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# Curriculum Reconstruction Based on Graduate Profile to Strengthen Managerial Competence in the Chemistry Education Study Program

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**ABSTRACT**

The alignment of the curriculum structure of the Chemistry Education Study Program at one university in South Sumatra with the graduate profile as educational institution managers was evaluated in this study, and recommendations for curriculum reconstruction based on the graduate profile were developed. Despite growing demands for graduates who can take managerial roles in educational institutions, little empirical evidence exists on how undergraduate chemistry education curricula allocate credits, learning experiences, and assessment to develop managerial competence, this study addresses that gap. A qualitative case study approach was employed, in which curriculum documents, tracer study data, questionnaires, and interviews were analyzed for data triangulation. Of the total 146 credits in the curriculum, only 16 credits were found to explicitly support managerial competencies. The tracer study (n = 165 respondents) indicated that 16.4% of alumni were employed in educational institution management. A mismatch was identified between the formulation of graduate profiles and the allocation of curricular content, along with limited implementation of project-based learning and managerial internships. Recommendations were proposed, including: (1) the inclusion of courses on educational management and leadership; (2) the strengthening of project-based learning and MBKM internships within managerial pathways; (3) the application of authentic assessment and portfolio evaluation to measure managerial competence; and (4) the development of a phased blueprint for curriculum reconstruction. To our knowledge, this study's novel contribution lies in empirically linking curriculum mapping, alumni tracer outcomes, and pedagogical practice to produce a context-specific, phased blueprint and concrete recommendations for a graduate-focused chemistry curriculum.

## INTRODUCTION

At the national level, the National Standard for Higher Education (*Standar Nasional Pendidikan Tinggi*/SN-Dikti) mandates that study program curricula be oriented toward learning outcomes as the foundation for teaching implementation and quality assurance (Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia No. 3 Tahun 2020). The Indonesian National Qualification Framework (*Kerangka Kualifikasi Nasional Indonesia*/KKNI) also requires learning outcomes to be defined according to competency levels, facilitating the recognition of competencies across education, training, and employment sectors (Peraturan Presiden Republik Indonesia No. 8 Tahun 2012). These normative policies

emphasize that each study program must design a curriculum that explicitly links graduate profiles with course structures and assessment mechanisms.

In line with these regulations, the *Merdeka Belajar-Kampus Merdeka* (MBKM) policy promotes curriculum flexibility through practice-oriented learning experiences, such as internships, partnership projects, applied research, and community-based learning, as essential components for enhancing graduates' employability (Kementerian Pendidikan dan Kebudayaan, 2020). The MBKM guidelines recommend that real-world experiences be integrated into the curriculum structure to equip students with 21st-century skills relevant to both traditional and alternative career pathways. The principles of *constructive alignment* and *outcomes-based education (OBE)* provide a relevant conceptual framework: when a graduate profile requires managerial competence, learning activities and assessments must be intentionally designed to cultivate and measure that competence (Biggs & Tang, 2011).

Although these principles and policies are clearly articulated, their translation into study program practices, especially for non-traditional career pathways such as educational institution management, often faces challenges. Traditional teacher education programs tend to emphasize disciplinary mastery and laboratory practice, leaving limited space for courses and experiential learning that foster managerial skills. Empirical literature suggests that strengthening managerial competence among education graduates requires the integration of project-based learning, relevant internships, performance assessments, and engagement with external stakeholders (Adman et al., 2017; Dickinson, 2000; Postuła, 2021; Williams, 1996). Without such deliberate design efforts, curricula risk producing graduates who are unprepared to assume managerial roles in educational institutions.

In the specific context of the Chemistry Education Study Program one university in South Sumatra, preliminary findings revealed a mismatch between the graduate profile, one of which includes educational institution managers, and curriculum implementation. Of the 146 credits, only 16 explicitly support managerial competencies, whereas tracer study findings show that 16.4% of alumni pursue managerial roles. This discrepancy raises fundamental questions about curriculum relevance, program responsiveness to labor market needs, and compliance with national curriculum policy.

Existing literature on curriculum evaluation in chemistry education typically focuses on content mastery, pedagogical competence, or general employability. Few studies address curriculum reconstruction specifically aimed at strengthening managerial competence within chemistry education. Additionally, prior work rarely integrates curriculum mapping, tracer study evidence, and stakeholder perceptions into a unified analytical framework. This study offers an integrative and evidence-based model for curriculum reconstruction by mapping managerial competence within a discipline-specific (chemistry education) curriculum; triangulating document analysis, tracer study data, and stakeholder insights; and proposing a phased blueprint for developing a managerial specialization track. This contribution fills a significant gap in the literature on graduate-focused curriculum design in science education. Previous research supports this approach: graduate relevance studies often employ tracer studies as a basis for curriculum evaluation (Bual & Bual, 2024; Kartika et al., 2019; Muhammad et al., 2024), while literature on project-based learning and internships demonstrates their effectiveness in enhancing employability (Li & Jansaeng, 2025; Ngobeni et al., 2025; Paryanto et al., 2023; Patil et al., 2023; Rahman et al., 2023).

By integrating local empirical evidence with theoretical insights, this article proposes pragmatic and phased recommendations for curriculum reconstruction aimed at strengthening managerial pathways without compromising the scientific quality of chemistry education. Grounded in regulatory frameworks (SN-Dikti, KKNI), MBKM policies, curriculum design principles (OBE and *constructive alignment*), and empirical findings from tracer studies and curriculum document analysis, this study pursues three main objectives: (a) to evaluate the

extent to which the Chemistry Education Study Program curriculum aligns with the graduate profile of educational institution managers; (b) to identify the factors contributing to the gap between profile formulation and curricular practice; and (c) to develop feasible recommendations and a *blueprint* for curriculum reconstruction at the institutional level. The scope of the study includes curriculum document analysis, alumni tracer studies (2019–2025), questionnaires, and interviews with lecturers, students, alumni, and internal stakeholders.

## METHODS

### Research Design

A qualitative institutional case study design was employed to analyze the alignment between the curriculum structure and the managerial graduate profile. This design was chosen to enable an in-depth, context-specific, and holistic exploration of curriculum implementation supported by multiple sources of evidence.

### Research Target

This study targeted multiple sources of participants to ensure comprehensive and triangulated data on curriculum relevance and graduate career pathways. The research sample consisted of several components. The quantitative component was derived from an official tracer study involving 165 respondents out of a total of 262 alumni of the Chemistry Education Study Program from the 2019–2025 period (response rate ≈ 62.98%). The data were used to map alumni career paths and identify the proportion engaged in managerial roles within educational institutions. In addition, to deepen the findings and ensure triangulation, purposive samples were selected for structured questionnaires and in-depth interviews. These involved core faculty members of the study program (lecturers of relevant courses), selected students (representing different cohorts and MBKM participants), as well as alumni currently serving in managerial positions within educational institutions.

### Research Data

Data collection employed three complementary techniques aligned with the objectives of the study. First, curriculum document data were collected using a structured document analysis protocol. This protocol included predefined indicators, adapted from the study's analytical framework, comprising: (1) the presence of learning outcomes related to managerial competencies (such as project management, leadership, and administrative competence), and (2) the alignment between the learning outcomes and the course descriptions, (3) the types of learning activities included (e.g., case studies, project tasks, practicum, administrative assignments), and (4) the nature of assessment designed for each course. These indicators, extracted from the coding sheet used in the full report, guided the mapping of courses, credit load distribution, and identification of managerial-supporting courses.

Second, quantitative data from the tracer study were collected from institutional alumni databases and validated tracer reports. The dataset included variables such as employment status, job title, description of managerial responsibilities, relevance of coursework to job tasks, and competency demands in the workplace. These variables correspond to the indicators used in the tracer study instrument, including demographic information, employment fields, competency relevance ratings, and skill-use patterns as documented in the full report.

Third, primary data were collected through structured questionnaires and in-depth interviews. The questionnaire items consisted of Likert-scaled statements assessing alumni perceptions of (1) the relevance of coursework to managerial competencies, (2) preparedness for managerial tasks, (3) adequacy of learning experiences, and (4) suggestions for curriculum improvement. Examples of these items include: "*Mata kuliah yang saya ambil membantu saya memahami tugas administrasi/manajerial di lembaga pendidikan*" and "*Saya membutuhkan*

*lebih banyak pengalaman praktik manajerial selama studi*." Interviews followed a semi-structured guide focusing on managerial tasks encountered in professional settings, perceived gaps between curriculum and workplace demands, and recommendations for strengthening managerial training. These instruments were adapted from the interview guide and alumni feedback framework outlined in the report.

**Research Instruments**

Three instruments were used:

1. Curriculum review sheet to map credit distribution and managerial learning outcomes.
2. Standardized tracer study questionnaire containing demographic data, job placement, and perceptions of curriculum relevance.
3. Semi-structured interview guide addressing curriculum adequacy, managerial competency needs, MBKM experience, and recommendations.

The research instruments were developed to meet the needs of the study. The questionnaire was validated by experts and subjected to limited pilot testing to assess the readability of the item statements.

**Data Analysis**

Data analysis was carried out through several complementary techniques. For the curriculum documents, a mixed quantitative-qualitative content analysis was employed: each course was mapped to the dimensions of learning outcomes and categorized according to its level of managerial support. The results of this mapping produced aggregate figures that served as the basis for diagnosing curricular gaps. The tracer study data were analyzed descriptively (frequency and percentage) to identify patterns of alumni absorption across different career paths. Meanwhile, qualitative data from open-ended questionnaires and interviews were analyzed thematically: interview transcripts were inductively coded to capture major themes (e.g., curricular barriers, practical learning needs, recommendations), followed by triangulation to test the consistency between document findings, tracer data, and informant narratives. To enhance the credibility of the findings, cross-checking across data sources (data triangulation), member-checking with several key informants, and systematic documentation through an audit trail were conducted.

Ethical considerations were integrated throughout the research process. All participants in the tracer study and interviews provided informed consent; they were informed about the study's purpose, voluntary nature, the right to withdraw at any time, and how their data would be used. Personal identifiers were removed from datasets and transcripts; anonymized data were stored on password-protected drives and only accessible to the research team. Where applicable, the study protocol was reviewed and approved by the institutional ethics committee (or equivalent), and audio-recordings were destroyed after transcription. These measures were taken to protect participant confidentiality and to ensure responsible handling of sensitive information.

To ensure a clear analytical foundation for the recommendations, the results from the three data sources were integrated into a unified curriculum reconstruction rationale. The competency-mapping matrix and gap indices directly informed the recommendation to increase credit allocation and develop a managerial specialization. Tracer study patterns provided empirical justification for the inclusion of programs that cultivate students' managerial competencies. Thematic findings from informants supported the need for authentic assessments and reinforced the importance of strengthening lecturer capacity and external partnerships to sustain managerial learning experiences.

## RESULTS AND DISCUSSION

The curriculum document analysis revealed that the Chemistry Education Study Program comprised a total of 146 credits (SKS), yet only about 16 credits explicitly covered content supporting the development of managerial competencies, such as educational management, supervision, or entrepreneurship (Farwati et al., 2025). This proportion represents approximately 11% of the overall curriculum. Such imbalance indicates a misalignment between the stated graduate profile, which includes the role of educational institution manager, and the actual course structure. This misalignment is summarized in Table 1, which maps the single graduate profile ("Educational Institution Manager") to the eight identified relevant courses and the specific managerial competencies developed through each of those courses. Within the framework of constructive alignment, graduate profiles should correspond with learning activities and assessments (Biggs & Tang, 2011). When the credit load devoted to managerial competencies is limited, students' opportunities to gain relevant learning experiences are also restricted, causing the learning outcomes to inadequately reflect the intended competencies. This finding aligns with previous studies by Hossain & Arefin (2025), Juma (2025), dan Khan (2023), which identified similar discrepancies between curriculum objectives and non-technical competency requirements in science education programs across Indonesia.

Table 1. Alignment between Graduate Profile, Course Content, and Mapped Managerial Competencies

| Graduate Profile | Course Content | Credits | Mapped Managerial Competencies |
|---|---|---|---|
| Educational Institution Manager | Educational Administration and Supervision | 2 | Institutional administration; academic and non-academic supervision; monitoring and evaluation; development of SOPs and reporting |
| | Digital Classroom Management | 2 | Digital learning management; digital administration systems; use of LMS and e-portfolios for monitoring |
| | Chemical Laboratory Management | 2 | Facilities and inventory management; safety compliance; budget and asset management; technical supervision |
| | Chemoentrepreneurship | 2 | Educational entrepreneurship; planning institutional initiatives; program management and innovation |
| | Business Feasibility Study | 2 | Feasibility analysis for educational programs or services; project and budget planning; market and sustainability assessment |
| | Internship 1 / Observation Practice | 1 | Institutional observation; introductory administrative procedures; identification of organizational roles and structure |
| | Internship 2 / Basic Teaching Practice | 2 | Operational participation; administrative task execution; collaboration with school or institutional units |
| | Internship 3 / Advanced Teaching Practice | 3 | Project and activity management; leadership in practical settings; program planning and evaluation |

The curriculum gap became even more evident when compared with the tracer study data involving 165 respondents out of 262 alumni (response rate ≈ 62.98%) from the 2019–2025 period. Among them, 27 alumni (≈ 16.4%) reported pursuing careers as educational institution

managers, including positions such as school principals, laboratory coordinators, and course center administrators (Farwati et al., 2025). This proportion demonstrates that managerial roles are not marginal but rather represent a significant career pathway. However, most alumni who have advanced to managerial positions admitted that their leadership and organizational skills were developed primarily through work experience and external training rather than formal instruction in the program. This phenomenon suggests that employability for managerial tracks still heavily depends on off-campus experiences. Such a condition is consistent with (Irvansyah et al. (2023) Syafruddin (2022), who found that science graduates often rely on non-formal experiences to fill managerial skill gaps not addressed by the curriculum.

Findings from interviews and questionnaires reinforced the quantitative patterns and, when interpreted through the lens of Biggs & Tang's constructive alignment, reveal a systemic misalignment across intended outcomes, learning activities, and assessment tasks. Although the graduate profile explicitly names the role of Educational Institution Manager, the intended managerial outcomes are weakly operationalized in course-level learning outcomes (as shown in Table 1) and are not matched by learning activities that would enable integrated, practice-oriented learning. Instead, teaching remains heavily content- and laboratory-focused, which encourages surface learning strategies that are poorly transferable to managerial roles. Assessment practices compound this problem: the predominance of cognitive tests and laboratory reports provides little evidence of students' ability to perform managerial tasks in authentic contexts. From a constructive-alignment perspective, this mismatch undermines the validity of the intended outcomes, students cannot be said to have achieved managerial competencies if teaching methods and assessment instruments do not require or measure those competencies. Practically, the data therefore point to three analytically derived priorities: (1) make managerial outcomes explicit at the learning outcomes level so they drive course design; (2) redesign learning activities toward authentic, experiential modalities (e.g., internships, PjBL, management simulations) that enact the intended outcomes; and (3) replace or complement traditional tests with performance-based assessments and rubrics that directly assess managerial behaviors and decision-making. Only by realigning intended outcomes, learning activities, and assessment can the program move from declarative statements about managerial profiles to demonstrable graduate capability (Farwati et al., 2025; Biggs & Tang, 2011). From an OBE perspective, the absence of authentic assessment hinders the achievement of targeted competencies (Biggs & Tang, 2011). These results are consistent with Savluk et al. (2022), Sharma et al. (2025), Smith & Forbes (2001), who emphasized that managerial and leadership skills cannot develop optimally without explicit integration into curriculum activities and assessments.

In addition, the MBKM policy, which provides opportunities for students to learn outside the classroom through internships, applied research, or partnership projects, has not been optimized for managerial pathways. Document analysis shows that the program offers 146 SKS in total but only about 16 SKS explicitly support managerial competencies, approximately 11% of the curriculum, indicating a structural shortfall that limits the program's capacity to credit externally acquired managerial experience (Farwati et al., 2025). Tracer study data further justify the recommendation to integrate internships and MBKM pathways: from 165 respondents (≈63% response rate), 27 alumni (≈16.4%) reported careers in managerial roles, yet most attributed their managerial skill development to workplace experience or external training rather than formal coursework. These quantitative patterns are visually summarized in Figure 1, which illustrates the distribution of alumni career pathways and highlights the proportion entering managerial roles. Taken together, these empirical facts explain why expanding credit allocation, developing a managerial concentration (±20 SKS), and formally recognizing MBKM-based managerial internships are not merely conceptual proposals but targeted responses to documented curricular and graduate-destination gaps.

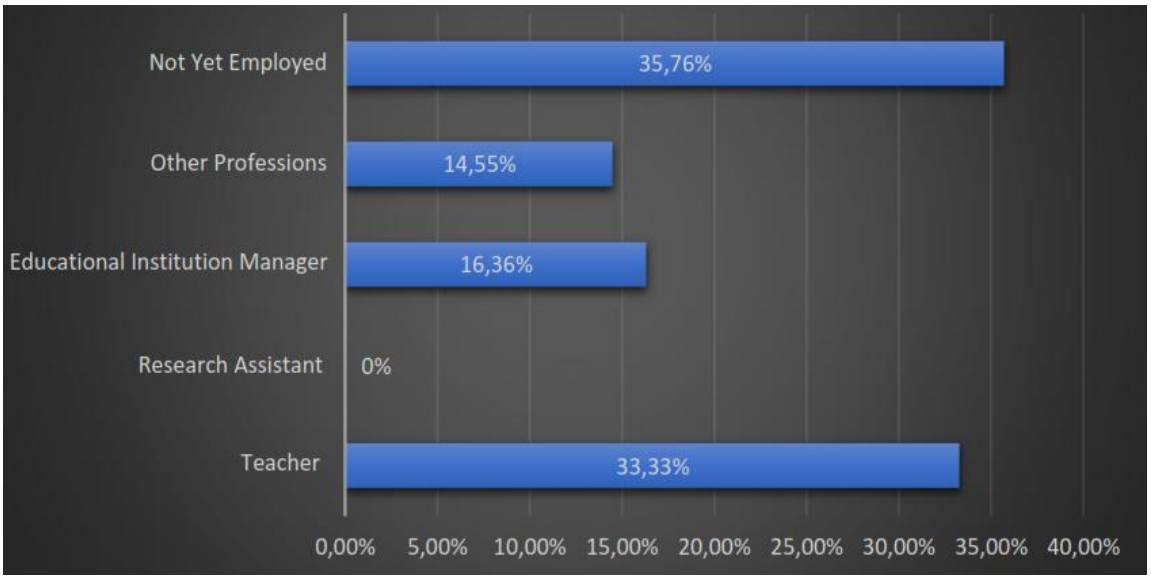

Figure 1. Distribution of Alumni Career Path Percentages

Institutional factors, particularly limited faculty capacity and underdeveloped quality assurance mechanisms, further compound implementation barriers. Although some lecturers possess expertise in educational management, the report documents insufficient systematic support for course development, a lack of incentive structures for faculty professional development in managerial domains, and weak coordination with external partners to secure managerial internship placements. These institutional constraints materially slow curriculum innovation and reduce the program's readiness to implement Project-Based Learning (PjBL), authentic assessment, and MBKM pathways at scale. Accordingly, strengthening faculty capacity, establishing incentive and professional development programs, and formalizing partnerships with field sites are empirically grounded prerequisites to enable the curricular reforms recommended here.

Overall, the findings of this study confirm the existence of both structural and operational gaps between the graduate profile, particularly the managerial career path, and the actual curriculum implementation. This imbalance directly affects the program's relevance to stakeholder needs and challenges its compliance with national standards (SN-Dikti, KKNI) as well as the spirit of the MBKM policy. The key recommendation emerging from this study, expanding credit allocations and establishing a managerial specialization track of approximately 20 credits; integrating managerial internships and PjBL; designing authentic assessments such as management simulations and portfolios; and strengthening faculty capacity and external partnerships, is grounded in the empirical evidence presented above (document analysis, tracer study, and stakeholder interviews) and is therefore an evidence-based roadmap rather than a set of conceptual prescriptions. These recommendations are consistent with international best practices (Adman et al., 2017; Dickinson, 2000; Postuła, 2021; Williams, 1996) and provide a practical, phased implementation strategy aligned with national education policy directives and accreditation requirements.

## CONCLUSION AND RECOMMENDATIONS

The findings indicate a clear misalignment between the stated graduate profile, Educational Institution Manager, and the current curriculum structure. Of the total 146 credits, only approximately 16 credits (≈11%) explicitly support managerial competence development, whereas tracer study results show that about 16.4% of alumni pursue managerial careers. This imbalance confirms that the existing curriculum does not sufficiently support the attainment of

the designated graduate profile.

The gap is driven by structural, pedagogical, and institutional factors. Structurally, the credit allocation for managerial competencies is limited. Pedagogically, teaching remains content- and laboratory-focused, providing minimal authentic learning experiences relevant to educational management. In terms of assessment, the instruments used do not adequately evaluate managerial capabilities. Institutionally, faculty capacity and external partnerships are not yet optimized to support a strengthened managerial pathway.

The study proposes several core recommendations: expanding credit allocation for managerial pathways (approximately ±20 credits), optimizing MBKM schemes through managerial internships, implementing project-based learning and management simulations, and integrating authentic performance-based assessments. Strengthening faculty capacity and developing broader institutional partnerships are necessary enabling conditions. These recommendations form an evidence-based and phased roadmap to achieve coherent alignment between graduate profiles, curriculum content, and instructional practices.

The findings of this study underscore the need for a curriculum reconstruction strategy that not only expands the proportion of managerial competencies but also embeds authentic and work-relevant learning experiences aligned with the demands of educational management roles. The recommended actions emphasize increasing credit allocation for managerial pathways, integrating project-based learning and managerial internships through MBKM schemes, and adopting authentic performance-based assessments that adequately capture managerial capabilities. Strengthening faculty capacity and establishing more robust institutional partnerships are also essential enabling conditions to ensure sustainable implementation. From a theoretical standpoint, these findings reinforce contemporary curriculum development principles that highlight the importance of constructive alignment, competency-based education, and coherence between intended learning outcomes, learning experiences, and assessment systems. The results contribute to curriculum theory by demonstrating that graduate-profile alignment requires not only structural adjustments but also epistemological clarity regarding the types of knowledge, skills, and dispositions that a curriculum should prioritize, particularly when preparing graduates for hybrid professional roles such as educational institution managers. By operationalizing these recommendations in a phased and systematic manner, the study program can achieve stronger alignment between its graduate profile, stakeholder expectations, and national policy requirements, ultimately producing graduates who are better prepared and more competent to assume managerial roles in educational institutions.

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