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DEVELOPING AN INDEPENDENT-LEARNING TASK BANK AND IMPLEMENTING A COMPETENCY-BASED ASSESSMENT RUBRIC IN FOOD TECHNOLOGY EDUCATION

Gulboyeva Shokhista Ismat kizi

Assistant teacher, Karshi State Technical University

E-mail: shohistagulboyeva1994@gmail.com

Abstract. *Independent learning is increasingly central to competency formation in Food Technology education; however, in many programs independent work remains fragmented (topic lists without operational tasks) and assessment is often score-centered rather than competency-centered. This study proposes and develops a structured solution: (1) an Independent-Learning Task Bank aligned with syllabus learning outcomes and (2) a competency-based analytic assessment rubric to improve transparency and consistency of evaluation. Using course syllabi from Food Technology-related training at Karshi State Technical University as primary design inputs, learning outcomes were extracted and clustered into key competencies (e.g., standards-based reasoning, quality–safety indicator interpretation, expert examination procedures, evidence-based reporting, and compliance decision-making). These competencies were operationalized into a task bank organized by task type (essay, calculation–drawing, analytical presentation, problem solving with analysis, extended case analysis) and three difficulty levels (foundational, applied, decision & reporting), packaged for LMS/HEMIS-compatible delivery. A four-level analytic rubric with weighted criteria was then developed to assess independent outputs across formats, emphasizing standards alignment, method selection, indicator reasoning, analysis quality, expert conclusion writing, and decision justification. The proposed model*

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supports scalable implementation, enables conversion of independent tasks into assessment pools, and offers a replicable framework for improving the design and evaluation of independent learning in Food Technology education.

Keywords: *independent learning; food technology education; task bank; competency-based assessment; analytic rubric; learning outcomes alignment; quality and safety; LMS/HEMIS implementation.*

1. Introduction

Engineering-oriented Food Technology education increasingly prioritizes independent learning as a core mechanism for building job-ready competencies such as process reasoning, product formulation, quality and safety decision-making, and technical documentation. Across leading international programs, independent and guided-independent learning is not treated as “extra homework,” but as a structured component embedded into laboratory practice, project work, and capstone problem solving.

A clear illustration comes from Wageningen University & Research (WUR), widely recognized for Food Technology education in Europe. WUR emphasizes learning formats that combine a theoretical foundation with laboratory practicals and group projects based on real-life cases and research assignments, strengthening teamwork and professional communication alongside technical competence. (Note: this citation supports the broader independent-learning governance; WUR program practices are commonly described on WUR pages—if you want, I can add a WUR-specific citation after a targeted fetch.)

Similarly, at UC Davis, food technology learning is strongly connected to product development workflows (prototype development, testing, and formal presentation), which inherently require systematic independent work and team-based execution between sessions. In parallel, many leading programs

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institutionalize capstone-style work where students apply knowledge to industry-relevant problems, emphasizing authentic tasks, evidence-based reasoning, and professional reporting—competencies that cannot be formed through lecture attendance alone.

This international trend is also increasingly relevant in Uzbekistan, where independent learning is formally positioned as an integral part of higher education. The Ministry's Model Regulation on Organizing Students' Independent Learning defines independent learning as an inseparable component of the educational process aimed at developing subject-specific competencies, independent thinking, problem analysis, and solution seeking. Within this national framework, universities are expected to translate curriculum outcomes into structured independent-learning activities and transparent assessment mechanisms.

A concrete example is Karshi State Technical University (KSTU), where Food Engineering training is institutionalized through the Shahrisabz Faculty of Food Engineering, which lists programs such as Food Technology and Food Safety among its current educational directions. The presence of such specialized programs strengthens the need for a consistent system to manage and assess independent learning—especially in practice-oriented fields like Food Technology, where students must demonstrate competence in product-related decisions, safety reasoning, standards-based justification, and technical documentation.

Despite strong global and national drivers, two persistent challenges remain in many Food Technology programs. First, independent learning tasks may be fragmented (topic lists without well-defined task formats, inputs, outputs, and difficulty levels), leading to uneven workload distribution and weak alignment with learning outcomes. Second, assessment may remain score-centered rather than competency-centered, limiting transparency about

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what constitutes strong performance (e.g., standards compliance, calculation accuracy, safety logic, data interpretation, documentation quality, or decision justification). Under these conditions, independent learning can consume substantial student effort while producing inconsistent learning gains and inconsistent grading.

To address this gap, the present study proposes a structured approach that connects syllabus learning outcomes → competency clusters → independent-learning tasks → analytic rubric-based assessment. The core idea is to create an Independent-Learning Task Bank that standardizes task formats (e.g., calculation-based tasks, laboratory data interpretation, HACCP/safety cases, mini product-development projects) and ensures each task is explicitly mapped to target competencies. In parallel, a competency-based analytic rubric is implemented to improve assessment transparency, strengthen feedback quality, and enhance consistency across instructors and student groups.

Accordingly, the aim of this paper is to develop an independent-learning task bank for Food Technology courses and implement a competency-based assessment rubric to evaluate independent work in a transparent and scalable manner. The study is guided by the following research questions:

- RQ1: How can syllabus learning outcomes in Food Technology be operationalized into a structured independent-learning task bank (task types, difficulty levels, and expected outputs)?
- RQ2: Which rubric criteria best represent Food Technology competencies, and how should they be weighted?
- RQ3: How does the task-bank + rubric model affect student performance and perceived clarity/fairness of assessment during implementation?

2. Materials and Methods

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This study employed a design-based development and implementation approach to create (i) an Independent-Learning Task Bank and (ii) a competency-based analytic assessment rubric for Food Technology education. The design process followed an iterative cycle: analysis of course outcomes → task bank construction → rubric development → pilot implementation → revision based on evidence.

The development work was grounded in course documentation from Karshi State Technical University (KSTU) Food Engineering–related training. Two disciplinary syllabi were used as primary design inputs:

Oziq-ovqat mahsulotlari ekspertizasi (OOME), which targets competence in evaluating food quality and safety, conducting expert examination, applying standards, certification, and documenting expert conclusions; learning outcomes emphasize standards literacy (O‘z DSt, ISO, Codex Alimentarius) and evidence-based expert decision-making.

Funksional oziq-ovqat mahsulotlari texnologiyasi (FOOMT), which similarly embeds independent learning as a dominant component and specifies task submission formats and assessment procedures through institutional platforms.

In addition, the program-level curriculum tables were reviewed to contextualize where Food Technology, food safety, chemistry/biochemistry, microbiology, metrology/standardization, and related courses sit in the overall training pathway.

The model explicitly aligned with existing syllabus-based requirements for independent learning organization:

Independent-learning tasks may be delivered directly or via HEMIS, and can be completed in multiple formats such as essay, calculation–drawing work, analytic presentation, problem solving, experiments, or project outputs.

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For course assessment design, syllabi note that at least 60% of midterm/final control questions should be formed from independent-study topics/tasks.

Practical implementation also allows independent work submission as written work, presentation, experiment, visuals, or video materials (examples given in FOOMT guidance).

These constraints were treated as “design rules” to ensure the proposed task bank and rubric can be adopted without conflicting with current university assessment logic.

Task bank construction followed five steps:

Step 1 — Outcome extraction and clustering.

Learning outcomes (knowledge and skills) were extracted from the syllabi and grouped into competency clusters. For example, OOME outcomes include product/quality knowledge, standards literacy, expert evaluation and certification decisions, and formal conclusion writing.

Step 2 — Task typology and level design.

A task typology was defined to match syllabus-approved independent-learning formats (e.g., essay, calculation–drawing, analytic presentation, experimental tasks).

Tasks were then stratified by difficulty level (basic–intermediate–advanced) to support progressive competency formation.

Step 3 — “Task passport” standardization.

Each task was documented using a unified template (task passport) including: learning outcomes targeted, required inputs/data, deliverable format, evaluation criteria, and academic integrity checks.

Step 4 — Alignment with assessment policy.

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Tasks were mapped to midterm and final assessment coverage so that independent-learning tasks could supply the required share of assessment items ($\geq 60\%$) while maintaining content validity.

Step 5 — Implementation packaging for HEMIS.

Tasks were packaged as HEMIS-ready items (instructions + files + rubric + submission format + deadlines), reflecting that syllabi explicitly use HEMIS for reinforcement and task-based learning.

A 4-level analytic rubric was developed to assess independent-learning outputs consistently across multiple formats. The rubric criteria were derived from the competency clusters found in the syllabi (e.g., standards-based reasoning, safety/quality interpretation, expert conclusion writing).

Rubric performance levels were defined as:

Level 1 (Insufficient): major gaps, weak justification, non-compliance with standards/tasks

Level 2 (Basic): partial correctness, limited justification, inconsistent documentation

Level 3 (Proficient): correct reasoning, adequate evidence and standards alignment

Level 4 (Advanced): strong evidence-based justification, professional documentation, clear decision logic

The evaluation stage of the model uses:

- Task completion and rubric scores (descriptive statistics)
- Evidence of transparency/consistency (e.g., reduction of score variance between assessors if multiple instructors apply the same rubric)
- Student feedback on clarity and fairness of assessment (short survey + thematic analysis).

3. Results

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Analysis of the Oziq-ovqat mahsulotlari ekspertizasi (OOME) syllabus (KSTU, 2025) yielded a clear competency profile: students are expected to (i) understand food product types/composition, (ii) apply expert examination and certification methods, (iii) determine quality–safety indicators, (iv) work with national and international standards (O‘z DSt, ISO, Codex Alimentarius), (v) evaluate results and write an expert conclusion, and (vi) make a justified “allow / not allow” market-release decision under certification and sanitary–hygienic requirements.

The course structure also confirms a large independent-learning component (60 hours of independent study within a 4-credit course), which makes standardization of independent tasks practically important.

Based on the shared institutional approach in the uploaded syllabi, the task bank was designed as a HEMIS-ready repository with standardized “task passports” and a limited set of reusable task formats. In FOOMT, independent work can be assigned directly or via HEMIS and is explicitly recommended in multiple forms (e.g., essay, calculation–drawing work, analytical presentation, problem solution with analysis, extended analysis with definitions and conclusions).

The same task-format logic appears in OOME, ensuring cross-course compatibility for implementation.

Competency cluster (e.g., standards reasoning; indicator interpretation; expert conclusion writing) derived from OOME learning outcomes.

Task format aligned to approved independent-learning outputs (essay / calculation–drawing / presentation / problem-solving + analysis).

Difficulty level (Foundational → Applied → Decision & Reporting), culminating in tasks that require writing an expert conclusion and making a compliance decision (TN7–TN8).

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In addition, the bank design includes a dedicated “assessment-pool tag” for tasks that can be converted into control questions. This directly supports the syllabus requirement that at least 60% of midterm/final control questions be formed from independent-study topics/tasks.

A 4-level analytic rubric was developed to ensure consistent grading across the independent-learning formats permitted in the syllabi. The rubric criteria were derived from the most “measurable” parts of the competency map (standards alignment; correctness of methods; indicator interpretation; evidence-based analysis; expert conclusion writing; decision justification), reflecting OOME’s explicit emphasis on standards-based evaluation and formal expert conclusions.

To align with the practical grading logic in the FOOMT assessment table (which uses a 100-point model with a 60/40 split between ongoing assessment and the final), the rubric is designed to be scalable: it can be applied either as (a) a 100-point rubric for each task or (b) a smaller-point rubric mapped into the existing course components.

FOOMT also specifies a high volume of independent tasks, which strengthens the need for a rubric that improves transparency and reduces grading variability across many submissions.

4. Discussion

The main contribution of this study is the development of a syllabus-aligned Independent-Learning Task Bank and a competency-based analytic rubric for Food Technology education. The design is grounded in the explicit learning outcomes of the OOME course (food product knowledge; expert examination and certification methods; quality–safety indicators; standards literacy; expert conclusion writing; and compliance-based market-release decisions).

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By converting these outcomes into a structured task bank and attaching a rubric that evaluates performance against clearly defined criteria, the proposed model addresses two common weaknesses in independent learning: (a) topic lists without operational tasks, and (b) grading practices that are score-centered rather than competency-centered.

A key interpretive point is that the model improves constructive alignment: learning outcomes are translated into observable student outputs (e.g., calculations, expert memos, compliance checklists, structured conclusions) and assessed through criteria that directly represent the targeted competencies (standards compliance, correctness of methods, indicator interpretation, evidence-based analysis, and decision justification). This alignment is particularly important in Food Technology, where competence is demonstrated through reasoned judgments and documentation rather than memorization alone.

The local context strongly supports a standardized repository approach. First, the OOME syllabus indicates a substantial independent-learning load (60 hours in a 4-credit course), making independent work a major part of learning rather than a peripheral activity.

Second, the FOOMT syllabus explicitly permits assignment and submission of independent work via HEMIS and lists diverse formats (essay, calculation–drawing work, analytical presentation, problem solution with analysis, and extended analysis with conclusions).

This flexibility is a strength, but without standardization it can lead to inconsistent task quality and inconsistent grading. A task bank mitigates this risk by providing a shared “catalog” of task passports, expected outputs, and evidence requirements.

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Third, the syllabi include a direct assessment integration principle: at least 60% of midterm/final control questions should come from independent-study topics/tasks.

This requirement creates a strong incentive to ensure independent learning is not only active but also assessment-ready. The task bank's "assessment-pool tagging" mechanism operationalizes this requirement, enabling instructors to generate question pools from completed independent tasks while preserving content validity.

The rubric is not merely a scoring tool; it functions as a feedback architecture. In contexts where many independent tasks are assigned (FOOMT indicates a high volume of independent tasks), the rubric reduces the cognitive and organizational burden on instructors and makes assessment more consistent across groups and assessors.

Moreover, because OOME learning outcomes explicitly require writing expert conclusions and issuing compliance decisions (allow/not allow), performance cannot be evaluated credibly without criteria that capture both technical correctness and decision logic.

The 4-level analytic structure supports formative feedback (students can see what "proficient" vs "advanced" means), which is consistent with independent learning as a competency-forming process.

An additional practical advantage is compatibility with existing grading models. FOOMT's assessment layout uses a 100-point structure with a 60/40 split between ongoing assessment and a final control.

A rubric can be scaled to fit such schemes while preserving criterion-level evidence. This matters because local programs often have fixed assessment architectures; proposed innovations must "fit" rather than replace established systems.

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Internationally, leading programs emphasize competence through hands-on labs, projects, and real-life cases—formats that depend on independent execution and clear assessment expectations. In that sense, the proposed model aligns local implementation with global trends by ensuring independent learning is authentic-task-based and criterion-referenced, not simply topic coverage. The contribution is thus not a new pedagogical philosophy but a deployable system: a bank of well-defined tasks plus a rubric that makes competence visible and assessable.

Standardized task quality across multiple courses (cross-syllabus compatibility is supported by the shared task format catalog).

Higher assessment validity, since tasks and rubrics are anchored in explicit learning outcomes (e.g., standards literacy, expert conclusion writing).

Better readiness for digital management, because tasks can be packaged and tracked through HEMIS as indicated in the syllabus implementation guidance.

This study reports the design and syllabus-grounded implementation logic; therefore, empirical outcomes (e.g., performance gains, inter-rater reliability, student satisfaction changes) require a pilot with defined cohorts and multiple assessors. In addition, the task bank presently draws heavily on two courses (OOME and FOOMT); expanding to additional Food Technology subjects (microbiology, chemistry, unit operations, HACCP-focused modules) would strengthen generalizability and enable a richer vertical progression of tasks.

For implementation, the most effective rollout path is a staged approach:

- adopt the task passport template and rubric in 1–2 courses (e.g., OOME, FOOMT);
- tag tasks suitable for assessment pools to support the $\geq 60\%$ requirement;

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- train assessors on rubric use to strengthen consistency;
- expand the bank to related courses and introduce learning analytics (submission patterns, criterion-level weaknesses).

Future research should test (i) learning gains over a semester, (ii) inter-rater agreement, and (iii) longitudinal competency progression across year levels, particularly for competencies that culminate in expert decision-making and compliance documentation.

5. Conclusion

This study developed and justified a practical model for improving independent learning in Food Technology education through two integrated outputs: an Independent-Learning Task Bank and a competency-based analytic assessment rubric. The model was constructed directly from syllabus learning outcomes, particularly those requiring standards-based evaluation, expert examination, formal conclusion writing, and compliance-driven decision-making.

The main conclusions are as follows:

1. Outcome-to-task operationalization was achieved.

Syllabus learning outcomes were translated into competency clusters and then into independent-learning tasks with clear inputs, outputs, and difficulty levels, ensuring constructive alignment between what students are expected to learn and what they are required to produce.

2. The task bank is implementation-ready within existing institutional rules.

The proposed task formats (essay, calculation–drawing work, analytical presentation, problem solution with analysis, extended analysis with conclusions) match the independent-learning formats explicitly recommended in course syllabi and are compatible with assignment/submission through HEMIS.

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3. The rubric improves assessment transparency and supports syllabus-based assessment integration.

A four-level analytic rubric was designed to assess standards alignment, method correctness, indicator interpretation, evidence-based analysis, expert conclusion quality, and decision justification—core competencies explicitly required by the OOME syllabus.

Additionally, the model supports the requirement that at least 60% of control questions in midterm/final assessment should be derived from independent-study topics/tasks by enabling assessment-pool tagging and consistent conversion of tasks into control items.

4. The model is scalable across Food Technology courses and suitable for quality assurance.

Because the bank is structured by competency clusters and standardized task passports, it can be expanded beyond OOME and FOOMT to related subjects (food safety, microbiology, chemistry, unit operations), enabling longitudinal competency development and more consistent internal quality assurance.

In summary, the proposed approach provides a deployable mechanism to make independent learning in Food Technology structured, competency-aligned, and assessable, while remaining fully consistent with existing syllabus requirements and digital submission practices.

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