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AN AI-ENABLED CONCEPTUAL FRAMEWORK FOR EVALUATING CURRICULUM-INDUSTRY ALIGNMENT IN THE STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

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Abstract

The Student Industrial Work Experience Scheme (SIWES) is intended to connect classroom learning with practical training in Nigerian tertiary institutions. However, the assessment of students' industrial activities remains affected by reliance on handwritten logbooks, irregular supervision, delayed feedback and placements that may not provide experiences relevant to departmental learning outcomes. Existing web-based internship systems improve record keeping and monitoring, but the studies reviewed in this research do not sufficiently address the assessment of curriculum-task relevance. This paper presents an AI-enabled conceptual framework for evaluating curriculum-industry alignment through the analysis of students' SIWES logbook entries. The framework is derived from the SIWES assessment challenges, literature on digital internship management and intelligent educational assessment, and Prosser's principles of vocational education. It brings together digital logbook submission, departmental curriculum competency records, natural language processing for identifying tasks, tools and skills, and semantic similarity analysis for comparing reported activities with expected competencies. A weighted relevance scoring component is proposed to calculate a Field Relevance Percentage, identify weak competency areas and support recommendation generation. Supervisor review and feedback are incorporated to maintain human oversight of the assessment process. The framework provides a structured basis for moving beyond the collection of training records towards curriculum-aligned relevance evaluation. Its contribution is a proposed integration of language-based activity analysis, competency mapping and feedback within SIWES monitoring; implementation and empirical validation are required to establish its accuracy and practical usefulness.

Keywords: Student Industrial Work Experience Scheme; Artificial Intelligence; Curriculum-Industry Alignment; Natural Language Processing; Semantic Similarity; Conceptual Framework.

1. Introduction

1.1 Background of the Study

The Student Industrial Work Experience Scheme (SIWES) was introduced in Nigeria in 1973 through the Industrial Training Fund (ITF) to provide students in tertiary institutions with practical workplace experience relevant to their academic programmes. The scheme was established to bridge the gap between theoretical knowledge acquired in the classroom and the skills required in the workplace, particularly in science, engineering, technology and vocational disciplines (Omonijo et al., 2019; Alao et al., 2022). Through industrial attachment, students are expected to become familiar with workplace procedures, equipment and professional responsibilities before completing their studies.

The importance of SIWES goes beyond fulfilling an academic requirement. The scheme provides an opportunity for students to develop practical competencies, improve their employability and understand how classroom knowledge is applied in real work situations (Madu et al., 2023). However, meaningful industrial training depends on the relevance of the activities students perform during their attachment. Students may complete the required training period without acquiring sufficient skills in their areas of specialisation if their assigned duties are unrelated to their academic programmes.

This raises an important question about how institutions determine whether students' industrial activities reflect their departmental curriculum competencies. Addressing this issue requires an assessment approach that considers not only participation in SIWES but also the relationship between reported workplace activities and expected learning outcomes.

1.2 Problem Statement

Despite the objectives of SIWES, several challenges continue to affect the quality of industrial training and its assessment in Nigerian tertiary institutions. Alao et al. (2022) identified poorly matched placements, inadequate supervision and the absence of clear job specifications for industry-based supervisors as challenges affecting the scheme. These problems may result in students performing activities that contribute little to the practical competencies expected in their academic programmes.

Another concern is the dependence on handwritten logbooks and physical supervision. Madu et al. (2023) reported that some students receive limited visits from institutional supervisors, while concerns also exist about the reliability of logbook records and industry-based assessments. Although logbooks provide information about students' activities, their submission alone does not establish whether the reported tasks are relevant to the students' fields of study.

The central problem addressed in this paper is therefore the lack of a structured approach for examining the alignment between students' reported industrial activities and departmental curriculum competencies. Without such an approach, identifying weak field relevance and providing corrective guidance during industrial training becomes difficult.

1.3 Existing Approaches and Limitations

Previous efforts to improve internship management have introduced digital systems for recording activities, monitoring students and supporting assessment. Perdana et al. (2025) developed a web-based internship management information system that

supported student placement, daily reporting, supervision, attendance tracking and evaluation. Similarly, Barrocan et al. (2025) presented a web-based monitoring system that supported real-time activity logging, progress monitoring and automated reporting. Moeinzadeh et al. (2021) also demonstrated how electronic internship assessment systems could support documentation, monitoring and feedback.

These studies show that digital platforms can improve the management of internship records and reduce dependence on manual documentation. However, the systems examined in the reviewed literature primarily address monitoring and administrative activities rather than the semantic relationship between reported workplace tasks and academic curriculum competencies. Recording a student's activity electronically does not, on its own, determine whether that activity contributes to the practical skills expected by the department.

Artificial intelligence offers a possible direction for addressing this limitation. Intelligent educational systems can support assessment, personalised feedback and early intervention (Del-Águila-Castro, 2024). In addition, semantic similarity techniques can compare written information based on meaning rather than exact word correspondence (Reimers & Gurevych, 2019). These approaches provide a basis for developing a framework that connects digital SIWES logbook records with curriculum-based relevance evaluation.

1.4 Aim and Objectives

The aim of this paper is to develop an AI-enabled conceptual framework for evaluating curriculum-industry alignment through the comparison of SIWES students' reported industrial activities with departmental curriculum competencies.

The specific objectives are to:

1. Examine the challenges of existing SIWES assessment practices and the limitations of digital internship monitoring systems in evaluating field relevance.
2. Identify the major components required for AI-enabled curriculum-task alignment evaluation.
3. Develop a conceptual framework integrating digital logbook processing, Natural Language Processing, semantic similarity analysis and Field Relevance Percentage calculation.
4. Explain how the proposed framework can support competency-gap identification, supervisor feedback and recommendation generation.

1.5 Research Questions

The following research questions guide the development of the proposed framework:

1. What limitations in existing SIWES assessment practices justify the need for an AI-enabled curriculum–industry alignment framework?
2. What components are required to support the automated analysis of SIWES logbook entries and comparison with departmental curriculum competencies?
3. How can Natural Language Processing and semantic similarity analysis be integrated into a framework for calculating students' Field Relevance Percentage?
4. How can the proposed framework support the identification of competency gaps, supervisor

feedback and recommendations during industrial training?

1.6 Research Contribution

The main contribution of this paper is the development of a conceptual framework that brings together digital SIWES logbook assessment, Natural Language Processing, semantic similarity analysis and curriculum competency mapping within a single relevance evaluation process. While the reviewed digital internship systems support documentation, supervision and reporting, the proposed framework places greater emphasis on examining the relationship between students' reported workplace activities and the competencies expected in their academic programmes.

The framework also introduces the proposed Field Relevance Percentage as a measurable indicator of curriculum-task alignment. By combining competency-based scoring with learning-gap identification and recommendation generation, it provides a structured approach for supporting students and supervisors during industrial training. Its foundation is consistent with Prosser's vocational education principles, which emphasise the relationship between vocational training and real occupational activities (Prosser & Allen, 1925; Agbeyinka, 2025).

The contribution is conceptual rather than an experimentally established improvement in SIWES assessment. The framework provides a basis for subsequent system implementation, expert assessment and empirical evaluation of its accuracy, usability and practical usefulness.

2. Literature Review and Theoretical Foundation

2.1 SIWES and Work-Integrated Learning

The Student Industrial Work Experience Scheme (SIWES) was introduced in Nigeria in 1973 through the Industrial Training Fund to help students relate what they learn in school to the demands of the workplace. It provides opportunities for students, particularly those in science, engineering, technology and related disciplines, to engage in practical activities before graduation (Omonijo et al., 2019). As a form of work-integrated learning, SIWES is expected to strengthen practical competence and support the movement from formal education into employment.

However, being attached to an organisation is not the same as receiving relevant training. Alao et al. (2022) explain that SIWES aims to develop competencies for productive employment and entrepreneurship, yet poorly matched placements can undermine that aim. A student may complete the attachment period without sufficient exposure to tasks related to the programme of study. For this paper, curriculum–industry alignment therefore refers specifically to the extent to which reported workplace activities reflect departmental curriculum competencies, rather than the mere completion of industrial training.

2.2 Challenges of SIWES Assessment

The assessment of SIWES experience involves students, workplace supervisors and their institutions. Students record activities in logbooks, while supervisors are expected to monitor the training and provide assessments. Madu et al. (2023) report

concerns about irregular visits by institutional supervisors, reliance on signed logbooks and instances where the recorded experience or ratings may not adequately represent the training undertaken. These concerns are important because a completed logbook does not necessarily establish what practical competencies a student has developed.

Omonijo et al. (2020) points to weaknesses in the organisation and coordination of SIWES in tertiary institutions in Ogun State. Alongside the placement and supervision difficulties discussed by Alao et al. (2022), these findings indicate that meaningful assessment requires more than collecting records at the end of attachment. Students and supervisors need a way to examine the relevance of recorded activities while there is still time to respond to learning gaps.

2.3 Digital Internship Management Systems

Perdana et al. (2025) designed and implemented a web-based internship management system using a Waterfall development approach. The system covered placement, daily activity records, attendance, supervision, evaluation and certificate generation. Barrocan et al. (2025) developed a web-based internship monitoring system using an Agile approach, with facilities for real-time logging, progress tracking and automated reporting. These studies illustrate the value of moving internship records from paper-based procedures into more accessible digital systems.

Moeinzadeh et al. (2021) similarly examined an electronic internship system for assessment and monitoring, showing the usefulness of structured documentation and feedback. Nevertheless, the systems discussed in these studies concentrate largely on recording, monitoring and managing internship processes. The reviewed descriptions do not establish a mechanism for interpreting the meaning of logbook activities against departmental curriculum competencies. The gap is not simply the absence of digital records; it is the limited attention given to whether the activities being recorded are relevant to the student's discipline.

2.4 Artificial Intelligence in Educational Assessment

Del-Águila-Castro (2024) reviewed intelligent systems used in university academic performance evaluation and identified applications involving educational assessment, personalised feedback and early intervention. These possibilities are relevant to SIWES because students' activity descriptions, curriculum expectations and supervisor comments contain information that can guide assessment during the training period.

For the present paper, the proposed role of AI is deliberately limited. It is to help organise logbook information, compare activities with expected competencies and suggest areas needing attention. The framework does not assume that an automated relevance score can verify whether a task was actually performed or replace the judgement of an industry or institutional supervisor. This distinction is necessary because reported activity, relevance to a curriculum and demonstrated practical competence are related but different matters.

2.5 NLP and Semantic Similarity

Reimers and Gurevych (2019) introduced Sentence-BERT, which produces sentence representations that can be compared using measures such as cosine similarity. This

approach is relevant where a student's words differ from the language used in the curriculum. For example, a student may report creating database tables and querying records while the curriculum refers more broadly to database management. Meaning-based comparison may recognise the connection. However, similarity should be treated as an indicator requiring suitable thresholds, weighting rules and supervisor review, not as automatic proof of occupational competence.

2.6 Theoretical Foundation

This paper is guided by Prosser's principles of vocational education, presented in the work of Prosser and Allen (1925). The principles emphasise that effective vocational education should relate closely to the conditions, processes and skills of the occupation for which learners are being prepared. In the context of SIWES, this means that the value of industrial attachment should be considered in terms of the workplace activities students encounter, not only the duration of their placement.

Agbeyinka (2025) applies this vocational education perspective when discussing the relevance of SIWES to business education programme objectives. The same reasoning supports the present framework: departmental competencies indicate what students are expected to learn, while logbook entries describe the work they report undertaking. Comparing these two sources offers one way of examining occupational relevance. Nevertheless, the comparison remains a measure of reported curriculum-task alignment. It must be considered alongside validation by supervisors and other evidence of the student's experience.

2.7 Identified Research Gap

The reviewed studies make different contributions to the SIWES problem. Research on SIWES explains the need for relevant placements and effective supervision (Omonijo et al., 2019; Alao et al., 2022; Madu et al., 2023). Digital internship studies demonstrate how submission, tracking and feedback can be managed electronically (Perdana et al., 2025; Barrocan et al., 2025). AI assessment literature points towards feedback and early support (Del-Águila-Castro, 2024), while semantic similarity research provides a technical basis for meaning-based text comparison (Reimers & Gurevych, 2019).

What remains insufficiently addressed in the systems reviewed for this study is the integration of these functions into a single SIWES curriculum-task relevance framework. The proposed framework brings together digital logbook input, NLP-based task extraction, curriculum competency mapping, semantic matching, weighted Field Relevance Percentage calculation and recommendations, with supervisors retaining responsibility for validating records. Table 1 summarises how the selected studies inform this proposal. The framework is a conceptual contribution: whether its scores and recommendations are accurate and useful must be established through subsequent evaluation.

Table 1: Comparative Analysis of Existing Studies and Identified Research Gaps

Study	Research focus	Method / approach	Main contribution	Limitation for this paper	Relevance to framework
Omonijo et al. (2019)	SIWES and work-related learning	Review of SIWES across selected countries	Explains the purpose and challenges of industrial training	Does not present a curriculum-task scoring framework	Establishes SIWES context
Omonijo et al. (2020)	SIWES institutional arrangements	Qualitative analysis in Ogun State	Identifies coordination and structural challenges	Not an AI-based logbook relevance model	Supports monitoring needs
Alao et al. (2022)	SIWES effectiveness	Assessment of SIWES challenges; specific design not detailed in thesis	Identifies placement and supervision problems	No proposed semantic activity–competency scoring method	Justifies alignment checks
Madu et al. (2023)	SIWES outcomes and logbooks	Study of LIS students; specific design not detailed in thesis	Reports supervision and logbook concerns	Does not implement automated curriculum comparison	Supports record validation
Perdana et al. (2025)	Digital internship management	Web-system design using Waterfall	Digital journals, placement and evaluation functions	No curriculum-task semantic matching reported	Guides digital input design
Barrocan et al. (2025)	Internship time monitoring	Web-system development using Agile	Activity logging, tracking and reporting	Focuses on monitoring rather than task relevance	Supports feedback workflow
Del-Águila-Castro (2024)	AI in educational evaluation	Literature review	Explains AI-supported assessment and feedback	Not focused on SIWES curriculum alignment	Supports AI feedback concept
Reimers & Gurevych (2019)	Sentence-level semantic comparison	Sentence-BERT embedding method	Enables meaning-based similarity measurement	Does not assess SIWES activities	Supports matching component
Agbeyinka (2025)	SIWES and programme objectives	Assessment; specific design	Links occupational training and	Does not provide the	Supports vocational rationale

		not detailed in thesis	learning objectives	proposed AI framework	

3. Research Methodology

3.1 Research Approach

The framework is informed by Prosser's principles of vocational education, which emphasise the relationship between vocational learning and actual occupational activities (Prosser & Allen, 1925; Agbeyinka, 2025). This theoretical position supports the use of departmental curriculum competencies as reference points for examining students' reported workplace tasks.

3.2 Literature Identification and Selection

The literature considered in this paper is drawn from the sources already reviewed and cited in the underlying thesis. These include journal articles on SIWES and work-integrated learning, studies of digital internship monitoring, research on artificial intelligence in educational assessment, work on sentence embeddings and semantic similarity, and books addressing vocational education. Examples include Omonijo et al. (2019), Alao et al. (2022), Madu et al. (2023), Perdana et al. (2025), Barrocan et al. (2025), Del-Águila-Castro (2024), and Reimers and Gurevych (2019).

The organising themes for the review were SIWES assessment, industrial placement relevance, digital logbook management, educational AI, natural language processing, semantic similarity and vocational training. Sources were included in the conceptual synthesis where they helped explain the SIWES problem, an existing approach or a component of the proposed framework. The documented references span foundational work published in 1925 and more recent studies published up to 2025; this is not a fixed search period. The available thesis does not record database-specific search strings, screening counts or a formal search protocol, so this paper does not claim to be a systematic literature review.

3.3 Requirement Identification

Requirements were identified by linking recurring SIWES assessment problems to the functions needed to address them. Concerns about weak supervision, unsuitable placements and logbook reliability highlighted the need for digital records, supervisor review and curriculum-based assessment (Alao et al., 2022; Madu et al., 2023). Existing internship platforms established the relevance of digital submission, monitoring, feedback and reporting (Perdana et al., 2025; Barrocan et al., 2025).

From these needs, the principal framework requirements are: student logbook capture; access to departmental curriculum competencies; extraction of reported tasks, tools and skills; semantic comparison of activities and competencies; weighted relevance scoring; identification of competency gaps; and recommendation and supervisor feedback functions. Usability, data protection, score interpretability and human oversight are also necessary considerations because the proposed output is intended to support, not replace, academic judgement.

3.4 Framework Development Procedure

The framework was structured around the movement of information from student activity records to assessment feedback. First, student logbook descriptions and relevant departmental competencies form the principal inputs. Second, natural language processing prepares logbook text and identifies reported tasks, tools and skills. Third, semantic similarity analysis compares the activity descriptions with curriculum competencies using meaning-based text representations, consistent with the approach described by Reimers and Gurevych (2019).

Fourth, matched competencies are combined with their assigned weights to produce a proposed Field Relevance Percentage. The score is intended to indicate the degree of alignment in the submitted records, not to prove that an activity took place. Fifth, the framework uses weak or missing competency matches to guide recommendations. Students and supervisors can then review the score, recommendations and logbook evidence, while coordinator-level reporting supports monitoring across placements. These linked components constitute the proposed conceptual framework rather than evidence of a tested software product.

3.5 Framework Assessment Approach

The proposed framework can be assessed at two levels. At the conceptual level, its components can be checked against the identified SIWES problems, the stated objectives and Prosser's emphasis on occupation-related learning. This assessment would consider whether each major requirement has a corresponding framework function and whether the information flow is logically consistent.

At the practical level, subsequent validation would require appropriately selected logbook examples and departmental competency statements, together with assessments by knowledgeable institutional or industry supervisors. The proposed Field Relevance Percentage could then be compared with expert judgements, while recommendations could be reviewed for relevance and clarity. Prototype evaluation could also examine functionality and usability. No expert-validation results, scoring accuracy figures or user-testing outcomes are reported in this conceptual paper because such results are not established in the source material.

4. Proposed AI-Enabled Conceptual Framework

4.1 Framework Overview

The proposed AI-enabled conceptual framework brings together the main activities needed to examine whether SIWES students' reported industrial experiences are related to the competencies expected in their academic programmes. In this paper, curriculum–industry alignment is considered through curriculum-task alignment: the relationship between what a student reports doing during attachment and the practical skills specified by the student's department. This meaning is important because the framework does not attempt to measure every aspect of an organisation's relationship with a university.

The framework is organised as a connected process involving data input, Natural Language Processing (NLP), semantic similarity analysis, field relevance evaluation, recommendation generation and supervisor feedback. Students submit logbook entries through a web-based platform, while authorised departmental users provide the curriculum competencies against which the entries are compared. The system processes the written records, estimates the relevance of reported activities

and makes the results available for review. Figure 1 presents these components and their expected connections.

4.2 Input Component

The input component provides the information required for the proposed assessment. Its first source is the student's digital logbook entry, which records the date and description of work done, together with tools used and skills applied. Students may also describe problems encountered while carrying out assigned tasks. These records provide the activity descriptions that the NLP component will examine, but the descriptions remain students' reports until a workplace supervisor confirms them.

The second source is placement information, including the organisation where the student is attached and the relevant supervisor. This information helps users understand the context in which an activity was reported. The third source is the departmental curriculum and competency knowledge base. It contains expected practical skills or learning outcomes relevant to the student's programme, with competency weights assigned where necessary for scoring. Authorised coordinators or departmental representatives would maintain these records so that comparison is made against the appropriate programme requirements.

The quality of these inputs affects the usefulness of later stages. Madu et al. (2023) raised concerns about the reliability of some SIWES logbook records. For this reason, the framework treats digital submission as a means of organising evidence, not as proof that every reported activity was performed.

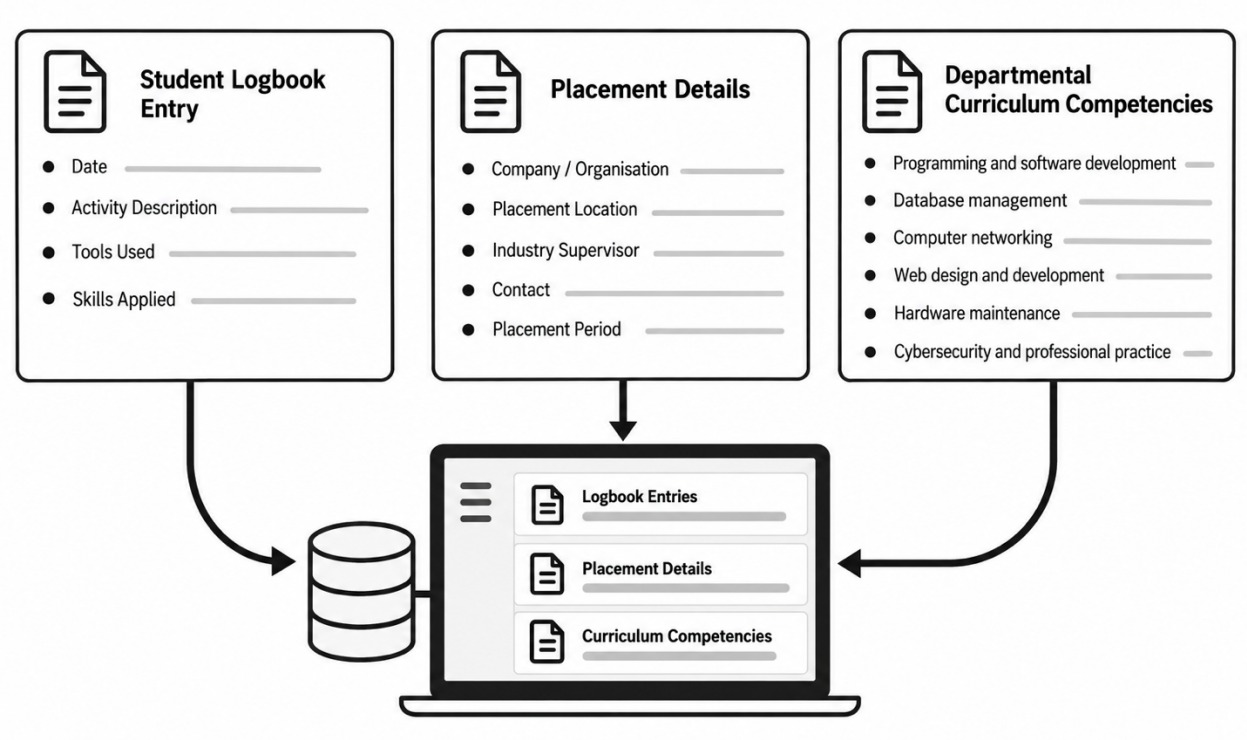


Figure 1: Input process for student logbook activity entries

4.3 NLP Processing Component

SIWES students usually describe their activities in ordinary language rather than in a standard list of academic competencies. The NLP component is proposed to make these descriptions easier to analyse consistently. Once an entry is submitted, the text is prepared through cleaning and normalisation, which may include handling unnecessary characters and bringing similar expressions into a consistent form. The text is then examined to identify useful descriptions of tasks, tools and skills.

For instance, a student may write that they installed software on office computers, created database tables or helped troubleshoot a network connection. The component should identify the work being described and the relevant tools or skill areas without requiring the student to use the exact wording found in a curriculum document. The extracted information is then passed to the semantic similarity component for comparison with departmental competencies.

This component is intended to reduce the burden of manually sorting large numbers of narrative entries. It does not independently judge whether a student has mastered a skill. Brief, vague or incorrect entries may also produce incomplete extraction, so supervisors still need access to the original logbook description when reviewing an assessment.

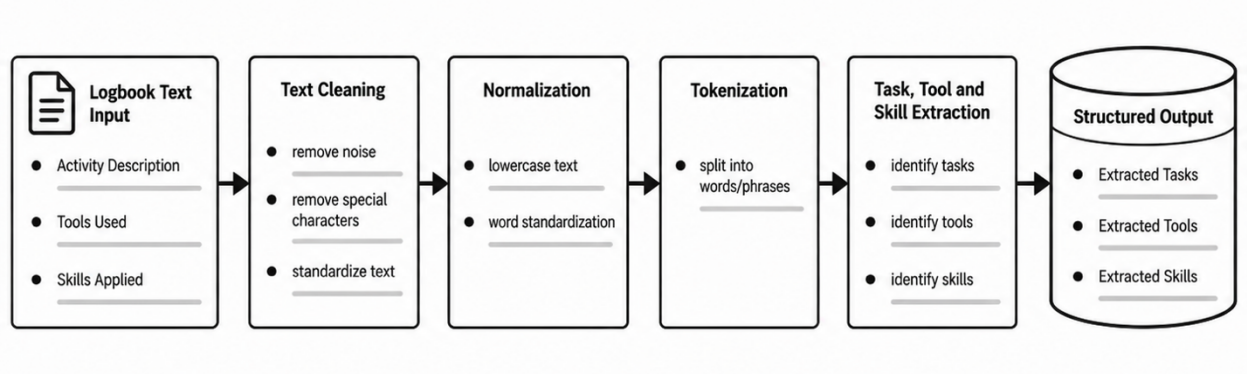


Figure 2: Natural Language Processing Workflow for Task, Tool and Skill Extraction from SIWES Logbook Entries

4.4 Semantic Similarity Component

Reimers and Gurevych (2019) demonstrated how Sentence-BERT can represent sentences in a form suitable for meaning-based comparison using measures such as cosine similarity. The present framework draws on that technical approach as a basis for comparing student entries with curriculum statements.

For example, the curriculum may specify database management, while a student reports creating tables, updating records and running database queries. These descriptions are not identical, but they can refer to related practical activities. The framework therefore proposes a similarity score for each relevant competency, based on the meaning of the reported activities rather than the presence of an exact phrase. Work on document similarity also supports comparison across longer written descriptions (Ginzburg et al., 2021).

A similarity score must be interpreted carefully. A strong textual match may indicate that an entry is relevant to a competency, but it cannot establish that the task was actually performed or performed well. The treatment of very short entries, overlapping competencies and similarity thresholds will require testing before the score can be relied upon for assessment.

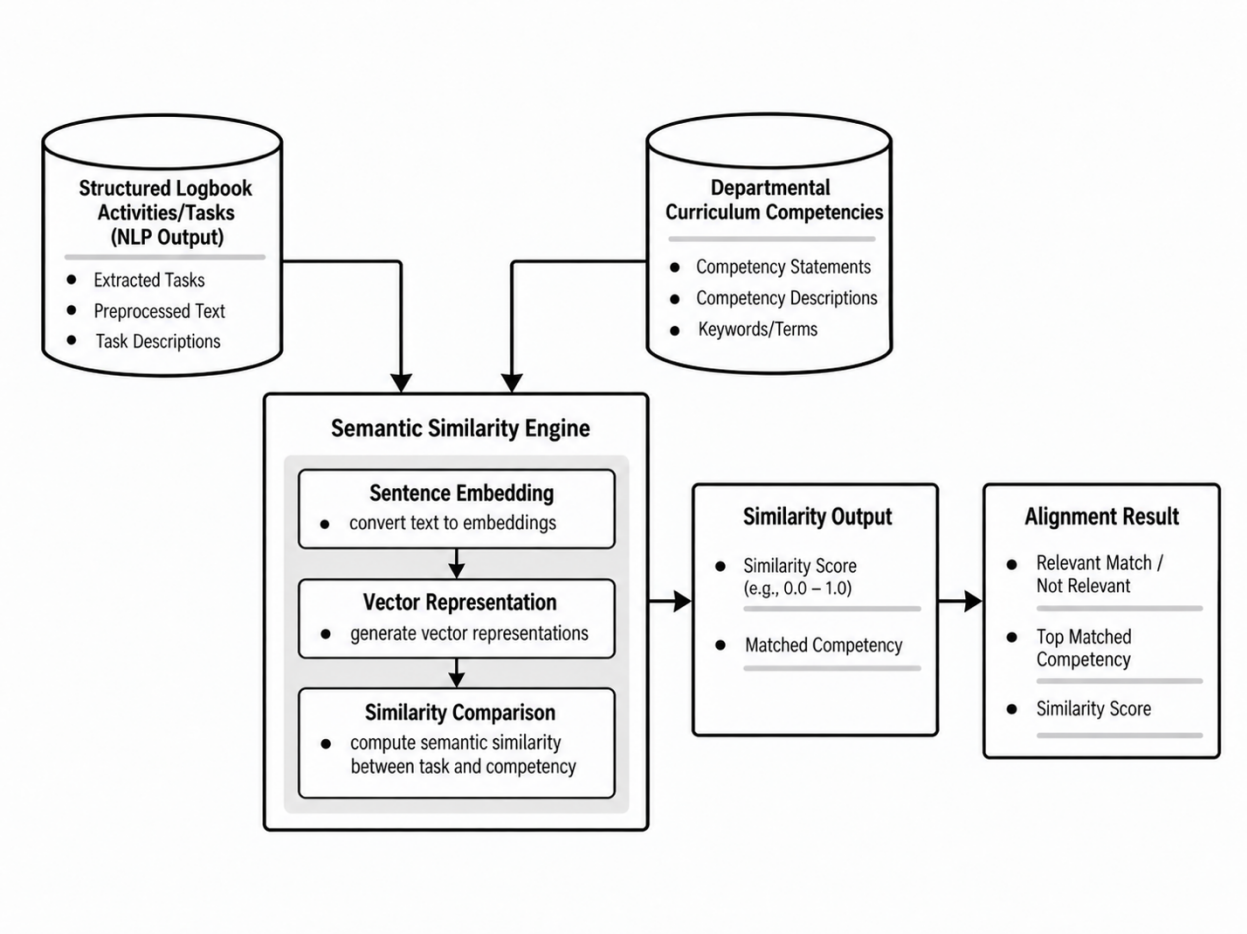


Figure 3: Semantic Similarity Analysis Process for Matching SIWES Logbook Activities with Departmental Curriculum Competencies

4.5 Field Relevance Evaluation Component

The field relevance evaluation component translates the results of curriculum-task comparison into a summary measure. In the underlying research, this measure is called the Field Relevance Percentage (FRP). The framework assumes that relevant curriculum competencies can be assigned different weights because some practical skills may be more central to a programme than others. The matching strength for each competency would contribute to the final result according to its assigned weight.

For a specified assessment period, the proposed calculation is:

$$FRP = [\Sigma(w_i \times s_i) \div \Sigma w_i] \times 100$$

Where (w_i) represents the assigned weight of competency (i), and (s_i) represents its normalised matching score between 0 and 1. The procedure for combining evidence from several logbook entries and converting semantic similarity values into this scale must be stated clearly during implementation and examined during validation.

The thesis proposes three interpretation bands: high relevance at 70% and above, moderate relevance from 40% to below 70%, and low relevance below 40%. These bands are proposed design thresholds, not established national SIWES standards. The percentage is intended to assist monitoring by showing possible curriculum-task alignment and drawing attention to weaker areas. It should not be treated as the sole basis for grading a student or confirming practical competence.

4.6 Recommendation Component

The recommendation component uses the relevance results to identify competency areas that have little or weak support in the student's recorded activities. Where a low or moderate score indicates a possible gap, the framework proposes corrective advice that the student and supervisors can consider while the placement is still ongoing. This responds to the SIWES concern that students may complete their attachment without adequate exposure to important field-related duties (Alao et al., 2022).

Recommendations may advise the student to request tasks linked to a missing competency, discuss the training schedule with the industry supervisor, seek guidance from the institutional supervisor or provide clearer descriptions in future logbook entries. For example, where records contain mainly programming and database activities but little evidence of networking or hardware tasks, the recommendation may encourage the student and supervisor to consider suitable practical exposure in those areas, where the placement permits it.

A distinction must be made between a skill that was not practised and a skill that was simply not described clearly. The framework cannot make that distinction from text alone in every case. Recommendation messages should therefore be treated as prompts for discussion and follow-up, rather than automatic findings that a student or organisation has failed.

4.7 Supervisor Feedback Component

This arrangement responds to concerns about limited institutional visits and dependence on signed logbooks discussed by Madu et al. (2023). The framework provides a common record through which supervisors can comment on activities, ask for clarification and guide students towards more suitable duties. Their feedback can inform subsequent logbook submissions and further relevance reviews, creating a continuing assessment process instead of one that occurs only at the end of attachment.

Supervisor judgement remains important where entries are ambiguous, tasks involve mixed competencies or workplace opportunities are limited. In this way, the proposed AI component supports professional review without claiming to make final academic decisions independently.

4.8 Framework Output

The proposed framework produces several related outputs. The principal output is the Field Relevance Percentage, accompanied by a high, moderate or low relevance category.

Other outputs include the curriculum competencies with weak recorded coverage, suggested actions for the student, supervisor feedback and progress summaries. The web-based dashboard and reporting component is intended to make these results available to authorised students, supervisors and SIWES coordinators.

At student level, the outputs may help identify areas requiring attention before the SIWES defence. At supervisor level, they may provide a starting point for reviewing reported activities and discussing adjustments to workplace exposure. At departmental level, summaries may support examination of placement relevance and recurring competency gaps. Such uses remain anticipated benefits, not demonstrated outcomes of a tested system.

The central contribution of the framework is therefore the connection between digital internship records and a curriculum-based relevance assessment process. Rather than stopping at activity submission and monitoring, it proposes a sequence from language analysis to competency comparison, relevance scoring, recommendations and human feedback. Its value must ultimately be judged through implementation and evaluation using suitable curriculum records, SIWES entries and expert assessments.

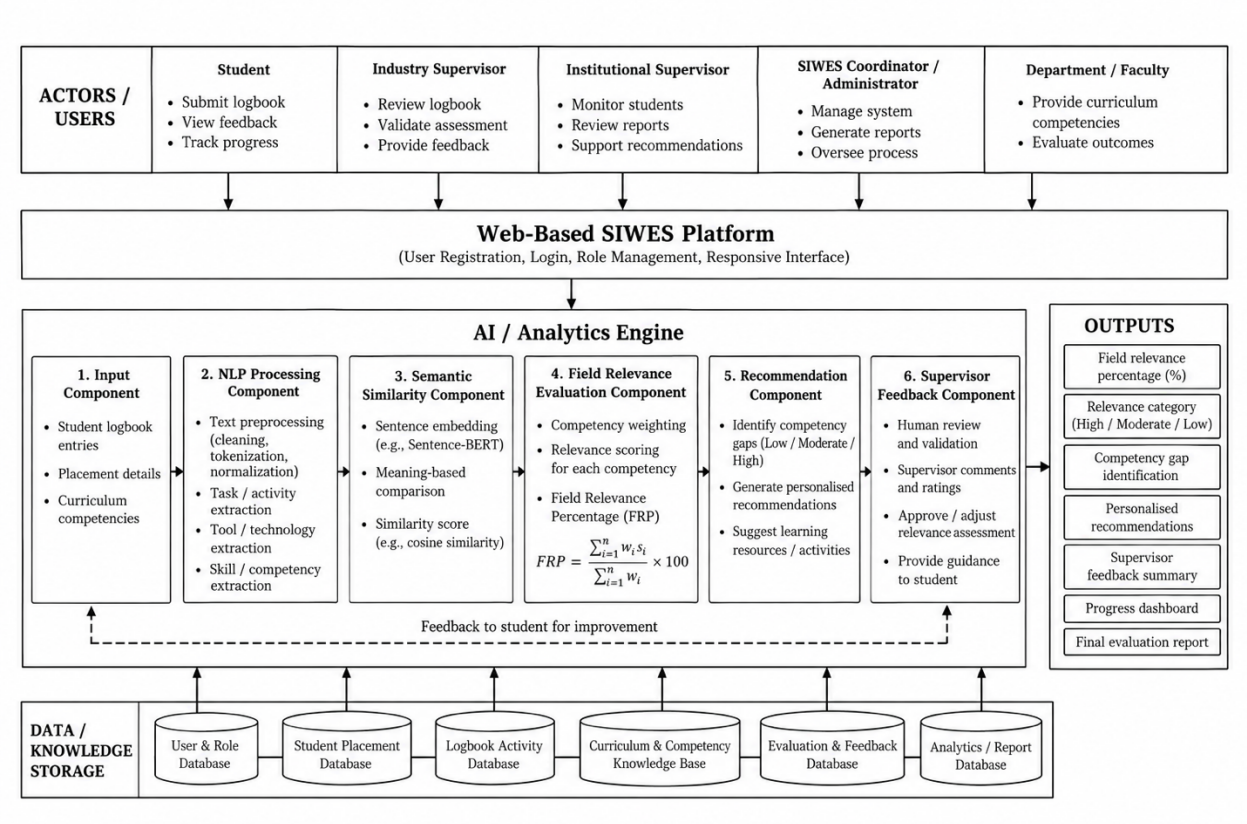


Figure 4: Proposed AI-Enabled Conceptual Framework for SIWES Curriculum–Industry Alignment

5. Operationalisation of the Proposed Framework

5.1 Curriculum-task Alignment

Curriculum-task alignment begins with the student submitting a digital logbook entry describing the work carried out during industrial attachment. The system retrieves the competencies attached to the student's academic programme and compares these with the recorded activities. Natural Language Processing (NLP) first prepares the entry and identifies relevant tasks, tools and skills. Semantic similarity analysis then examines the relationship between the extracted activities and the competency descriptions.

The comparison considers meaning rather than exact wording. For instance, a student may report that they "created tables, updated records and queried customer data", while a curriculum document uses the expression "database management". Although the wording differs, the descriptions may refer to related practical skills. Sentence embeddings and cosine similarity provide a technical basis for this comparison (Reimers & Gurevych, 2019). A meaningful text match indicates possible relevance; it does not prove that the student performed the task or has mastered the competency. Supervisor confirmation therefore remains necessary.

5.2 Field Relevance Percentage Model

The proposed Field Relevance Percentage (FRP) combines competency weights with the degree of matching between recorded activities and curriculum expectations. Each curriculum competency is assigned a positive weight according to its expected importance within the programme. A normalised matching score between 0 and 1 represents the strength of its relationship with the student's activities: 0 indicates no recognised match, while 1 indicates the strongest possible match under the proposed scoring rule.

To make the conceptual calculation explicit, let c_{ij} be the cosine similarity between competency i and extracted activity j. A proposed normalisation is $m_{ij} = \max(0, \min(1, c_{ij}))$, which sets negative similarity values to zero and limits scores to one. Where several entries are available within the assessment period, the matching score for competency i is $s_i = \max_j(m_{ij})$; if no usable activity exists, $s_i = 0$. This uses the strongest recorded match for each competency and avoids increasing the score merely because the same activity was repeated in different entries. These aggregation and normalisation rules are proposed implementation choices that require empirical validation.

The Field Relevance Percentage is calculated as:

$$FRP = [\Sigma(w_i \times s_i) \div \Sigma w_i] \times 100, \text{ for } i = 1 \text{ to } n.$$

Here, w_i is the weight of competency i, s_i is its normalised matching score, and n is the number of selected curriculum competencies. Scores are combined once per competency before division by the total weight. The choice of embeddings, the conversion of similarities and the resulting scores would need to be checked against supervisor or academic expert assessments before practical adoption.

5.3 Relevance Classification

The framework proposes three categories for interpreting the calculated percentage. They provide a simple indication of the level of reported curriculum-task alignment and help determine when additional feedback may be useful.

FRP range	Proposed classification
70–100%	High relevance
40–69.99%	Moderate relevance
Below 40%	Low relevance

These bands are suggested thresholds for the proposed model, not nationally established SIWES standards or empirically validated cut-off points. They must be examined against expert judgements and real logbook data. A low or moderate result should prompt further review rather than automatically determine the student's final assessment.

5.4 Illustrative Framework Application

For illustration, consider a National Diploma Computer Science student whose expected competencies cover programming, database management, networking, web development, hardware maintenance and basic cybersecurity. The example values below demonstrate the proposed calculation; they are not observations collected from SIWES participants.

Curriculum competency	Weight	Matched score
Programming and software development	25	20
Database management	20	18
Computer networking	20	6
Web design and development	15	12
Hardware maintenance	10	4
Basic cybersecurity and professional practice	10	3
Total	**100**	**63**

In this example, FRP = (63 ÷ 100) × 100 = 63%, giving a moderate relevance classification. Programming, database management and web development show comparatively stronger recorded alignment, while networking, hardware maintenance and cybersecurity have weaker scores. The system could consequently suggest that the student discuss opportunities for additional related tasks with the industry supervisor and seek guidance from the institutional supervisor. This illustration shows how the framework is intended to work; it does not establish that the scoring method is accurate or that the recommendations improve training outcomes.

6. Discussion and Implications

The developed framework addresses an important limitation in existing SIWES assessment practices by moving beyond digital record keeping to curriculum-task relevance evaluation. Previous studies by Perdana et al. (2025) and Barrocan et al. (2025) demonstrated how digital systems support internship documentation, monitoring and reporting. However, the

systems reviewed did not adequately address automated comparison of students' industrial activities with departmental curriculum competencies. This study extends these approaches by integrating Natural Language Processing, semantic similarity analysis and a Field Relevance Percentage model.

The Field Relevance Percentage formula has been implemented in software and tested successfully. This demonstrates that the proposed weighted scoring model can be translated into a working software function for calculating curriculum-task relevance. The approach also aligns with Prosser's vocational education principles, which emphasise the importance of practical training that reflects occupational requirements (Prosser & Allen, 1925; Agbeyinka, 2025).

The framework has practical implications for SIWES students, supervisors and academic departments. Students can use relevance scores to understand how their recorded activities relate to their programmes, while supervisors can use the results to identify areas requiring attention. Departments may also use the information to support placement monitoring and curriculum–industry alignment.

7. Framework Validation and Future Evaluation

The Field Relevance Percentage formula developed in this study has been integrated into a software application and tested. The testing confirmed that the formula works within the developed software, demonstrating the functional feasibility of calculating field relevance from weighted competency scores.

Although the calculation function has been tested, further evaluation is required to establish how accurately the resulting scores reflect expert judgements of SIWES relevance. This can be achieved by comparing system-generated results with assessments made by institutional supervisors, industry supervisors and academic staff familiar with departmental curriculum competencies.

Further evaluation should also examine the accuracy of NLP-based task extraction, semantic similarity matching, the appropriateness of relevance classification thresholds and the usefulness of generated recommendations. User acceptance and usability testing can determine how effectively students and supervisors interact with the system.

These additional evaluations will provide evidence of the system's accuracy, reliability and practical usefulness beyond the successful functional testing of the formula.

8. Conclusion

This study developed an AI-enabled framework for evaluating curriculum–industry alignment in SIWES through Natural Language Processing, semantic similarity analysis and weighted relevance scoring. The framework addresses limitations associated with manual logbooks, weak supervision and the absence of systematic curriculum-task relevance assessment.

A major contribution of the study is the Field Relevance Percentage model, which has been implemented in software and successfully tested. This demonstrates the practical feasibility of translating the proposed relevance calculation into a working software function.

The framework provides a basis for identifying competency gaps and supporting feedback to students and supervisors. Further evaluation against expert assessments and

real SIWES records is necessary to establish its accuracy and wider applicability.

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