

The BEHEALTH Intelligent Mentoring Tool for Quality Improvement in Nursing Education: A Pilot Demonstration

DOI: 10.12776/qip.v30i2.2410

Kristína Zgodavová, Peter Bober, Aleš Bourek, Juliana Gabzdilová,
Jozef Babečka

Received: 04-08-2026 Accepted: 20-08-2026 Published: 31-08-2026

ABSTRACT

Purpose: The purpose of this paper is to introduce the BEHEALTH Intelligent Mentoring Tool (IMT) and demonstrate its operational feasibility and analytical functionality as a practical decision-support tool for Institution Quality Managers (IQMs) in Nursing Vocational Education and Training (NVET) and Nursing Work-based Learning (NWBL).

Methodology/Approach: Rooted in the ENQA ESG (2015) and EQAVET framework (Council of the European Union, 2020), the IMT extends quality assessment by incorporating student mental health and well-being, occupational health and safety, and environmental management. A 360-degree survey on a 1–5 scale gathered pilot data from four stakeholder groups: managers, teachers, students, and employers across six European countries.

Findings: The pilot testing demonstrated the IMT's operational feasibility as a decision-support tool for IQMs. The IMT integrated multi-stakeholder assessments, identified perceptual gaps, and generated rule-based feedback to support institutional quality improvement.

Research Limitation/Implications: The survey data are intended to demonstrate IMT functionality and should not be used to draw generalisable conclusions.

Originality/Value of paper: The paper combines stakeholders' psychological mental health and well-being metrics with an automated prescriptive expert system for direct institutional action.

Keywords: nursing education; quality assurance; 360-degree assessment; intelligent mentoring tool.

Category: Research paper

Research Areas: Quality of Life; Strategic Quality Management

1 INTRODUCTION

Providing high-quality Nursing Vocational Education and Training (NVET) is a fundamental pillar of resilient healthcare systems. Unlike general educational pathways, NVET exhibits a unique duality, seamlessly blending theoretical classroom instruction with intensive work-based learning (WBL) in clinical environments. This dual nature introduces multi-layered operational risks and quality-assurance challenges. The clinical setting exposes nursing students not only to professional rigour but also to significant psychosocial stressors, occupational hazards, and complex environmental protocols. Consequently, traditional quality management frameworks that focus solely on academic compliance or administrative metrics are no longer sufficient to address the modern holistic needs of healthcare education.

In the era of Quality 5.0, the paradigm of quality assurance must transition from rigid, technocentric automation in Quality 4.0 toward human-centric, resilient, and sustainable ecosystems (Hashim, Tlemsani, Mason-Jones, Matthews, & Ndrecaj, 2024), where:

- Co-creation means involving students, teachers and administration not as passive objects of evaluation, but as active creators of quality processes.
- Well-being and mental health mean expanding quality indicators to include assessments of the psychological and cognitive well-being of students and staff (building resilience and preventing burnout).
- Reducing bureaucracy means digitising and streamlining processes so that data collection does not burden teachers with excessive administrative duties.

In the context of the Erasmus+ BEHEALTH project No: 2024-1-SK01-KA220-VET-000253130 “Promoting Quality Assurance in Nursing VET Education”, accessible at <https://behealthproject.eu/>, this implies that quality mentoring and monitoring must systematically incorporate dimensions such as student mental health, occupational health and safety, and institutional environmental management. Ensuring clinical competence cannot be decoupled from safeguarding the psychological well-being and physical safety of the trainees. To systematically operationalise these requirements, educational institutions and clinical providers require agile, data-driven evaluation frameworks. Current macro-level guidelines, specifically the European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ENQA ESG, 2015) and the European Quality Assurance in Vocational Education and Training (EQAVET framework, Council of the European Union, 2020) directives, provide excellent structural foundations. However, they lack localised, granular tools capable of capturing the diverging perspectives of the diverse stakeholders involved in the NVET and NWBL ecosystem.

Quality in nursing education and training is perceived differently by four stakeholder groups: Managers (study programme guarantors; MA), teachers (TE), students (ST), and employers (EM).

To address this gap, this paper introduces the BEHEALTH Intelligent Mentoring Tool (IMT), the web-based tool developed within the Erasmus+ BEHEALTH project. The primary objective of the IMT is to monitor the comprehensive status of the internal quality assurance system within the institution. The tool digitises and extends the ten core areas of the ENQA ESG standards by embedding dedicated modules for Student Mental Health, Occupational Health and Safety, and Environmental Management. Utilising a rigorous 360-degree self-assessment methodology on a 5-point Likert scale, the tool aggregates evaluations from all four key stakeholder groups across six European countries: Slovakia, Hungary, Cyprus, Türkiye, Greece and Ireland.

The core scientific contribution of this study lies in demonstrating how the IMT utilises built-in expert intelligence to automatically translate stakeholder groups' feedback, visualised via multi-axial radar charts, into actionable institutional intelligence. For standards areas showing critical perceptual variance or low scores, the system generates automated qualitative recommendations to streamline the development of targeted institutional action plans. Conversely, high achievement combined with strong stakeholder alignment provides a basis for identifying good practices and supporting institutional and international comparison.

The primary objective of this study is to demonstrate the IMT as a practical decision-support tool for the IQM. The pilot data illustrate its multi-stakeholder assessment, aggregation, visualisation via multi-axial radar charts, perceptual-gap identification, and rule-based feedback. For standards areas showing critical perceptual variance or low scores, the system generates automated qualitative recommendations to streamline the development of targeted institutional action plans. The results should be interpreted as demonstrative IMT outputs rather than final assessments of NVET or NWBL quality.

2 LITERATURE REVIEW

2.1 Macro-Level Quality Frameworks: ENQA ESG Standards and EQAVET Directives in Vocational Contexts

The European landscape of quality assurance in education is governed by dual macro-level frameworks designed to harmonise standards, enhance transparency, and facilitate cross-border mobility. For higher education institutions, the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ENQA ESG, 2015) serve as a key reference framework. The ENQA ESG framework structures internal and external quality assurance across ten core areas, emphasising student-centred learning, robust institutional governance, and

continuous data monitoring (Manatos, Sarrico, & Rosa, 2017). Concurrently, for vocational pathways, the European Quality Assurance in Vocational Education and Training EQAVET framework (Council of the European Union, 2020) provides a systematic, cyclical model comprising four key phases: planning, implementation, evaluation, and review. For work-based learning pathway e.g. hospitals or other institutions providing practical training usually (ISO 9001:2015) or (ISO 21001:2025) is applied. While both frameworks successfully standardise administrative compliance, their deployment in specialised practical domains reveals operational limitations. Recent literature highlights that generic quality indicators often fail to capture the specific micro-level risks inherent to clinical training and nursing work-based learning (NWBL) (Grollmann, Hugo, Thomas, & Wittig, 2021; Attenborough, Abbott, Brook, & Knight, 2019). In nursing education, where academic instruction is strictly intertwined with immediate clinical accountability, a structural misalignment frequently emerges between institutional quality policies and the real-world conditions experienced by trainees in healthcare facilities (Spector et al., 2020).

2.2 The Triad of Human-Centred Quality Assurance: Mental Health, Occupational Health and Safety, and Environmental Management

To bridge this gap, contemporary educational research increasingly advocates expanding quality metrics to encompass socio-environmental and psychological dimensions (Rathnayaka Mudiyansele, & Samita, 2026). The integration of student mental health, occupational health and safety, and environmental management into standards represents a crucial paradigm shift:

- **Student Mental Health:** Nursing trainees face unprecedented levels of psychological distress, clinical anxiety, and burnout due to early exposure to patient suffering, rotating shifts, and high-stakes clinical environments (Andargeery et al., 2025). Traditional quality frameworks treat student satisfaction as an administrative metric; however, modern Quality 5.0 principles dictate that psychological well-being is a direct prerequisite for learning efficacy and clinical safety (Leblebici, Saylam, & Özacit, 2026).
- **Occupational Health and Safety:** The clinical NWBL environment exposes students to biological hazards, sharps injuries, and ergonomic strain. Rigorous OHS protocols within the educational quality loop reduce institutional liability and protect the workforce pipeline (Alsharari & Kerari, 2024).
- **Environmental Management:** Modern healthcare facilities operate under strict green directives, waste segregation protocols, and eco-efficiency standards. Integrating environmental management into nursing training ensures that future professionals comply with sustainability mandates, a dimension explicitly emphasised in the updated European green transition priorities. The synchronisation of these three pillars with standard ENQA ESG standards ensures that quality monitoring transitions from superficial bureaucratic auditing, e.g. in hospitals or periodic programme reviews in

education institutions, to a holistic evaluation of institutional and environmental resilience (Lattanzio et al., 2022).

2.3 The 360-Degree Evaluation and the Perceptual Gap in Quality Assurance

A major failure mode in traditional quality assurance systems is the reliance on single-source feedback, typically gathered through isolated student evaluations or top-down managerial monitoring or auditing. Such approaches mask internal operational friction. Methodologically, a 360-degree feedback mechanism solves this bottleneck by collecting simultaneous evaluations from four key stakeholder groups (Morgan, Cannan, & Cullinane, 2005). In organisational theory, comparing these distinct vectors regularly reveals a significant “perceptual gap”. Managers (study program guarantors) often perceive quality through the lens of policy compliance and resource allocation. Teachers focus on pedagogical delivery and curriculum adherence. Students evaluate quality based on real-time subjective experience and stress levels, while employers assess trainees’ immediate technical competence and readiness.

2.4 Digital Transformation and Expert Systems: Driving Quality 5.0

The volume of multi-dimensional data generated by a 360-degree multi-national survey requires advanced analytical processing to remain actionable for decision-makers. In the Quality 5.0 framework, digital transformation must move beyond descriptive data storage (e.g., merely displaying tables of means) toward prescriptive analytics driven by expert systems (Leblebici et al., 2026).

3 METHODOLOGY

3.1 IMT Operational Workflow

The IMT is designed to support the Institution Quality Manager (IQM) in continuously improving the institution’s Internal Quality Assurance System (IQAS). To initiate the assessment process, the IQM registers the institution in the IMT and establishes a respondent pool representing the four stakeholder groups: managers (study programme guarantors; MA), teachers (TE), students (ST), and employers (EM). The IQM provides the participating respondents with the necessary instructions and invites them to complete the 360-degree survey independently through the web-based IMT.

Following completion of the data-collection phase, the IMT processes and aggregates the responses and provides the IQM with quantitative and visual outputs at different levels of aggregation. These outputs enable the IQM to examine the assessment results by criterion and stakeholder group, compare stakeholder perspectives, and identify areas of alignment and perceptual gaps. The

results are presented numerically and through multi-axial radar charts, allowing the institution's quality performance to be examined from multiple perspectives.

In addition to quantitative and visual analytics, the IMT applies built-in rule-based expert intelligence to generate targeted institutional feedback. Depending on the achievement level and the degree of alignment among stakeholder-group assessments, the system provides qualitative feedback and recommendations through the Remediation Loop or the Excellence Loop. The Remediation Loop supports the identification of areas requiring improvement and proposes corresponding corrective or developmental actions, whereas the Excellence Loop identifies areas of high achievement and supports the maintenance and further development.

The overall operational workflow of the IMT and its integration into the institutional quality assurance cycle are illustrated in Figure 1.

The combined quantitative, visual, and qualitative outputs provide the IQM with decision-support information for identifying improvement priorities and developing an institutional action plan. The implementation and monitoring of the resulting action plan remain the responsibility of the institution. In this way, the IMT functions as a decision-support component of the IQAS, facilitating a continuous cycle of stakeholder assessment, evidence-based evaluation, targeted improvement, and quality development.

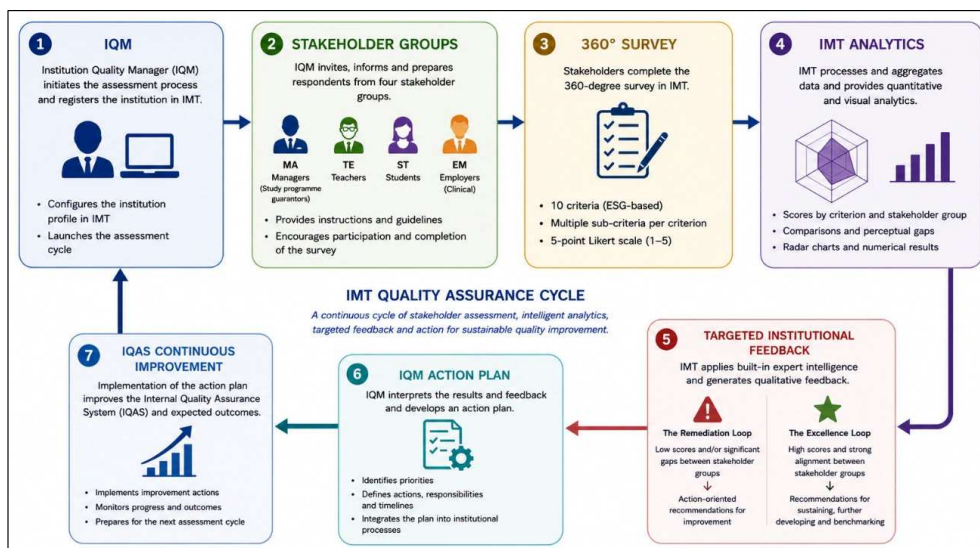


Figure 1 – The overall operational workflow of the IMT and its integration into the institutional quality assurance cycle

Repeated assessment cycles allow the IQM to monitor changes in institutional quality performance over time and to evaluate the effects of previously implemented improvement actions.

3.2 Pilot Demonstration Design and Evaluation Framework

This study adopts a pilot demonstration design aimed at evaluating the operational feasibility and analytical functionality of the IMT in real NVET and NWBL settings. The multinational implementation provides diverse institutional and stakeholder contexts in which the complete IMT workflow can be demonstrated. The study is therefore primarily demonstrative and exploratory rather than confirmatory or comparative. The methodological framework implemented in the IMT integrates the four-phase EQAVET framework (Council of the European Union, 2020) quality cycle (Planning, Implementation, Evaluation, and Review), the ten internal quality assurance standards of the ENQA ESG (2015), and the global guidelines of the World Federation for Medical Education (WFME, 2011).

The core research focus expands these standard administrative vectors by embedding non-traditional micro-level compliance areas directly relevant to work-based learning environments. Specifically, the methodology investigates how traditional educational quality co-exists with student mental health resources, occupational health and safety, and institutional environmental hygiene and sustainability protocols (Djukic et al., 2013).

3.3 360-degree Tool and Survey Structure

The data collection instrument consists of a multi-perspective, 360-degree survey designed for four stakeholder groups:

- Managers (study programme guarantors; MA): Providing perspectives on programme governance, evaluation, development, and compliance with accreditation requirements.
- Teachers (TE): Providing pedagogical, evaluative, and clinical supervision perspectives.
- Students (ST): Providing perspectives on educational experience, workload, and psychological well-being.
- Employers (EM): Assessing competencies, workforce readiness, and compliance with healthcare delivery requirements.

The survey evaluates ten quality assurance areas derived from the ENQA ESG (2015). For the purposes of the IMT survey, these ENQA ESG areas are referred to as criteria. Each criterion is assessed through a set of statements, referred to as sub-criteria in the IMT. The sub-criteria are formulated based on the respective ENQA ESG requirements and are complemented by project-specific statements addressing dimensions particularly relevant to NVET and NWBL, including student mental health and well-being, occupational health and safety (OHS), and environmental management. For example, Criterion 1 (Policy for Quality Assurance) includes project-specific sub-criteria addressing safe and secure NWBL environments and environmentally sustainable infrastructure. Similarly, Criterion 2 (Design and Approval of Programmes) includes additional sub-criteria

addressing OHS, environmental hygiene and waste management, mental and physical health, stress reduction, and counselling resources.

All sub-criteria are rated on a 5-point Likert scale (Allen & Seaman, 2007), corresponding to the following achievement levels: 1 – Minimal Achievement, 2 – Developing Achievement, 3 – Moderate Achievement, 4 – High Achievement, and 5 – Full Achievement. The complete set of survey criteria and sub-criteria, including the project-specific statements, is available in a separate document published on the BEHEALTH project accessible at <https://behealthproject.eu/>.

The 360-degree tool was developed through expert discussions among the BEHEALTH project partners and validated during the beta testing by representatives of the NVET and NWBL institutions.

3.4 Data Collection and Multi-National Sampling Procedures

IMT pilot data were collected between March and July 2026 from participating NVET and NWBL institutions in six countries represented in the BEHEALTH project: Slovakia, Hungary, Cyprus, Türkiye, Greece, and Ireland. The study involved four stakeholder groups: managers, teachers, students, and employers. Each participating institution's IQM coordinated the assessment process.

The pilot sample was designed to provide real-world data to test and demonstrate the complete IMT workflow across different stakeholder, institutional, and national contexts. A total of 112 respondents from 14 NVET institutions and 14 NWBL institutions participated in the pilot testing.

Table 1 presents the distribution of participating institutions and respondents by country and stakeholder group. The sampling procedure targeted NVET and NWBL institutions with established, accredited Internal Quality Assurance Systems (IQAS) and authorisation to deliver nursing qualification programmes. Including both educational and clinical institutions, together with four stakeholder perspectives, enabled assessment of institutional performance across different institutional and national contexts.

Table 1 – Distribution of participating institutions and respondents by country and stakeholder group in the pilot study

Country	NVET institutions	NWBL institutions	Respondents	Managers	Teachers	Students	Employers
Slovakia	4	4	32	8	8	8	8
Hungary	2	2	16	4	4	4	4
Cyprus	2	2	16	4	4	4	4
Türkiye	2	2	16	4	4	4	4
Greece	2	2	16	4	4	4	4
Ireland	2	2	16	4	4	4	4
Total	14	14	112	28	28	28	28

The survey was fully digitalised and administered through the interactive, multilingual, web-based IMT, available on the BEHEALTH project website (<https://behealthproject.eu/intelligent-mentoring-tool/>). The processing of

personal data associated with access to and use of the IMT was conducted in accordance with applicable data protection legislation, including the General Data Protection Regulation (GDPR), as specified in the BEHEALTH project website's registration conditions.

3.5 IMT Data Processing and Analytics

The IMT processes survey data through a hierarchical workflow corresponding to the evaluation framework. Individual sub-criterion ratings are first aggregated into criterion-level scores and subsequently into stakeholder-group results, enabling comparison of MA, TE, ST, and EM within an institution. Further aggregation supports institutional and cross-country comparisons.

The criterion-level results are presented through numerical indicators and multi-axial radar charts. The simultaneous visualisation of the four stakeholder-group profiles enables differences in perceptions of quality among MA, TE, ST, and EM to be identified. These differences provide the basis for identifying perceptual gaps between stakeholder groups and for highlighting criteria in which stakeholder assessments are closely aligned or substantially divergent.

In the final processing stage, the IMT applies predefined rule-based logic to link the quantitative assessment results with qualitative feedback and management recommendations. Based on the calculated achievement levels and the degree of alignment among stakeholder-group assessments, the analytical workflow follows two complementary pathways:

- The Remediation Loop is activated when the assessment identifies areas of insufficient achievement or substantial differences between stakeholder-group perceptions. The IMT links the identified area to the corresponding content in its predefined knowledge base and generates qualitative recommendations to address the detected weaknesses. These recommendations support the IQM in identifying priorities and formulating targeted improvement actions.
- The Excellence Loop applies to areas demonstrating the highest level of achievement together with strong alignment among stakeholder-group assessments. Rather than generating corrective recommendations, the IMT provides feedback aimed at maintaining and further developing the achieved level of performance. Such results can also serve as a basis for identifying good practices and supporting institutional, national, or international comparison.

Through these two pathways, the IMT extends the survey from descriptive assessment towards rule-based decision support by linking stakeholder-group evaluations with targeted institutional feedback. The detailed calculation procedures, aggregation rules, achievement-level thresholds, and conditions used to activate the Remediation and Excellence Loops are described in Section 3.6.

3.6 Statistical Calculation Principles and Data Aggregation

The IMT data structure comprises eight dimensions: country, institution type (NVET or NWBL), institution, stakeholder group, criterion, sub-criterion, respondent, and assessment time. These dimensions enable the collected data to be aggregated and analysed from different perspectives.

For the purposes of the pilot implementation, the IMT applies a transparent equal-weight aggregation model. Each sub-criterion contributes equally to its corresponding criterion score, each criterion contributes equally to the overall stakeholder-group assessment, and each of the four stakeholder groups contributes equally to the institutional score. At country level, participating institutions represent the units of comparison and contribute equally to the aggregated score. Equal weighting was selected to ensure transparency and interpretability of the pilot decision-support model and should not be interpreted as an empirically validated optimal weighting scheme.

The calculations presented below describe the processing of data obtained within a single assessment cycle; therefore, the time dimension is held fixed and is not explicitly included in the following equations. Similarly, country and institution type are treated as fixed for the purpose of simplifying the mathematical notation. The same calculation procedure is applied independently to each institution and assessment cycle. The pilot study comprised a single assessment cycle; consequently, analyses of changes over time were not performed.

Step 1: Data Collection and Normalisation

Each respondent logged into the IMT belongs to some stakeholder group of the institution. When evaluating the survey items, the respondent assigns a raw score to each sub-criterion:

$$s_{ricj} \in \{1,2,3,4,5\}, \quad (1)$$

where $r \in R_{gj}$ is a respondent belonging to the set of respondents R_{gj} , g is the stakeholder group of institution j , and i is the sub-criterion of criterion c .

The following equation (2) linearly rescales the discrete ordinal data s_{ricj} from the 5-point Likert scale into a 0–100% value suitable for multi-axial radar charting:

$$X_{ricj} = \frac{s_{ricj}-1}{4} \cdot 100\%. \quad (2)$$

Step 2: Sub-criteria to Criterion Aggregation

Criterion-level score X_{rcj} of respondent $r \in R_{gj}$ for criterion c in institution j is:

$$X_{rcj} = \frac{1}{I_c} \sum_{i=1}^{I_c} X_{ricj}, \quad (3)$$

where I_c is the number of sub-criteria for criterion c .

Step 3: Respondents to stakeholder group aggregation

Average criterion score X_{gcj} of criterion c for group g in institution j is:

$$X_{gcj} = \frac{1}{N_{gj}} \sum_{r \in R_{gj}} X_{rcj}, \quad (4)$$

where $N_{gj} = |R_{gj}|$ is the number of respondents in group g in institution j .

Step 4: Perceptual Gap and Inter-Group Variance Analysis

The multi-axial radar charts plot the values of X_{gcj} for all four groups simultaneously across the criterion axes. To algorithmically identify areas of friction, the IMT calculates the Perceptual Gap Δ_{cj} for each criterion, defined as the maximum absolute difference between any two stakeholder groups:

$$\Delta_{cj} = \max(X_{gcj}) - \min(X_{gcj}); \text{ for } g \in \{1, 2, 3, 4\}. \quad (5)$$

Furthermore, to measure overall institutional misalignment within a specific standards area, the system computes the inter-group variance (σ_A^2):

$$\sigma_{cj}^2 = \frac{1}{4} \sum_{g=1}^4 (X_{gcj} - \mu_{cj})^2 \quad (6)$$

where μ_{cj} is the global institutional mean for X_{gcj} across all groups.

Step 5: Overall Institutional Assessment by Stakeholder Group

To obtain an overall assessment X_{gj} of institution j from the perspective of stakeholder group g , the criterion-level scores X_{gcj} are aggregated across all criteria:

$$X_{gj} = \frac{1}{C} \sum_{c=1}^C X_{gcj}, \quad (7)$$

where C is the number of evaluated criteria.

Step 6: Institution and Country Level Aggregation

The overall assessment score of institution j is calculated by averaging the overall scores X_{gj} across the four stakeholder groups:

$$X_j = \frac{1}{G} \sum_{g=1}^G X_{gj}, \quad (8)$$

where $G = 4$ is the number of stakeholder groups.

For cross-country comparison, institutions are grouped by country and institution type (NVET or NWBL). The country-level score for institution type k in country u is calculated as:

$$X_{ku} = \frac{1}{J_{ku}} \sum_{j \in J_{ku}} X_j, \quad (9)$$

where J_{ku} is the set of institutions of type k in country u , and $J_{ku} = |J_{ku}|$ is the number of these institutions. The resulting X_{ku} represents the average overall institutional score for the respective institution type and country.

Step 7: Detailed Verbal Feedback and Recommendations

The final phase of the prescriptive data processing pipeline within the IMT transforms quantitative scores into structured verbal feedback and operational management recommendations. A deterministic, rule-based decision-support mechanism produces recommendations by linking calculated achievement levels to predefined, criterion-specific feedback stored in the IMT knowledge base. The knowledge base was developed through expert discussions among the BEHEALTH project partners and validated by external institutions.

The platform's algorithm maps the final percentage score of each monitored quality criterion onto distinct qualitative performance tiers, automatically pairing them with dynamic action directives according to Table 2.

Table 2 – Criterion achievement levels, thresholds and recommendations

Achievement level	Threshold	Recommendation
Minimal	0 – 20%	The IQA mechanism is not established
Developing	21 – 40%	The IQA mechanism exists in a limited or informal capacity
Moderate	41 – 60%	The IQA system is working, but inconsistently
High	61 – 80%	The IQA system is well-established and regularly used
Full	81 – 100%	The feedback process is strategic, embedded, and part of a continuous improvement cycle

Lower achievement levels prioritise corrective and developmental actions, whereas high and full achievement levels focus on sustaining performance, further development, and national or international comparison. Examples of the generated feedback are presented in Section 4.2.

The Excellence Loop is activated when the assessment reaches the Full Achievement level (81–100%). For all other achievement levels, the IMT activates the Remediation Loop and provides recommendations aimed at addressing identified weaknesses and supporting further improvement. This automated apparatus ensures that the institutional quality manager transitions from passive data visualisation to immediate, text-guided institutional action, significantly optimising the formulation of targeted action plans.

4 PILOT DEMONSTRATION OF IMT FUNCTIONALITY

The pilot testing demonstrated the operational functionality of the IMT across the participating NVET and NWBL institutions. The following sections present the main analytical outputs available to respondents and IQMs, progressing from

individual and stakeholder-group assessment to institutional and cross-country comparisons.

4.1 Individual and Stakeholder-Group Assessment

The pilot testing demonstrated the ability of the IMT to present assessment results at both individual and stakeholder-group levels. For each respondent r , the criterion-level scores X_{rcj} are visualised in a multi-axial radar chart.

In the respondent view, the individual criterion-level profile X_{rcj} is displayed together with selectable stakeholder-group profiles X_{gcj} . Respondents can therefore compare their individual assessment with the aggregated assessment of all stakeholder groups.

The IQM view presents only the aggregated criterion-level profiles X_{gcj} for the four stakeholder groups, without displaying individual respondent scores. This enables the IQM to compare stakeholder perspectives across the evaluated criteria and identify areas of agreement or divergence.

Figure 2 illustrates these role-specific views using pilot data for one institution. The simultaneous presentation of stakeholder-group profiles provides a visual basis for identifying perceptual gaps, which are further quantified and interpreted in Section 4.3. The “Personal Actual” profile represents the assessment of an individual respondent, a manager in this example.

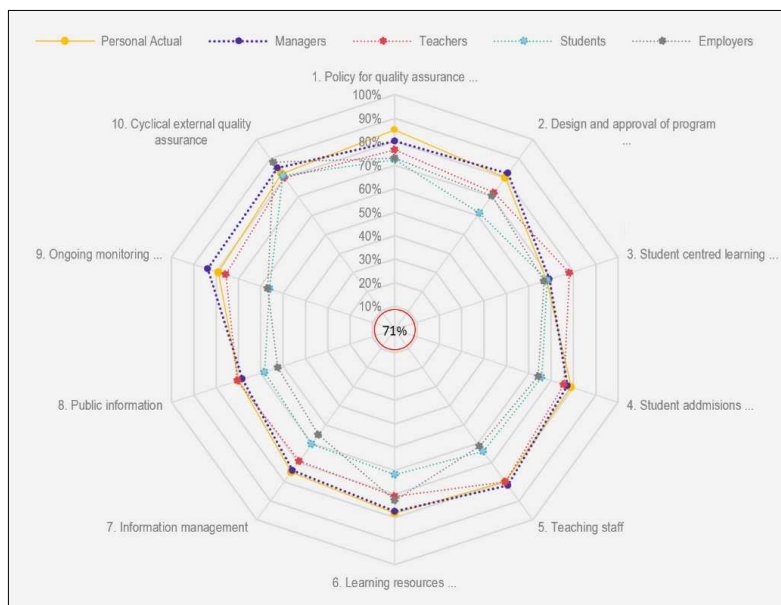


Figure 2 – Comparison of individual and stakeholder-group criterion scores within an institution

4.2 Automated Detailed Feedback and Recommendations

In addition to quantitative and visual results, the IMT provides qualitative feedback and targeted recommendations for the evaluated criteria. Based on the calculated achievement level, the built-in rule-based expert intelligence links the assessment result to predefined recommendations supporting either improvement through the Remediation Loop or further development through the Excellence Loop.

Figure 3 illustrates how quantitative assessment results are translated into practical decision-support information that can be used by the IQM when defining improvement priorities and developing an institutional action plan. In the pilot case presented, the three lowest-scoring criteria were Criterion 8 (62.4%), Criterion 7 (64.7%), and Criterion 9 (68.1%).

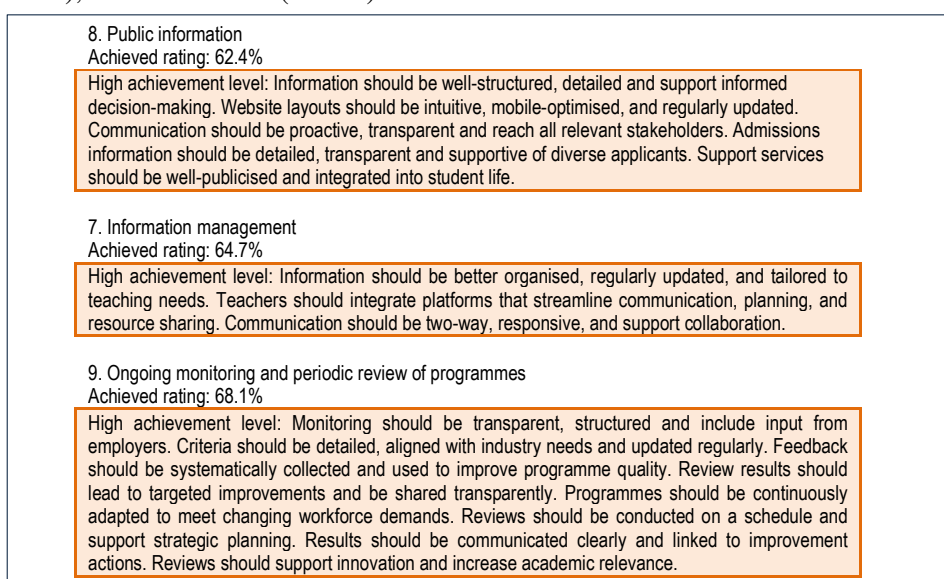


Figure 3 – Example of IMT-generated detailed feedback and recommendations for criteria with lowest scores

4.3 Identification and Interpretation of Perceptual Gaps

The pilot results revealed substantial differences between stakeholder-group assessments in several criteria (Figure 4). The largest Perceptual Gap was identified for Criterion 9 (Ongoing Monitoring), reaching 27.7 percentage points between managers (83.8%) and students (56.1%). Further notable gaps were observed for Criterion 2 (Design and Approval of Programmes), with a 20.9-point difference between managers (82.2%) and students (61.3%), and Criterion 5 (Teaching Staff), with a 20.5-point difference between managers (81.9%) and employers (61.4%).

Figure 4 ranks these differences and identifies the stakeholder groups defining each gap, enabling the IQM to identify priority areas for further investigation and targeted improvement.

Criterion (%)	Overall score (%)	Managers (%)	Teachers (%)	Students (%)	Employers (%)	Perceptual Gap (%)	Largest gap between
9. Ongoing monitoring ...	68.1	83.8	75.7	56.1	56.9	27.7	Managers - Students
2. Design and approval of program ...	71.5	82.2	72.0	61.3	70.4	20.9	Managers - Students
5. Teaching staff ...	71.9	81.9	80.1	64.0	61.4	20.5	Managers - Employers

Figure 4 – IMT identification and interpretation of highest perceptual gaps between stakeholder groups

4.4 Overall Institutional Assessment by Stakeholder Group

The overall stakeholder-group assessment further confirmed differences in perceptions of institutional quality. Managers reported the highest overall score (78.0%), followed by teachers (74.9%), while employers (66.1%) and students (64.9%) provided lower assessments. The overall institutional score was (71.0%), corresponding to the High Achievement level.

Figure 5 demonstrates that aggregation at the institutional level preserves the differences between stakeholder perspectives and provides the IQM with a concise overview of their relative assessments.

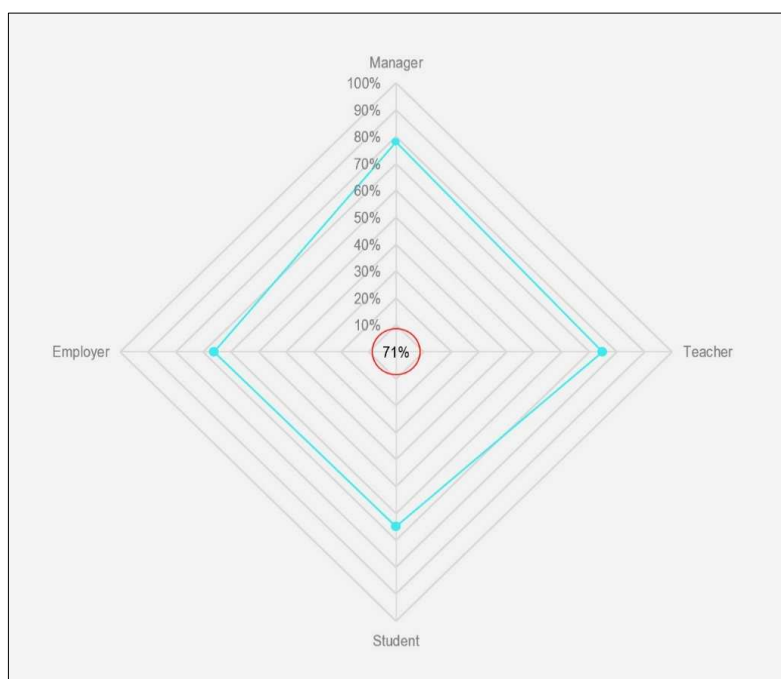


Figure 5 – Overall institutional assessment by stakeholder group

4.5 Cross-Country Institutional Comparison

Cross-country aggregation revealed differences in the pilot assessment results for both institution types. The mean country-level score was 76.5% for NVET institutions and 70.7% for NWBL institutions. Cyprus achieved the highest scores for both NVET (89%) and NWBL (85%), while Türkiye showed identical scores for the two institution types (79%). The largest within-country difference was observed in Greece, where the NVET score reached 80% compared with 62% for NWBL. Figure 6 demonstrates the potential of the IMT for comparing aggregated institutional performance across countries and between NVET and NWBL settings. Given the pilot nature of the sample, these results should be interpreted as illustrative comparisons.

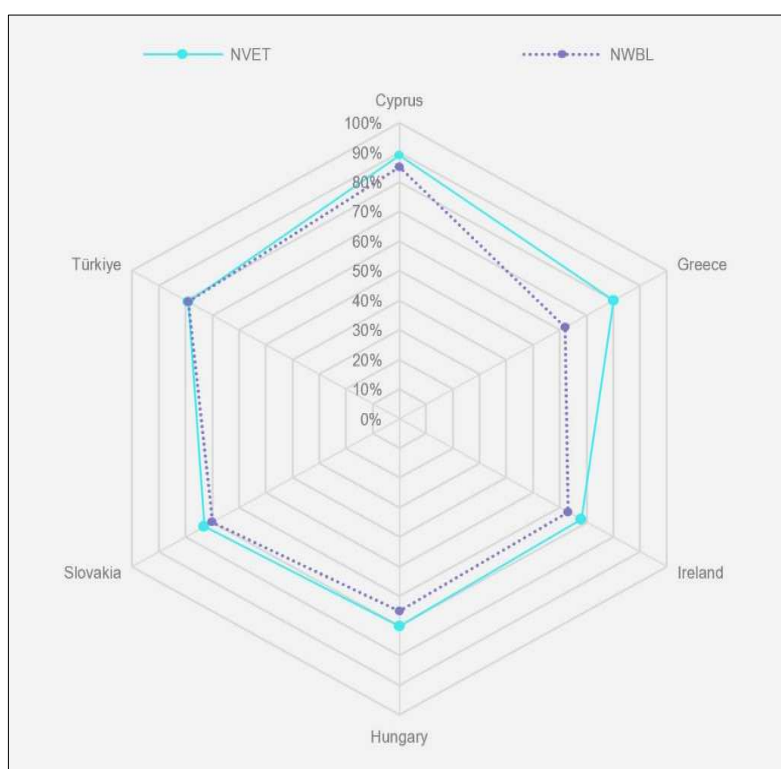


Figure 6 – Cross-country comparison of overall institutional scores for NVET and NWBL institutions

5 DISCUSSION

5.1 Multi-Stakeholder Assessment and the Perceptual Gap

The pilot results demonstrate the practical value of maintaining separate stakeholder perspectives within the 360-degree assessment. Although the overall institutional score in the presented case was (71.0%), stakeholder-group

assessments ranged from (64.9%) for students to (78.0%) for managers. At criterion level, these differences were even more pronounced, with the largest Perceptual Gap reaching 27.7 percentage points for Ongoing Monitoring (Figure 4). Aggregation into a single institutional score would therefore conceal potentially important differences in how quality is perceived by individual stakeholder groups.

The identification of perceptual gaps provides the IQM with information that cannot be obtained from overall mean scores alone. Divergent assessments may indicate differences between institutional policies, their implementation, and the actual experience of stakeholders. Conversely, close alignment among stakeholder groups strengthens the evidence that a quality criterion is consistently perceived across the institution. Thus, the multi-stakeholder approach extends IQAS evaluation beyond overall performance measurement.

5.2 From Assessment to Action: Rule-Based Decision Support

A key practical contribution of the IMT is its transition from descriptive assessment to rule-based decision support. Unlike a conventional online survey or dashboard that primarily collects and visualises data, the IMT links quantitative results to predefined qualitative feedback and targeted recommendations.

Through the Remediation and Excellence Loops, the IMT distinguishes between areas requiring improvement and those demonstrating high achievement. This provides the IQM with an interpretation of the assessment results and supports the identification of priorities for an institutional action plan. The IMT therefore does not replace managerial decision-making but provides structured evidence and expert-based guidance to support it.

5.3 Institutional Learning and Continuous Improvement

The aggregation of stakeholder assessments at institutional and country levels extends the use of the IMT beyond the evaluation of individual quality criteria. Institutional profiles and cross-country comparisons provide the IQM with reference information for identifying relative strengths, weaknesses, and opportunities for improvement.

These results can inform the institutional action plan and subsequent quality improvement activities. Repeated assessment cycles will further enable institutions to compare current and previous results, monitor changes in quality performance over time, and evaluate whether implemented actions have produced the expected improvements. In this way, the IMT supports the continuous quality improvement cycle illustrated in Figure 1.

5.4 Limitations and Future Development

The present study was based on pilot testing involving 112 respondents from 14 NVET and 14 NWBL institutions across six countries. Although the four

stakeholder groups were equally represented, the limited number of participating institutions and the higher representation of Slovakia restrict the generalisability of the findings. The country-level results should therefore be interpreted only as pilot comparisons. Further testing with larger samples is required to assess the reliability and validity of the evaluation framework and the comparability of results across institutional and national contexts. Monitoring of changes over time will require repeated assessment cycles.

The structure of the criteria and the survey questions is aligned with the specific requirements of the ENQA ESG (2015); therefore, any future revision of these standards will require corresponding updates to the 360-degree survey, while the IMT evaluation framework, including averaging, aggregation, and graphical visualisation, can remain unchanged.

6 CONCLUSION

The BEHEALTH Intelligent Mentoring Tool (IMT) provides a digital, multi-stakeholder approach to supporting internal quality assurance in NVET and NWBL institutions. By integrating ENQA ESG-based criteria with student mental health and well-being, occupational health and safety, and environmental management, the IMT extends quality assessment beyond conventional administrative indicators.

Pilot testing demonstrated that the IMT can preserve and visualise stakeholder differences that may be obscured by institutional averages. The largest criterion-level Perceptual Gap reached 27.7 percentage points, while the overall institutional assessment showed higher scores from managers and teachers than from students and employers. The IMT further links quantitative results to targeted qualitative feedback and enables institutional and cross-country comparisons.

By combining multi-stakeholder assessment, perceptual-gap analysis, rule-based feedback, and cross-institutions comparison, the IMT provides the IQM with structured decision support for evidence-based quality improvement.

Country-level results from the present pilot should be regarded as illustrative. Broader and repeated deployment is required to validate comparative applications and assess changes over time.

ACKNOWLEDGEMENTS

This research was supported by the Erasmus+ Programme of the European Union under the project “Promoting Quality Assurance in Nursing VET Education” [Project No. 2024-1-SK01-KA220-VET-000253130]. The authors acknowledge the collaborative efforts of all project partners in Q-IMPULZ and Catholic University in Slovakia, TREBAG Hungary, DELTA Cyprus, MAMAK Türkiye, IEK DELTA Greece, and EHFF Ireland for their contribution to the data collection process.

REFERENCES

- Allen, I. E., & Seaman, C. (2007). Statistics roundtable: Likert scales and data analyses. *Quality Progress*, 40(7), 64–65.
- Alsharari, A. S., & Kerari, A. (2024). Factors influencing occupational health and safety among nursing students in their clinical placements: A cross-sectional study. *Healthcare*, 12(9), 884.
- Andargeery, S. Y., Altaweel, E. A., Alkorbi, F. S., Alanazi, B. F., Idriss, S. H., Alqahtani, S. S., & Alkhamis, L. M. (2025). Nursing students' academic burnout: Its prevalence and association with self-efficacy, psychological distress, and quality of learning experience. *BMC Nursing*, 24(1), Article 631. <https://doi.org/10.1186/s12912-025-03242-2>
- Attenborough, J., Abbott, S., Brook, J., & Knight, R. (2019). Everywhere and nowhere: Work-based learning in healthcare education. *Nurse Education in Practice*, 36, 132–138. <https://doi.org/10.1016/j.nepr.2019.03.004>
- Djukic, M., Kovner, C. T., Brewer, C. S., Fatehi, F. K., Bernstein, I., & Aidarus, N. (2013). Improvements in educational preparedness for quality and safety. *Journal of Nursing Regulation*, 4(2), 15–21. [https://doi.org/10.1016/S2155-8256\(15\)30152-6](https://doi.org/10.1016/S2155-8256(15)30152-6)
- European Association for Quality Assurance in Higher Education (ENQA). (2015). *Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)*. Brussels, Belgium.
- Council of the European Union. (2020). Council Recommendation of 24 November 2020 on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience (2020/C 417/01). *Official Journal of the European Union*, C 417, 1–16.
- Grollmann, P., Hugo, F., Thomas, S., & Wittig, W. (2021). *Monitoring and evaluating work-based learning in vocational education and training: A handbook for policy makers and social partners*. Turin, Italy: European Training Foundation.
- Hashim, M. A. M., Tlemsani, I., Mason-Jones, R., Matthews, R., & Ndrecaj, V. (2024). Higher education via the lens of industry 5.0: Strategy and perspective. *Social Sciences & Humanities Open*, 9, Article 100828. <https://doi.org/10.1016/j.ssaho.2024.100828>
- International Organization for Standardization. (2015). *Quality management systems – Requirements* (ISO Standard No. 9001:2015). Geneva, Switzerland.
- International Organization for Standardization. (2025). *Educational organizations – Management systems for educational organizations – Requirements with guidance for use* (ISO Standard No. 21001:2025). Geneva, Switzerland.

Lattanzio, S., Stefanizzi, P., D'ambrosio, M., Cuscianna, E., Riformato, G., Migliore, G., Tafuri, S., & Bianchi, F. P. (2022). Waste Management and the Perspective of a Green Hospital—A Systematic Narrative Review. *International Journal of Environmental Research and Public Health*, 19(23), 15812. <https://doi.org/10.3390/ijerph192315812>

Leblebici, D. N., Saylam, A., & Özacit, İ. (2026). *Artificial intelligence in public administration: From e-government to smart government*. Nova Science Publishers. <https://doi.org/10.52305/SDNY3312>

Manatos M. J., Sarrico C. S., & Rosa M. J. (2017). The European standards and guidelines for internal quality assurance: An integrative approach to quality management in higher education. *The TQM Journal*, 29(2) pp. 342–356. <https://doi.org/10.1108/TQM-01-2016-0009>

Morgan, A., Cannan, K., & Cullinane, J. (2005). 360° feedback: A critical enquiry. *Personnel Review*, 34(6), 663–680. <https://doi.org/10.1108/00483480510623457>

Rathnayaka Mudiyansele, A. C., & Samita, S. (2026). Development and validation of a Nursing Students' Clinical Practice Stress Scale: A mixed methods study. *Nursing Open*, 13(1), Article e70424. <https://doi.org/10.1002/nop2.70424>

Spector, N., Silvestre, J., Alexander, M., Martin, B., Hooper, J. I., Squires, A., & Ojemeni, M. (2020). NCSBN regulatory guidelines and evidence-based quality indicators for nursing education programs. *Journal of Nursing Regulation*, 11(2, Suppl.), S1–S64. [https://doi.org/10.1016/S2155-8256\(20\)30075-2](https://doi.org/10.1016/S2155-8256(20)30075-2)

World Federation for Medical Education. (2011). *Quality assurance in medical education: Global standards for quality improvement*. Copenhagen, Denmark.

ABOUT AUTHORS

Kristína Zgodavová ORCID: 0000-0001-7164-3810 (K.Z.) – executive director, Slovenská únia pre kvalitu inovácie a dizajn (Q-IMPULZ), Slovakia, e-mail: kristina.zgodavova@gmail.com.

Peter Bober ORCID: 0000-0002-8743-5220 (P.B.) – assistant professor, Technical University of Košice, Košice, Slovakia, e-mail: peter.bober@tuke.sk.

Aleš Bourek ORCID: 0000-0002-5481-3408 (A.B.) – assistant professor, Masaryk University, Brno, Czech Republic, e-mail: bourek@med.muni.cz.

Juliana Gabzdilová ORCID: 0000-0002-8125-1885 (J.G.) – assistant professor, Pavol Jozef Šafárik University in Košice, Košice, Slovakia, e-mail: juliana.gabzdilova@upjs.sk.

Jozef Babečka ORCID: 0000-0002-1592-0833 (J.B.) – associate professor, Catholic University in Ružomberok, Ružomberok, Slovakia, e-mail: jozef.babecka@ku.sk.

AUTHOR CONTRIBUTIONS

Conceptualisation, K.Z.; Methodology, K.Z., P.B.; Software, P.B.; Validation, A.B.; Formal analysis, A.B.; Investigation, K.Z., A.B.; Resources, J.G., A.B.; Data curation, J.B.; Original draft preparation, K.Z., P.B.; Review and editing, K.Z., P.B.; Visualisation, K.Z., P.B.; Supervision, A.B.; Funding acquisition, K.Z.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest. The funders had no role in the design of the study, in the collection, analysis, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

DISCLOSURE OF ARTIFICIAL INTELLIGENCE ASSISTANCE

The authors acknowledge the use of generative artificial intelligence tools in the preparation of this manuscript. Specifically, ChatGPT by OpenAI was used to support the development and organisation of the manuscript structure, translation into English, linguistic and stylistic refinement, terminology consistency, and the formulation and presentation of selected methodological and results-related sections. Generative AI was also used to create Figure 1 based on the authors' conceptual design and specifications. All AI-assisted content was critically reviewed, edited, and validated by the authors to ensure accuracy, scholarly integrity, originality, and consistency with the underlying methodology and data. The authors retain full responsibility for the study design, data, analyses, interpretation of results, and the final content of the manuscript.



© 2026 by the authors. Submitted for possible open-access publication under the Terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).