



Competency-Based Assessment Tools in Music and Arts Education Using a Undar Plugin Module in Open Edx

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Abstract

The purpose of the study was to verify the relevance of the UNDAR Open Edx plugin module for competence-based assessment in music and arts education; for this purpose, an applied research type and pre-experimental design for paired samples with a single group was formulated, pre and posttest for the dependent variable, and a correlation between the independent and dependent variables to establish causality; the study worked with a population of 30 teachers from UNDAR and ISMPDAR, and a sample of 9 teachers who voluntarily participated in the research; The data collection instrument consisted of a data recording form, a questionnaire based on the Likert scale, and an observation guide. The independent variable, "Competency-Based Assessment Instruments," was structured around the following dimensions: Competencies and Assessment Criteria, and Pedagogically Appropriate Holistic and Analytical Rubrics. The corresponding dependent variable was "Level of Relevance of the UNDAR Open EdX Plugin Module for Competency-Based Education in Music and Arts Education," with the following dimensions: Technical Functioning and Usability, Comprehensiveness for Music and Arts Assessment, and Utility and Adoption in the Educational Context. This was achieved through eight closed-ended questions validated by expert judgment. The study concludes that the UNDAR Open EdX plugin module is relevant for competence-based assessment in music and arts education.

Keywords: assessment instruments, competency-based assessment; music and arts education; UNDAR Open edX plugin; digital rubrics.

Introduction

Music and arts education plays an essential role in the holistic development of students, articulating cognitive, technical, creative, expressive, and socio-emotional dimensions that transcend the mere acquisition of theoretical knowledge. In higher education, these disciplines demand pedagogical and evaluative approaches that allow for the assessment of students' authentic performance in real or simulated contexts, considering processes, results,



and levels of achievement in an integrated manner. In this sense, competency-based assessment has become established as a relevant paradigm, focusing on the articulated mobilization of knowledge, skills, and attitudes in meaningful situations (Andino et al., 2025).

However, limitations persist in the implementation of assessment tools consistent with this approach in music and arts education. Traditional assessment tends to prioritize summative methods and theoretical content, hindering the systematic evaluation of practical, interpretive, and creative skills inherent to these disciplines.(Bachiri & Mouncif, 2023)This situation restricts formative feedback and affects the monitoring of the actual progress of artistic-musical learning, especially in contexts mediated by digital technologies.

The integration of information and communication technologies (ICTs) into higher education has expanded the possibilities for access, flexibility, and personalization of learning. Open-source learning management platforms, such as Open edX, offer robust environments for creating and managing online courses, as well as for assessing learning.(Blanco et al., 2020)However, various studies and the institution's own diagnosis show that these platforms do not always have specific tools that allow for the proper operationalization of competency-based assessment in music and the arts, particularly when it is necessary to integrate performance criteria, achievement levels, and qualitative feedback through pedagogically sound rubrics.(Cruz et al., 2023).

Faced with this challenge, the Daniel Alomía Robles National University has promoted the development of a UNDAR plugin module for Open edX, specifically designed for implementing competency-based assessment tools in music and arts education. This is achieved through the use of holistic and analytical checklists and rubrics adapted to virtual environments, allowing for the creation of exams in text, audio, image, and video formats. The module incorporates assessment criteria specific to artistic disciplines, considering both pedagogical and technological aspects, such as usability, technical functionality, and the comprehensiveness of the evaluation process. It also allows for the assignment of configurable timers, both asynchronous and synchronous (directed by the instructor), as well as the possibility of reusing rubrics, checklists, and exams across multiple subjects, based on the instructor's technical criteria. Regarding the management of assessment reports, it allows for the generation of reports for each student and the configuration of feedback notes when required.

Based on the described context, the following question was formulated: What is the level of relevance of the UNDAR Open Edx plugin module for competency-based assessment in music and arts education? In accordance with the identified problem, the general objective was established, which was to verify the relevance of the UNDAR Open Edx plugin module



for competency-based assessment in music and arts education. The following specific objectives were also proposed:

- a) Pedagogical: Identify the competencies and performance criteria in music and art education that should be incorporated into holistic and analytical rubrics for adaptation in virtual environments.
- b) Instrumental: Design holistic and analytical rubrics with structures, indicators, achievement levels and scales appropriate to ensure relevance in the evaluation of artistic-musical performance in virtual contexts.
- c) Technological: Develop the architecture, functionalities and workflows of the UNDAR Open EdX plugin module that allow for the relevant operationalization of competency-based assessment in music and art education through rubric mapping.
- d) Experiential: Evaluate teachers' perceptions of the clarity, usability, and relevance of the rubrics implemented in the UNDAR Open EdX plugin module after their application in a pilot competency-based assessment in music and art education.

The research hypothesis was: The relevance of holistic and analytical rubrics in the UNDAR Open edX plugin module significantly influences competency-based assessment in music and arts education. There is some background research that provides a preliminary contribution regarding the variables and dimensions of the study. Internationally, various studies have demonstrated the potential of virtual platforms and MOOC environments for teaching and assessment in musical and artistic contexts. Studies such as those by Bachiri and Mouncef (2023) show that platforms like Open edX and Moodle, supported by intelligent systems, can optimize learning assessment processes through automated tools and pedagogical analytics, promoting personalization and performance monitoring. Similarly, Hu et al. (2021) evaluated learning analytics tools implemented in Moodle and Open edX, finding positive perceptions regarding their usefulness for monitoring academic progress, which reinforces the relevance of integrating more sophisticated assessment systems into these platforms. From a pedagogical perspective, Blanco et al. (2020) emphasize that evaluation should not be conceived as a stage subsequent to instructional design, but as a central component of the training process in virtual environments, which supports the incorporation of holistic and analytical rubrics to evaluate complex competencies, such as musical and artistic ones.

Similarly, at the national level, research on music education and the use of ICTs reveals a growing concern for improving teaching and assessment processes in this field. Contador (2020) identified that the use of digital tools in music reading and ear training courses significantly contributes to learning, provided they are accompanied by appropriate pedagogical strategies. Likewise, Chong (2021) analyzed the pedagogical usability of music notation software in higher education, concluding that students' positive perceptions depend on the clarity of the assessment criteria and the feedback received. From an evaluative



perspective, Acosta (2022) highlights the importance of formative assessment in the area of arts and culture, emphasizing the need for instruments that allow for the evaluation of processes, performance, and levels of achievement. This national background demonstrates the need to develop and implement competency-based assessment instruments adapted to virtual environments, such as the UNДАР plugin module in Open edX, especially in institutions specializing in music and arts education.

At the local level, particularly in the Huánuco region, research has demonstrated the need to strengthen teaching and assessment processes in music education through updated pedagogical approaches and the use of educational technologies. Berrospi (2018) developed a teaching guide for learning to read music in students at the “Daniel Alomía Robles” Public Higher Institute of Music, concluding that clarity in assessment criteria and the use of structured tools significantly enhance musical learning. Similarly, Arias (2019) analyzed the implementation of a pedagogical program for teaching saxophone at UNДАР, highlighting the importance of assessing not only theoretical knowledge but also the student's practical performance. Likewise, Julca (2022) investigated the use of Huánuco musical repertoire in saxophone instruction at the Daniel Alomía Robles National University, emphasizing the need for contextualized assessment tools that allow for the evaluation of technical, interpretive, and expressive skills. These local studies agree in pointing out limitations in traditional evaluation methods and reinforce the relevance of implementing competency-based assessment instruments supported by virtual environments, such as the UNДАР plugin module in Open edX, adapted to the particularities of music and art education in the region.

Methodology

This research adopted a quantitative approach, employing descriptive and inferential statistical processes to analyze and interpret the data collected. The study was applied, using a pre-experimental, single-group pre- and post-test design (Hernández Sampieri et al., 2018). The study was conducted with a population of 30 teachers from UNДАР and ISMPDAR, using a non-probability sample of 9 teachers. Data was collected using a Likert-scale questionnaire before and after a teacher training workshop on competency-based assessment tools in music and arts education using Open EdX. A data recording form and an observation guide were also used to validate the technical specifications of the UNДАР Open EdX plugin module. The questionnaire questions were structured based on the independent variable, Competency-Based Assessment Instruments, with its dimensions: Competencies and Assessment Criteria, and Pedagogically Appropriate Holistic and Analytical Rubrics; and its corresponding dependent variable, Level of Relevance of the UNДАР Open Edx Plugin Module for Competency-Based Education in Music and Arts Education, with its dimensions: Technical Functioning and Usability, Comprehensiveness for Music and Arts Assessment, and Utility and Adoption in the Educational Context. Eight closed-ended questions were



validated by expert judgment, resulting in the rejection of the normality assumption. Therefore, the non-parametric Wilcoxon signed-rank test was used for inferential analysis. The scientific method (Hernandez-Sampieri et al., 2018) was used in the research process, and its design scheme is as follows:

G: EITHER₁ X EITHER₂

Where:

- G: represents the experimental group
- X: This is the treatment of the independent variable (Competency-based assessment instruments)
- O1: Application of the Pretest to measure the dependent variable (Level of relevance of the UNDAR Open edX plugin module for music and arts education)
- O2: Application of the Posttest to measure the dependent variable (Level of relevance of the UNDAR Open edX plugin module for music and arts education)

Additionally, a data recording form and an observation guide were used to validate the technical specifications of the UNDAR Open Edx plugin module, as well as to concisely organize the most important aspects. The collected data were processed and analyzed using Excel and R, yielding descriptive and inferential results.

Technological development

The UNDAR Open EdX plugin module is based on a modular technological architecture designed for native integration with the Open EdX platform using the Micro Frontends (MFE) paradigm. Its frontend stack is built on React 17, Vite 6.3.5, and Tailwind CSS, complemented by specialized libraries such as Ant Design for UI components, AG Grid for advanced data handling, and react-countdown-circle-timer for timed interfaces.

State management is handled through React Hooks, local storage, and cookies (js-cookie), while communication with the backend is managed via Axios for REST APIs and Socket.IO for real-time interactions. This architecture ensures an interactive, accessible, and optimized user experience across multiple devices, with a focus on usability during assessments in artistic environments.

The technological advantage is that it allows competency-based assessments using text, audio, image and video formats, with configurable timers, both in asynchronous and teacher-directed synchronous modes.

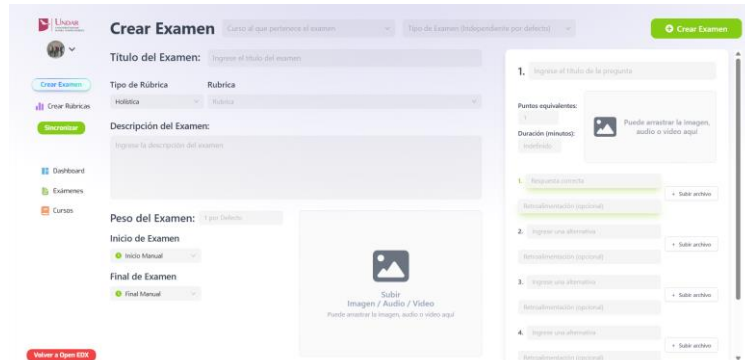


Figure 1:Exam creation interface

Fountain:The authors.

On the backend, the system uses Hono.js as a lightweight and efficient framework, with data persistence managed through Prisma ORM on a MySQL database. Integration and deployment are facilitated by Tutor, Open EdX's official orchestration tool, which automates the installation, configuration, and updating of the plugin using CLI commands that manage Docker containers, database migrations, and initial seeds.

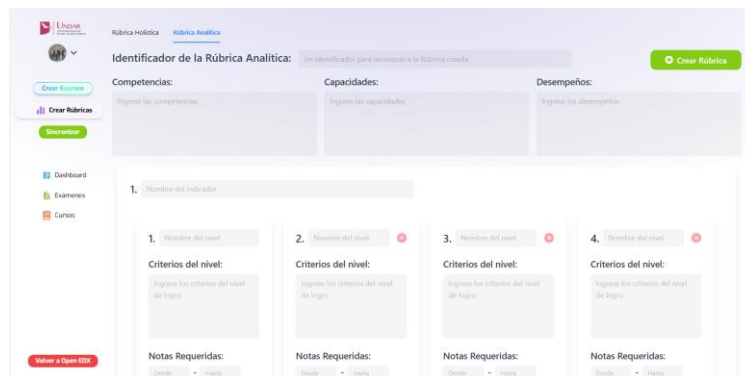


Figure 2:Interface for creating holistic and analytical rubrics

Fountain:The authors.

Furthermore, best security practices have been implemented, including TLS encryption, strict HTTP policies (CSP, X-Frame-Options), CSRF protection, and event auditing. This architecture not only ensures scalability and maintainability but also enables the reuse of assessment items through a question bank with version control, categories, and tags, aligned with competency-based pedagogical approaches.

One aspect to highlight is the possibility of reusing rubrics, checklists, and exams for several subjects, based on the teacher's technical criteria, generating reports for each student, and configuring feedback notes if required.

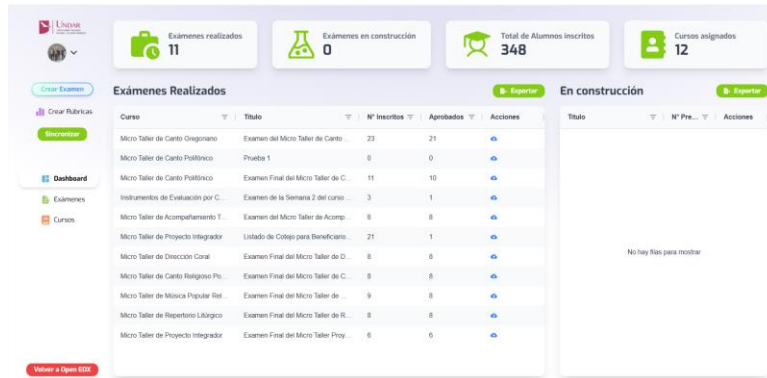


Figure 3:Dashboard reporting interface

Fountain:The authors.

Results

The results show significant improvements in teachers' perceptions regarding the clarity of the competency-based assessment criteria, the system's usability, and the module's ability to comprehensively evaluate musical and artistic performance. Furthermore, greater consistency was observed between the performance criteria and the assessed competencies, as well as an optimization of the formative feedback process.

Regarding assessment reports, the UNRAR Open Edx plugin module offers a user-friendly interface with a gamification approach for students.

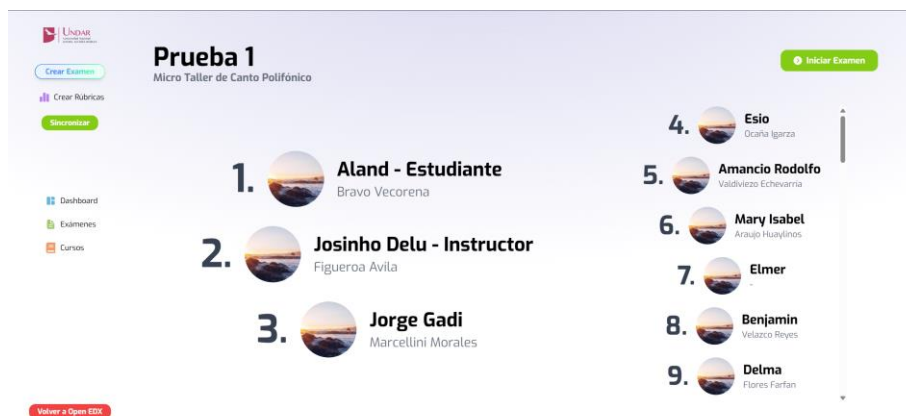


Figure 4:Assessment report interface

Fountain:The authors.

Prior to the inferential analysis, a descriptive analysis of the items evaluated in the pretest and posttest was carried out, with the objective of characterizing the general level of perception of



the participants regarding the evaluation instruments used before and after the implementation of the UNDAR Open Edx plugin module.

For each item, measures of central tendency (mean and median) and dispersion (standard deviation) were calculated independently for the pretest and posttest.

This analysis has allowed us to identify general patterns of change, as well as to evaluate the stability or variability of the responses, without yet assuming the existence of statistically significant differences.

Regarding the assessment of the normality assumption of the pretest-posttest differences, using the Shapiro-Wilk test, it shows that most items do not meet the normality assumption. In particular, five of the seven items have p-values less than 0.05, indicating a distribution of differences significantly deviating from normality.

Items related to more detailed performance assessment, feedback quality, and content validity of rubrics and checklists exhibit the lowest p-values, suggesting skewed or concentrated distributions on specific scale values.

Table 1: Descriptive results – Pretest

Initial assessment of the evaluation instruments

Item	Item description	N	Average	Median	Std. Dev.
q1	Following implementation, does the Open Edx plugin module facilitate a clearer operationalization and a more precise application of competencies and assessment criteria?	9	3.78	4	1.09
q2	Do the rubrics integrated into the Open Edx plugin improve the quality and pedagogical suitability in the evaluation of practical, theoretical, and creative performance?	9	3.89	4	1.05
q3	Did the Open Edx plugin demonstrate seamless native integration, efficient centralization, and accurate mapping between rubrics and competencies?	9	3.67	4	0.71
q4	In your experience, does the Open Edx plugin offer favorable usability and relevance for competency-based assessment in arts and music, compared to previous tools?	9	3.78	4	0.83
q5	Did the Open Edx plugin allow for more detailed assessment and more useful feedback on students' practical and creative performance?	9	3.78	4	0.83



q6	Do you consider that the rubrics in the Open Edx plugin have greater content validity for representing and measuring artistic-musical competencies?	9	3.56	4	0.88
q7	Was the feedback generated by the Open Edx plugin clearer, more relevant, and more useful for the development of students' skills?	9	3.56	3	0.73

Note:The values correspond to the initial perception of the participants before the implementation of the UNDAR Open Edx plugin module.

This pattern is consistent with previous descriptive evidence, where the median of the differences was found to be equal to zero in all items, accompanied by moderate positive increases in the mean.

Table 2: Descriptive results – Posttest

Post-implementation evaluation of the module plugin UNDAR Open Edx

Item	Item description	N	Average	Median	Std. Dev.
q1	Following implementation, does the Open Edx plugin module facilitate a clearer operationalization and a more precise application of competencies and assessment criteria?	9	3.89	4	0.93
q2	Do the rubrics integrated into the Open Edx plugin improve the quality and pedagogical suitability in the evaluation of practical, theoretical, and creative performance?	9	4	4	0.71
q3	Did the Open Edx plugin demonstrate seamless native integration, efficient centralization, and accurate mapping between rubrics and competencies?	9	3.89	4	0.6
q4	In your experience, does the Open Edx plugin offer favorable usability and relevance for competency-based assessment in arts and music, compared to previous tools?	9	4	4	0.71
q5	Did the Open Edx plugin allow for more detailed assessment and more useful feedback on students' practical and creative performance?	9	4.11	4	0.78
q6	Do you consider that the rubrics in the Open Edx plugin have greater content validity for representing and measuring artistic-musical	9	4	4	0.71



	competencies?				
q7	Was the feedback generated by the Open Edx plugin clearer, more relevant, and more useful for the development of students' skills?	9	3.89	4	0.6

Note:The values reflect the participants' perception after the implementation of the UNDAR Open Edx plugin module.

Only two items have p-values greater than 0.05, which implies that, in these specific cases, there is not enough evidence to reject the assumption of normality.

However, given the small number of pairs ($n = 9$) and the lack of normality in most items, the use of parametric tests for pretest-posttest comparison is not methodologically appropriate.

6. Discussion

The findings confirm that integrating competency-based rubrics into virtual platforms like Open edX helps overcome the limitations of traditional assessment in music and arts education. Consistent with previous studies, the use of well-designed digital tools strengthens formative assessment, increases the transparency of the evaluation process, and promotes technological adoption by teachers.

The descriptive results of the differences between the post-test and pre-test show small positive changes in all the items evaluated, suggesting a general trend of improvement in the perception of the participating teachers after the implementation of the UNDAR Open Edx plugin module. In the seven items analyzed, the mean difference is positive and ranges between 0.11 and 0.44 points on the scale used, with the largest average increase observed in the item referring to the content validity of the rubrics for representing artistic-musical competencies (mean = 0.44).

One aspect to consider is the feedback functionality of the UNDAR Open Edx plugin module, which has an average score of 0.33.

Table 3: Descriptive differences between post-test and pre-test

Change observed in the perception of the participants

Item	Item description	N	Average	Median	Std. Dev.
q1	Following implementation, does the Open Edx plugin module facilitate a clearer operationalization and a more precise application of competencies and assessment criteria?	9	0.11	0	1.05



q2	Do the rubrics integrated into the Open Edx plugin improve the quality and pedagogical suitability in the evaluation of practical, theoretical, and creative performance?	9	0.11	0	0.93
q3	Did the Open Edx plugin demonstrate seamless native integration, efficient centralization, and accurate mapping between rubrics and competencies?	9	0.22	0	0.67
q4	In your experience, does the Open Edx plugin offer favorable usability and relevance for competency-based assessment in arts and music, compared to previous tools?	9	0.22	0	0.97
q5	Did the Open Edx plugin allow for more detailed assessment and more useful feedback on students' practical and creative performance?	9	0.33	0	0.5
q6	Do you consider that the rubrics in the Open Edx plugin have greater content validity for representing and measuring artistic-musical competencies?	9	0.44	0	0.53
q7	Was the feedback generated by the Open Edx plugin clearer, more relevant, and more useful for the development of students' skills?	9	0.33	0	0.5

Note:The differences were calculated as posttest – pretest. Positive values indicate an improvement in perception after the implementation of the Open Edx plugin module, while values close to zero suggest stability in the evaluation.

However, the median difference for all items is zero, indicating that for at least half of the participants, the post-test score remained the same as the pre-test score. This suggests that the observed changes are concentrated in a subset of participants, rather than a uniform shift across the entire distribution of responses.

The dispersion of the differences, reflected in the standard deviations, is moderate, ranging from 0.50 to 1.05, which indicates heterogeneity in the magnitude of individual change. In particular, the items related to more detailed evaluation and feedback show relatively larger mean increases and less dispersion, suggesting a more consistent perception of improvement in these specific aspects of the evaluation process.

Regarding the difference test, the results of the Wilcoxon signed-rank test indicate that no statistically significant differences were observed between the pretest and posttest measurements in any of the evaluated items, since all p-values were above the significance threshold of 0.05.



Consequently, there is not enough statistical evidence to affirm the existence of systematic changes attributable to the intervention in the variables analyzed.

From a descriptive point of view, the mean differences between post-test and pre-test are slightly positive in all items.

However, these variations are of small magnitude and do not result in consistent shifts of the median, which remains equal to zero in all cases.

Table 4: Evaluation of the assumption of normality of pretest-posttest differences

Shapiro-Wilk test applied to individual differences per item

Item	Item evaluated	N (pairs)	p-value (Shapiro-Wilk)	Assumption of normality
q5	Did the Open Edx plugin allow for more detailed assessment and more useful feedback on students' practical and creative performance?	9	0.0002	Normality is rejected
q7	Was the feedback generated by the Open Edx plugin clearer, more relevant, and more useful for the development of students' skills?	9	0.0002	Normality is rejected
q6	Do you consider that the rubrics in the Open Edx plugin have greater content validity for representing and measuring artistic-musical competencies?	9	0.0004	Normality is rejected
q3	Did the Open Edx plugin demonstrate seamless native integration, efficient centralization, and accurate mapping between rubrics and competencies?	9	0.0284	Normality is rejected
q2	Do the rubrics integrated into the Open Edx plugin improve the quality and pedagogical suitability in the evaluation of practical, theoretical, and creative performance?	9	0.0679	Normality is not rejected
q1	Following implementation, does the Open Edx plugin module facilitate a clearer operationalization and a more precise application of competencies and assessment criteria?	9	0.1942	Normality is not rejected
q4	In your experience, does the Open Edx plugin offer favorable usability and relevance for competency-based assessment in arts and music, compared to previous tools?	9	0.2729	Normality is not rejected

Note: The Shapiro-Wilk test was applied to the individual differences between post-test and pre-test. P-values less than 0.05 indicate statistical evidence to reject the assumption of normality.



This pattern suggests that, for a considerable portion of the participants, the scores remain stable between the two measurement times.

This could be interpreted as requiring further training on the two competency-based assessment tools implemented: rubrics and checklists; or that it would warrant the additional implementation of more competency-based assessment tools (observation guides, e-portfolio, field notebook, etc.) in a future version of the UNDAR Open Edx plugin module.

Furthermore, the small number of paired observations available ($n = 9$) substantially limits the statistical power of the tests applied, reducing the ability to detect differences even when they might exist. In this context, the lack of statistical significance should not be interpreted as evidence of no effect, but rather as an expected consequence of the sampling limitations and the exploratory nature of the analysis.

7. Conclusions and recommendations

It is concluded that the developed UNDAR Open edX plugin module is relevant for competency-based assessment in music and arts education, as it effectively integrates pedagogical, instrumental, and technological dimensions. Experience demonstrates that competency-based assessment in virtual environments is viable and effective when instruments are designed that align with the nature of artistic disciplines, such as checklists and rubrics. This study provides empirical evidence and a replicable proposal for innovation in university assessment in music and the arts.

As of the publication date of this article, the official version of the UNDAR Open Edx plugin module has been published in the GitHub repository, located at the following link:

https://github.com/oti-undar/plugin_openedx

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