The diversity of assessment methods available, such as exams, quizzes, presentations, assignments, group projects, lab reports, and clinical case presentations, highlights the necessity of selecting the most suitable approach for each course. The unique requirements and context of each course necessitate a careful consideration of assessment methods to ensure they are both appropriate and effective. For instance, courses with a strong emphasis on foundational knowledge might benefit from frequent quizzes to reinforce learning and ensure retention of key

concepts. On the other hand, this approach may not be suitable for courses that require deep, reflective thinking or the application of complex theories, where fewer but more comprehensive assessment methods might be more effective. The frequency of assessments is another critical factor; some courses may require ongoing assessments to provide continuous feedback and support incremental learning, while others may benefit from fewer, more in-depth evaluations that allow students to demonstrate their understanding in a more holistic manner.

Feedback mechanisms also need to be tailored to the specific nature of the course. In basic science courses, feedback typically follows exams and is designed to clarify misunderstandings and provide correct answers, thereby reinforcing learning. In contrast, training courses often employ feedback through student reflections, which allows for a more personalized and introspective learning experience. This reflective feedback can help students internalize their learning and apply it in practical contexts. Therefore, it is essential to evaluate each course based on its unique requirements and context. A custom-made approach to assessment and feedback ensures that the methods employed are both appropriate and effective for achieving the specific learning outcomes of each course. This tailored strategy not only enhances the learning experience but also ensures that students are adequately prepared for their future professional roles.

The collaboration with the exam center has been a valuable aspect of the course review process. By comparing course reports with exam center reports, any discrepancies in grading distribution or assessment methods can be identified and addressed. This collaboration ensures the accuracy and reliability of the evaluation process, providing a more comprehensive assessment of students' performance. The integration of exam center data strengthens the validity of the course review process and enhances its credibility. Furthermore, the collaboration with the exam center has fostered a culture of transparency and accountability. It has facilitated a continuous feedback loop, allowing for ongoing adjustments and improvements to the assessment methods based on the analysis of exam center reports. As a result, the assessment methods have become more refined and effective, ensuring that they accurately reflect students' understanding and their performance in the course as well as fostered a culture of transparency and accountability. By comparing course reports with exam center reports, it has ensured that grading distribution is fair and consistent across different courses. This has helped to maintain the integrity of the evaluation process, ensuring that students are assessed based on their performance and understanding of the course content (Holden et al., 2021).

The course review process has also fostered a culture of continuous improvement within the College of Pharmacy. The committee's commitment to refining evaluation criteria, conducting workshops, and providing training sessions demonstrates their dedication to staying up-to-date of emerging accreditation standards and best practices in pharmacy education. This continuous improvement culture ensures that the course review process remains effective and relevant, adapting to the evolving needs of the pharmacy profession.

Our study, while providing valuable insights into the course review process and the role of the Pharmacy Education Unit in facilitating, coordinating, and monitoring the course evaluation process, faces several challenges that need to be addressed. First, the study relies on data collection from various sources, necessitating the establishment of a unique system for collecting, analyzing, interpreting, and archiving data. The involvement of different stakeholders, such as course directors and students, poses a challenge, especially with low student participation potentially limiting the committee's ability to review the course. Delays in receiving reports from exam centers can further hinder the process. To mitigate these challenges, dedicating human and resource power to establish a systematic data collection system and sending frequent reminders to increase stakeholder participation is essential. Second, each course has its own unique requirements and context, impacting the choice of assessment methods. This variability can affect the consistency and comparability of findings. Adapting assessment

methods to suit each course's specific needs is crucial. For instance, some courses may benefit from more frequent quizzes for reinforcement, while others may require different evaluation approaches. Feedback mechanisms also vary based on the course content, with basic science courses typically utilizing exam feedback and training courses relying on student reflections for personalized learning experiences. Third, the inherent variability in measurable outcomes across different types of courses, particularly when comparing basic biomedical courses to clinically oriented courses, presents a significant challenge. Basic biomedical courses typically focus on foundational scientific concepts such as cellular biology, biochemistry, and pharmacology, emphasizing theoretical knowledge. In contrast, clinically oriented courses prioritize the practical application of clinical skills and patient care practices, assessing students on their ability to conduct patient assessments, develop treatment plans, communicate effectively with patients and healthcare providers, and demonstrate professionalism in clinical settings. This distinction can create challenges in standardizing assessment methods and ensuring consistent evaluation criteria across the curriculum. Finally, our study primarily focuses on the immediate outcomes of the course review process, lacking an assessment of long-term impacts on student performance and program effectiveness. Future efforts should focus on increasing student participation, customizing assessment methods, and assessing the long-term impact of course reviews on educational quality.

In conclusion, the four-step course review process has been a valuable tool for improving course quality and meeting program goals and accreditation standards. The comprehensive nature of the process, the inclusion of student evaluations, collaboration with the exam center, and the cultivation of a continuous improvement culture have all contributed to its success. By continuously refining and improving the course review process, the College of Pharmacy demonstrates its commitment to providing high-quality education and preparing students for successful careers in pharmacy. The positive outcomes of the course review process serve as a useful model for other institutions seeking to enhance the quality and effectiveness of their educational programs.

CRediT authorship contribution statement

Lobna Aljuffali: Writing – review & editing, Methodology, Conceptualization. **Amjad Faihan BinLebdah:** Resources, Investigation, Data curation. **Rihaf Alfaraj:** Writing – review & editing, Methodology, Formal analysis. **Dalal Alkheib:** Writing – review & editing, Visualization, Formal analysis. **Jawza F. Alsabhan:** Writing – original draft, Resources, Investigation. **Ahmed Z. Alanazi:** Writing – original draft, Visualization, Supervision. **Khalid Alhazzani:** Writing – original draft, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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