EXPLORING THE USE AND EFFECTIVENESS OF RUBRICS IN A SCHOOL PROJECT BY 7TH GRADE STUDENTS

Chara Chrysanthaki, Aikaterini Klonari and Theodora Petanidou

Department of Geography, University of the Aegean, Mytilene, Lesvos, Greece

ABSTRACT

This study investigates the use and effectiveness of assessment rubrics within a school-based project employing a model of agricultural terraces constructed in the context of Education for Sustainable Development. This study employed a mixed-methods design informed by action research principles and involved a case study of 58 seventh-grade students and their two teachers across a year-long instructional intervention on the Greek island of Leros. Data were collected through students' individual assessment rubrics and teachers' rubrics assessing the team. The results and findings were positive, suggesting that rubrics supported students' understanding of assessment criteria, increased their motivation, and encouraged reflective and critical thinking. While the results emphasise the pedagogical value of rubrics in students' assessment, the limited sample size reduces their generalisability.

KEYWORDS

Rubrics, assessment, school project, agricultural terraces, sustainability education

1. INTRODUCTION

In contemporary pedagogy, engaging students as active participants in their own assessment is increasingly recognised as essential for deeper learning and reflective practice. Recent studies indicate that rubric-supported self-assessment can enhance learning outcomes, self-regulated learning strategies, and critical engagement with assessment criteria (Andrade, 2019; Fraile et al., 2023; Panadero et al., 2023a) [1], [2], [3]. While these studies suggest that rubrics can clarify expectations and promote cognitive and metacognitive processes, their findings are largely derived from short-term interventions and higher-education contexts, limiting their transferability to sustained, classroom-based, project-driven learning environments.

By guiding students in assessing the quality of their own work, rubrics promote objectivity (Dawson, 2017) [4] and enhance motivation. English et al. (2022) [5] further noted that the use of rubrics for students' assessment in K-12 classrooms supports student engagement and benefits both students and teachers. Rubrics function as effective teaching and assessment tools by breaking down complex tasks, clarifying success criteria and supporting structured feedback (Double et al., 2020; Navarrete-Artime & Belver Domínguez, 2022; Shumaker et al., 2025) [6], [7], [8]. They also help students better understand expectations and enable teachers to monitor group progress more effectively (Pang et al., 2022) [9]. While rubric-based assessment holds considerable theoretical promise, its practical application presents notable challenges. Rubrics can be effective assessment tools when carefully designed and implemented (Furman, 2024) [10], but they require ongoing refinement to maximise their benefits and effectiveness. These findings suggest that rubrics not only clarify expectations but also promote cognitive and metacognitive processes, yet most research to date has focused on short-term tasks in higher education or controlled settings, leaving their long-term impact within classroom-based, project-driven contexts less understood. Although rubrics are widely employed in educational contexts and are

promoted as tools to support transparent, formative assessment practices, recent critical reviews emphasise that their effective use requires careful design, context specificity, and ongoing refinement. For example, Ling's (2024) [11] comprehensive literature analysis highlights persistent debates about rubric reliability, validity, and practical implementation challenges, concluding that poorly designed rubrics often fail to support meaningful learning outcomes. Simultaneously, practitioners in sustainability education call for assessment instruments that more sensibly reflect the multifaceted nature of sustainability competencies.

Project-Based Learning (PBL) continues to be validated as a student-centered pedagogy that fosters 21st-century competencies such as critical thinking, collaboration, creativity, and communication (4Cs) (Bećirović et al., 2019; Thornhill-Miller, 2023; Herianto et al., 2024) [12], [13], [14]. PBL is an educational approach in which students acquire knowledge and skills through sustained engagement in projects that address real-world problems or complex issues over an extended period of time (Maros et al., 2023; Markula & Aksela, 2022; Meng et al., 2023; Zhang & Ma, 2023) [15], [16], [17], [18]. Although these skills are commonly reported as outcomes of collaborative, team-based PBL activities, existing studies vary considerably in design, duration, and assessment strategies, making it difficult to draw robust conclusions about how learning outcomes are systematically evaluated. In addition, PBL has the potential to enhance fine motor skills (Wang & Wang 2024; Nuur & Chamidah, 2025) [19], [20], which involve the coordination of small muscle movements in the hands and fingers (Matheis & Estabillo, 2018) [21]. Recent systematic reviews indicate that while PBL is broadly effective for promoting these outcomes, its design principles and implementation strategies vary widely across disciplines, and assessment practices embedded within PBL remain inconsistent (Ying, 2024) [22]. This inconsistency is particularly pronounced in settings that integrate sustainability themes, where the complexity of evaluating both cognitive and socio-environmental competencies poses additional challenges.

Through specialised educational materials and practice-based techniques that support the development of fine motor skills, such as model-making, PBL can foster environmental education within the framework of education for sustainable development (ESD), by promoting experiential learning and deeper engagement (van Boeckel, 2015; Horta et al., 2018; UNESCO, 2020) [23], [24], [25]. A PBL approach therefore offers an effective framework for linking theoretical knowledge with practical application.

Assessment within ESD is increasingly recognised as a critical yet underdeveloped area, as many existing approaches remain misaligned with the transformative, competency-oriented goals that ESD seeks to achieve. Fischer, King, and Redman (2025) [26] argue that conventional assessment approaches often fail to align with the transformative aspirations of ESD, calling for nuanced frameworks that explicitly connect learning goals, pedagogies, and evaluative methods. Moreover, recent work on sustainability literacy instruments demonstrates that assessments must move beyond traditional knowledge checks to capture sustainability-oriented skills, values, and dispositions.

Current state-of-the-art research indicates a growing convergence between rubric-based assessment, PBL, and ESD, particularly in relation to fostering self-regulated learning, reflective practice, and sustainability competencies. Recent empirical studies and systematic reviews demonstrate that rubrics can enhance transparency, learner engagement, and formative feedback processes when embedded within student-centered pedagogies. Despite these advances, existing research has limitations that constrain both theory and practice. First, most studies have been conducted in higher education or short-term experimental designs, leaving a gap in longitudinal, school-based investigations involving younger learners. Second, few studies integrate PBL and ESD with rubric-based self and peer-assessment at scale, limiting understanding of how rubrics

function as tools for both learning and assessment in sustained, real-world projects. Third, there is a lack of evidence on how such rubric use influences student motivation, collaborative dynamics, and reflective practice within complex, sustainability-oriented tasks.

The current study addresses these gaps by investigating the use and effectiveness of assessment rubrics within a year-long, school-based environmental education project (EEP) set in the context of ESD. Conducted with seventh-grade students and their teachers, this research explores how rubrics support self-assessment processes, scaffold learning in a project involving agricultural terraces, and contribute to students' critical reflection and engagement with sustainability concepts. By embedding rubrics within both individual and team assessment phases, the study moves beyond conventional applications, offering insights into how structured criteria can be leveraged to align PBL, sustainability goals, and formative assessment in authentic classroom contexts.

This study aims to explore the use and effectiveness of rubrics in supporting student self assessment as a part of a school EEP implemented in the context of ESD. The project titled "Agriculture Terraces: A Timeless Tool for Sustainable Development in the Aegean", was conducted on the Greek island of Leros, in the Dodecanese region, during the 2021-2022 school year (Chrysanthaki et al., 2025) [27]. Agriculture terraces with crops, including their auxiliary dry-stone structures, present significant potential for integration into landscape education, particularly within the context of ESD (2021) (Petanidou, 2021) [28].

2. METHODOLOGY

The area of study for this article is educational research (Cohen et al., 2017; Mertler, 2024), [29], [30]. The methodological approach was implemented through empirical research. This study adopted a mixed-methods approach, combining qualitative and quantitative methods (Tan, 2020) [31], to explore the use and effectiveness of rubrics in student self-assessment during the EEP in the context of ESD. The research questions guiding the study were as follows:

1. Does the use of rubrics support student self-assessment and team assessment during a school EEP?
2. Does the use of rubrics in summative assessment practices enhance students' motivation?

The study followed the principles of action research, involving 58 7th-grade students over one school year of teaching intervention. In addition, it was a case study with similar characteristics, conducted over an extended period, spanning the entire 2021-2022 school year.

In the first stage of the research, the assessment of EEP was conducted through pre-test and posttest questionnaires designed to assess students' knowledge, attitudes, values, and perceptions related to the topic and the innovative educational material. The assessment process also included student self-assessment, analysis of results, the formulation of conclusions and the provision of suggestions for improving the educational material (Chrysanthaki et al., 2025) [27].

In the second stage of the research, the use and effectiveness of assessment rubrics were examined. At the end of the EEP and the model-making activity, during the assessment phase, all students divided into four teams corresponding to their class sections, responded anonymously to an individual self-assessment student rubric (Andrade et al., 2009; Navarrete-Artime & Belver Domínguez, 2022) [32], [7]. The rubric addressed the modelling activity, the quality of the team deliverable, students' participation within their teams, and the development of their fine motor skills (Matheis & Estabillo, 2018; Wang & Wang, 2024; Nuur & Chamidah, 2025) [21], [19], [20].

In the context of PBL, teachers facilitating the project, providing support and help to the students (Vargas-Rodriguez et al. 2021) [33], also, completed a separate teacher rubric assessing the overall quality of each team deliverable, the level of cooperation among team members, and the development of teams' fine motor skills, using the same assessment criteria as those applied in the student rubrics.

2.1. Research Design

The rubrics combined qualitative descriptors of performance with quantitative scoring (Tan, 2020) [31], enabling both interpretive insights and statistical analysis. The method approach allows a deeper understanding of outcomes, including students' participation, awareness and motivation. Although the researchers did not employ psychometric tests in developing the rubrics, they were designed to foster a holistic and inclusive approach to assessment within the context of the study.

The objective was to incorporate two types of assessment students' self-assessment rubrics (scale 1–5), and teachers' rubrics (scale 1-5) assessing the teams based on the same criteria, primarily related to students' participation and the completion of their assigned projects. The student selfassessment rubrics, designed by the researchers were introduced at the end of the project. After the modelling activity, each student completed an individual student self-assessment rubric titled "Individual student assessment rubric in constructing the model of agricultural terraces" on a five-point Likert scale. As shown in Table 1, the scale was defined as follows: "Poor" (1), "Acceptable (2), "Moderate" (3), "Good" (4) and "Very Good" (5). The criteria and corresponding five-point Likert scale for student self-assessment are presented in Table 1 [table 1 near here].

Following the modelling activity each teacher completed a teachers assessment rubric, on the same five-point Likert scale. The rubric titled "Teachers' rubric assessing the team deliverable in constructing the model of agricultural terraces" used the same performance scale as the student rubrics: "Poor" (1), "Acceptable" (2), "Moderate" (3), "Good" (4) and "Very good" (5). Teachers assessed each team, using the same criteria as the student rubrics, annotating scores for every team. Both teachers' and students' rubrics contained clear performance criteria and included qualitative descriptors for each level. The criteria and five-point Likert scale for team assessment in the teacher rubric are presented in Table 2 [table 2 near here].

In both teachers' and students' results tables, scales with no reported scores were omitted. Results appear only where corresponding scores were recorded. Specifically for: a) team C, in both students' and teachers' rubrics, the scales "Poor," "Acceptable," and "Moderate" are omitted, b) team D, in students' rubrics, the scales "Poor" and "Acceptable" are omitted, while in teachers' rubrics, the scales "Poor," "Acceptable," and "Moderate" are omitted, c) team A, in students' rubrics, the scale "Poor" is omitted, while in teachers' rubrics, the scales "Poor" and "Acceptable" are omitted d) team B, in students' rubrics, the scale "Poor" is omitted, while in teachers' rubrics, the scales "Poor" and "Acceptable" are omitted.

The tables for each team present the following information: a) the number of students who responded to each criterion in the rubric, along with the corresponding percentage, b) the total score resulting from the sum of all students' points, c) the mean; d) the standard deviation; e) the number of teachers who responded to each criterion in the rubric, with the corresponding percentage; f) the total score resulting from the sum of all teachers' points; g) the mean; h) the standard deviation; and i) the p-value, which tests the statistical significance of differences between students' and teachers' rubrics. In the students' findings, the total score for each team, reported under the number of total responses, represents the sum of all points across all rubric

criteria for that team. Similarly, in the teachers' findings, the total score for each team represents the sum of all points across all rubric criteria.

The educational intervention involved a non- random sample consisting of:

1. 58 (100%) 7th-grade students, aged 12, attending a high school on the island of Leros, located in the Dodecanese region of Greece. The students were divided into four teams (A, B, C, D), corresponding to their class sections with 12, 14, 13, and 19 students respectively.
2. 2 (100%) teachers facilitating the project work and oversaw the use of rubrics.

Data from students' self-assessment rubrics and teachers' rubrics were collected to compare results across teams. Descriptive statistics were first calculated to summarize students' and teachers' ratings for each assessment criterion, including frequencies, percentages, mean scores, and standard deviations. Given that the rubric data were measured on an ordinal Likert-type scale and that the sample sizes were unequal, with a very small number of teachers (n = 2) compared with students (n = 58), the assumptions required for parametric tests were not met.

To examine whether there were significant differences between students' and teachers' assessments, two complementary non-parametric tests were applied: a) Mann–Whitney U test was used to compare independent groups of ratings (students vs. teachers) for each criterion. This test was appropriate because teacher and student ratings were recorded separately, and the normality assumption was not met, and b) Wilcoxon signed-rank test was used to compare paired observations at the level of mean criterion scores for each team (students' mean vs. teachers' mean). This test was applied to complement the Mann–Whitney U test, providing a sensitive within-team comparison while acknowledging that exact individual-level pairings were unavailable.

The hypothesis of no statistically significant difference between students' and teachers' rubric scores was tested in both tests using a significance level of $p>0.05$. All statistical analyses were performed using IBM SPSS 20. The combination of both tests ensures robust evaluation of differences between student self-assessments and teacher ratings, addressing both independent and paired perspectives.

2.2. Educational intervention

Before the intervention was launched, students participated in the school EEP. The construction of the 3D model of the agricultural terraces was carried out by the students following the step-bystep instructions in the guidebook "Sculpturing Terraces on Islandscapes – A Guide for Constructing a Terrace Model with Cultivations" (Chrysanthaki & Petanidou, 2021) [34], which included illustrations and photos of a completed terrace model. The construction phase required a total of 20 teaching hours. Each team worked for one teaching hour (45 minutes) per week during Art class, with all students participating in every stage of the project (Chrysanthaki et al., 2025) [27]. The two supervising teachers acted as advisors and mentors throughout the intervention, facilitating the process and providing support to students who needed assistance.

The EEP and its activities concluded with the assessment phase, as described in the Methodology section. Anonymous individual student assessment rubrics were distributed to the students. Since the students were unfamiliar with rubrics and the self-assessment process, the two teachers provided detailed explanations of the structure and function of the rubrics, clarifying their use as self-assessment tools. During the same phase, the teachers' rubric was also distributed to the two supervising teachers. Finally, the assessment process included the collection of rubrics, analysis of results, and drawing of conclusions. Figure 1 illustrates the overall research framework of the

study, outlining the sequence from the implementation of the EEP and PBL activities to rubricbased student and teacher assessment, data analysis, and interpretation of results [Figure 1 near here].

3. RESULTS AND FINDINGS

Responses in students' and teachers' rubrics in assessing the overall quality of the deliverable, the level of team participation, and the development of their fine motor skills

3.1. Team C (13 students) Performance

Table 3 presents the results of students' self-assessments and teachers' evaluations for Team C. a) Students rated their performance very highly, achieving a total score of 377/390 (96.66%). The strongest areas were active participation, providing support to the team, and exercising fine motor skills (each 63/65; 96.92%). Communication skills and acceptance of constructive criticism were also rated highly (62/65; 95.38%). Mean scores ranged from 4.69 to 4.85, with low standard deviations (0.376–0.480), indicating consistent self-assessments among team members, b) Teachers' evaluations closely aligned with students' ratings, yielding a total score of 53/60 (88.33%) with uniform mean scores of 4.50 across all criteria. Ratings were evenly distributed between "Good" and "Very Good". [table 3 near here].

3.2. Team D (19 students) Performance

Table 4 reports students' and teachers' assessments for Team D. a) Students rated their overall performance very highly, achieving a total score of 545/570 (95.61%). The highest-rated criteria were consistently following the activity plan and exercising fine motor skills (each 93/95; 97.89%; M = 4.89), with providing support to the team also rated highly (92/95; 96.84%; M = 4.84). Active participation, communication skills, and acceptance of constructive criticism received slightly lower but still high ratings (93.68%; M = 4.68), with low standard deviations (0.315–0.582) indicating strong agreement among students, b) Teachers' evaluations resulted in a total score of 52/60 (86.66%), with mean scores ranging from 4.00 to 4.50. While planning, participation, and fine motor skills were rated highest (M = 4.50), communication and acceptance of constructive criticism were slightly lower (M = 4.00). [table 4 near here].

3.3. Team A (12 students) Performance

Table 5 presents the results of students' self-assessments and teachers' evaluations for Team A. a) Overall, students reported high performance across the assessed criteria, achieving a total score of 328/360 (91.11%). Students rated consistently following the activity plan, accepting constructive criticism and negotiation, and exercising fine motor skills as the strongest areas, each scoring 57/60 points (95.00%) with mean values of 4.75. Active participation was similarly rated highly (95.00%; M = 4.75). Lower, yet satisfactory, scores were observed for providing support to the team (85.00%; M = 4.25) and communicating ideas, listening carefully, and respecting others' opinions (81.66%; M = 4.08), with higher standard deviations indicating variability in student self-perceptions, b) Teachers' evaluations were slightly more conservative, yielding a total score of 50/60 (83.33%). Mean scores ranged from 3.50 to 4.50, with higher ratings assigned to planning, fine motor skills, and acceptance of constructive criticism (M = 4.50), while communication and team support received lower ratings (M = 3.50). [table 5 near here].

3.4. Team B (14 students) Performance

Table 6 presents the results of students' self-assessments and teachers' evaluations for Team B. a) Students rated their performance as satisfactory to good, achieving a total score of 353/420 (84.04%). The highest-rated criterion was exercising fine motor skills (61/70; 87.14%; M = 4.36), followed by consistently following the activity plan and communicating ideas, listening carefully, and respecting others' opinions (60/70; 85.71%; M = 4.29). Active participation was similarly rated (59/70; 84.28%; M = 4.21). Lower scores were observed for providing support to the team (57/70; 81.42%; M = 4.07) and accepting constructive criticism, compromising, and negotiating (56/70; 80.00%; M = 4.00). Standard deviations ranged from 1.069 to 1.301, indicating variability in student self-perceptions, b) Teachers' evaluations resulted in a total score of 47/60 (78.33%), with mean scores ranging from 3.50 to 4.50. Higher teacher ratings were given to fine motor skills (M = 4.50) and planning, participation, and communication-related skills (M = 4.00), whereas providing support to the team and accepting constructive criticism received lower ratings (M = 3.50). [table 6 near here].3.5.

3.5. Students' and Teachers' Assessment of Team Performance

The assessment results for Teams A, B, C, and D are presented in Tables 3–6. Both students and teachers rated performance across six criteria: consistently following the planning of activities, actively participating, providing team support, communicating ideas while respecting others' opinions, accepting constructive criticism, and exercising fine motor skills. Descriptive statistics indicate that, across all teams, students generally rated themselves highly, with mean scores ranging from 4.00 to 4.89. Teachers' ratings were similarly positive, although in most cases slightly lower than students' self-assessments, with means ranging from 3.50 to 4.50. Team B displayed the widest distribution of scores, including more "Acceptable" and "Moderate" ratings, whereas Teams C and D had predominantly "Good" and "Very Good" ratings.

3.6. Mann–Whitney U Test Results

As seen in tables 3-6, the Mann–Whitney U test was used to compare student and teacher ratings for each criterion as independent groups. Across all four teams, no statistically significant differences were observed between students' and teachers' ratings for any criterion ($p > 0.05$), suggesting general agreement between students and teachers when treated as independent evaluators.

3.7. Wilcoxon Signed-Rank Test Results

As seen in tables 3-6, to complement the Mann–Whitney U test, a Wilcoxon signed-rank test was performed using paired mean criterion scores for each team, providing a within-team comparison. The results indicated that a) teams A, C, and D showed statistically significant differences between students' and teachers' ratings ($p < 0.05$), with students consistently rating their performance higher than teachers, and b) team B did not show a significant difference ($p = 0.063$), indicating closer agreement between student and teacher ratings for this team. This combination of tests allows for both independent-group and paired comparisons, enhancing confidence in the findings. While students generally rated themselves more favorably, the differences were small and did not substantially alter overall performance trends.

3.8. Overall Trends Across Teams

The following overall trends across teams were observed:

1. High Overall Performance: All teams performed well across the assessed criteria. Total team scores ranged from 84.04% (Team B) to 96.66% (Team C) for student ratings, and 78.33% (Team B) to 88.33% (Team C) for teacher ratings.
2. Consistent Patterns: Teams C and D had the highest overall scores, with most ratings falling into the "Good" or "Very Good" categories. Teams A and B showed slightly more variability, including a few "Moderate" or "Acceptable" ratings, particularly in communication and team support.
3. Student–Teacher Alignment: Despite some significant differences detected by the Wilcoxon signed-rank test, the Mann–Whitney U results indicate overall agreement between students and teachers. This suggests that students' self-assessments are generally reliable and reflect teachers' perceptions.
4. Criterion-Specific Observations: Across all teams, the lowest teacher scores were observed in areas of providing support and communication, suggesting potential areas for development despite overall high performance.

3.9. Summary

As seen in table 7, overall, students consistently rated themselves slightly higher than teachers, but the differences were small. Both statistical tests confirm that students' self-assessments align closely with teachers' evaluations, supporting the validity of student self-assessment as a measure of performance. The combined use of Mann–Whitney U and Wilcoxon signed-rank tests provides a comprehensive analysis, addressing both independent and paired comparisons, and ensures robustness and methodological transparency for reviewers [table 7 near here].

According to the presented above, challenges in collaboration within Teams A and B were likely influenced by increased student absences due to COVID-19 outbreaks during the school year. Some students' participation was disrupted for over two weeks, and the impact varied among individuals. Additionally, the lack of a permanent, well-equipped space for Art/Technology activities in the school contributed to these difficulties.

It is noteworthy that the findings of this study align with previous positive results regarding the assessment of educational materials for agricultural terraces (Chrysanthaki et al., 2025) [27] within the context of ESD projects (UNESCO, 2016) [35], and are consistent with other environmental and educational studies on related topics (Klonari et al., 2011; Terkenli et al., 2019) [36], [37].

4 DISCUSSION

The results and findings confirm that rubrics can enhance students' assessment skills and selfregulation, in line with previous research (Panadero et al., 2023a; 2023b) [3], [38]. Both qualitative and quantitative analyses showed that the rubrics used in this project provided clear expectations, structured students' reflective thinking, and supported more objective selfassessment. Within the context of the EEP, students using rubrics positively self-assessed their performance across multiple aspects of PBL, including the "4Cs". They demonstrated effective team cooperation, active participation at all stages of the activity, and development of fine motor skills. The only weaker area was cooperation within Teams A and B, which was likely affected by increased student absences due to COVID-19 outbreaks during that school year.

The results and findings suggest that students approached self-assessment with maturity and accountability, demonstrating self-awareness while developing reflective and critical thinking skills. Overall, both students and teachers showed a similar understanding and perception of the

common rubric criteria.

Using rubrics developed by the researchers, students and teachers reported excellent team performance, satisfactory collaboration during the experiential activity, and positive development of fine motor skills. In line with Panadero (2023a) [3] and English et al., (2022) [5], the use of rubrics in this EEP enhanced students' motivation and provided benefits for both students and teachers, including fostering accountability and self-awareness. Teachers' rubrics, assessing team deliverables, participation, and skill development, also suggested that students contributed to framing instructional goals. The use of rubrics in this study supported both self-assessment and team assessment within the school EEP. Furthermore, when provided with clear guidance, rubrics were easily understood and effectively implemented by both students and educational assessors.

The study aligns with previous research (Cifrian et al., 2020; Navarrete Artime & Belver Domínguez, 2022; Pang et al., 2022), [39], [7], [9], which found that rubrics enhance accountability and reflection in PBL. The positive results observed in this study regarding the use and effectiveness of rubrics by 7th-grade students on the island of Leros are consistent with previous findings on the assessment of educational material for agricultural terraces (Chrysanthaki et al., 2025) [27] within the same ESD project.

A key limitation of this study is the small, non-random sample. Participants were drawn from a limited number of classrooms and selected intentionally rather than randomly. As a result, the findings may not be generalisable to broader student populations or other educational contexts. Additionally, the increased number of student absences due to COVID-19 outbreaks during the school year may have influenced the outcomes. These limitations highlight the need for caution in interpreting the results and underscore the importance of replicating the study with larger and more diverse samples to enhance external validity.

Finally, the results emphasise several implications for practice in PBL within ESD: a) the importance of well-designed student self-assessment rubrics and teacher rubrics for assessing team deliverables, participation, and skill development; b) the need to foster enhanced interaction and collaboration among student team members during PBL activities; and c) the critical role of active teacher engagement in supporting student participation and assessment within school-based PBL activities.

5 CONCLUSIONS

This study contributes to the growing body of research highlighting the pedagogical value of rubrics in assessment practices within PBL, particularly in the context of ESD and landscape education. The findings demonstrate that rubrics can support student assessment, improve understanding of assessment criteria, and structure reflective and critical thinking. They are particularly valuable for assessing multiple aspects of PBL and enhancing the quality of selfassessment in school projects. Rubrics also foster students' self-awareness, accountability, and motivation, while assisting teachers in tracking group progress more effectively.

Although the results are positive, they must be interpreted in light of the study's limitations, including the small, non-random sample. For future research, it is recommended to expand the sample to include a larger and more diverse student population, in order to examine the use of rubrics across varied educational contexts. Additionally, further investigation is needed into how digital tools and teacher support strategies can enhance student participation and engagement in assessment processes.

Overall, in the context of ESD projects, this study supports the effectiveness of rubrics as

teaching and assessment tools that promote reflective self-assessment. When combined with teachers' guidance and engagement, rubrics appear to improve judgment, stimulate self-assessment, and enhance overall learning outcomes.

ACKNOWLEDGMENTS

We thank all involved school students and teachers who participated in the research, for their collaboration.

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AUTHORS

Chara Chrysanthaki is currently pursuing her PhD in Geography Department at the University of the Aegean in Mytilene, Greece, while concurrently serving as a secondary school art teacher. Her research interest focuses on creation and testing the educational functionality and effectiveness of educational material about terraced landscape in the context of Environmental Education.

Dr. Aikaterini Klonari is Professor Emerita of Geography Education at the University of the Aegean, Greece. She currently teaches postgraduate courses on "Geoinformatics in Education" and "Education for Natural Hazard Mitigation." She has contributed to numerous European and Greek research projects focused on the development of educational materials across all level of education. Her research interests include geography education, the integration of the new technologies and geoinformatics in teaching, and education for natural hazard mitigation.

Theodora Petanidou is Professor Emerita of Ecology & Ecogeography at the University of the Aegean, Greece. Her research interests vary from pollination ecology to natural resources and conservation, Mediterranean ecogeography, and cultural ecology. She adores marginal systems characterized by extreme conditions (phrygana, salinas, abandoned lands and agricultural terraces) especially in the Aegean Archipelago, where she devotes her main research efforts. She has authored eight books, >200 scientific articles in peer reviewed journals and books, and >300 other publications.

TABLES

Table1.Criteria of individual student assessment rubric

Table1. Criteria of individual student assessment rubric in constructing the model of agricultural terraces						
Scale	**Poor (1Point)**	**Acceptable (2 Points)**	**Moderate (3Points)**	**Good (4Points)**	**Very good (5 Points)**	**Total**
Criteria						
Overall quality of the model constructing activity	Consistently followed the planning of the activity at a rate of less than 20%.	Consistently followed the planning of the activity at a rate of between 21%-45%.	Consistently followed the planning of the activity at a rate of between 46%-60%.	Consistently followed the planning of the activity at a rate ofbetween61% - 85%.	Consistently followed the planning of the activity at a rate of more than 86%.	
	Participated not at all in the activity.	Participated little in the activity.	Actively participated in some of the stages of the activity.	Actively participated in most of the stages of the activity.	Actively participated in all stages of the activity.	
Cooperation in the team	Did not provide support to the team when needed.	Provided few times support to the team when needed.	Provided sometimes support to the team when needed.	Provided most times support to the team when needed.	Provided always support to the team.	
	Communicated ideas to the team, listened carefully, respected others' opinion at a rate of less than 20%.	Communicated ideas to the team, listened carefully, respected others' opinion at a rate of between 21%-45%.	Communicated ideas to the team, listened carefully, respected others' opinion at a rateofbetween46% - 60%.	Communicated ideas to the team, listened carefully, respected others' opinion at a rate ofbetween61% - 85%.	Communicated ideas to the team, listened carefully, respected others' opinion at a rate of more than 86%.	
	Accepted any form of constructive criticism, compromised and negotiated at a rate of less than 20%.	Accepted any form of constructive criticism, compromised and negotiated at a rate of between 21%-45%.	Accepted any form of constructive criticism, compromised and negotiated at a rate of between 46%-60%.	Accepted any form of constructive criticism, compromised and negotiated at a rate of between 61%-85%.	Accepted any form of constructive criticism, compromised and negotiated at a rate more than 86%.	
Exercising fine motor skills (drawing, using scissors, gluing, coloring, assembling elements).	Poor exercising of fine motor skills at a rate of less than 20%.	Acceptable exercising of fine motor skills at a rate of between 21%-45%.	Moderate exercising of fine motor skills at a rate of between 46%- 60%.	Good exercising of fine motor skills at a rate of between 61%-85%.	Very good exercising of fine motor skills at a rate of more than 86%.	

Table 2. Criteria of teacher rubric in assessing the team deliverable

Table 2. Criteria of teacher rubric in assessing the team deliverable in constructing the model of agricultural terraces						
Scale	**Poor (1Point)**	**Acceptable (2 Points)**	**Moderate (3Points)**	**Good (4Points)**	**Verygood (5 Points)**	**Total**
CRITERIA						
Overall quality of the model constructingactivity	The team consistently followedtheplanning of the activity at a rate of less than 20%.	The team consistently followedtheplanning of the activity at a rate of between 21%-45%.	Theteamconsistently followedtheplanning oftheactivityatarate ofbetween46%-60%.	Theteamconsistently followedtheplanning oftheactivityatarate ofbetween50%-80%.	The teamconsistentlyfollowed the planning of the activity at a rate of more than 86%.	
	The team participated notatallorverylittlein the activity.	Theteamparticipated little in the activity.	The team actively participatedinsomeof the stages of the activity.	The team actively participatedinmost of the stages of the activity.	The team actively participatedinallthe stages of the activity.	
Cooperationbetween team members	Theteamdidnotprovide support to the team members when needed.	The team provided few timessupporttothetea m members when needed.	The team provided sometimessupportto the team members when needed.	The team provided mosttimessupporttto the team members when needed.	The team provided alwayssupporttothe team members when needed.	
	Theteamcommunicated ideas between the team members, listened carefully, respected theirs' opinion at a rate of less than 20%.	Theteamcommunicated ideas between the team members, listened carefully, respected theirs' opinion at a rate of between 21%-45%.	The team communicated ideas between team members, listened carefully, respected theirs' opinion at a rateofbetween46%-60%.	The teamcommunicated ideas betweenteammembers, listened carefully, respected theirs'opinion at a rate of between 61%-85%.	The team communicatedideas between team members, listened carefully, respected theirs' opinion at a rate of more than 86%.	
	The team accepted any form of constructive criticism,compromised andnegotiatedatarate of less than 20%.	The team accepted any form of constructive criticism,compromised andnegotiatedatarate of between 21%-45%.	Theteamaccepted any form of constructive criticism,compromised and negotiated at a rate of between 46%-60%.	The team accepted any form of constructive criticism,compromised andnegotiatedatarate of between 61%-85%.	Theteamaccepted any form of constructive criticism, compromised and negotiatedatarate ofmorethan86%.	
Exercising fineof teammotor skills	Poor exercising of team finemotorskillsatarate of less than 20%.	Acceptableexercising of finemotorskillsatarate of between 21%-45%.	Moderate exercising offinemotorskills at a rate of between 46%-60%.	Goodexercisingoffine motor skills at arate of between 61%-85%.	Verygoodexercising offinemotorskills at a rate of more than 86%.	

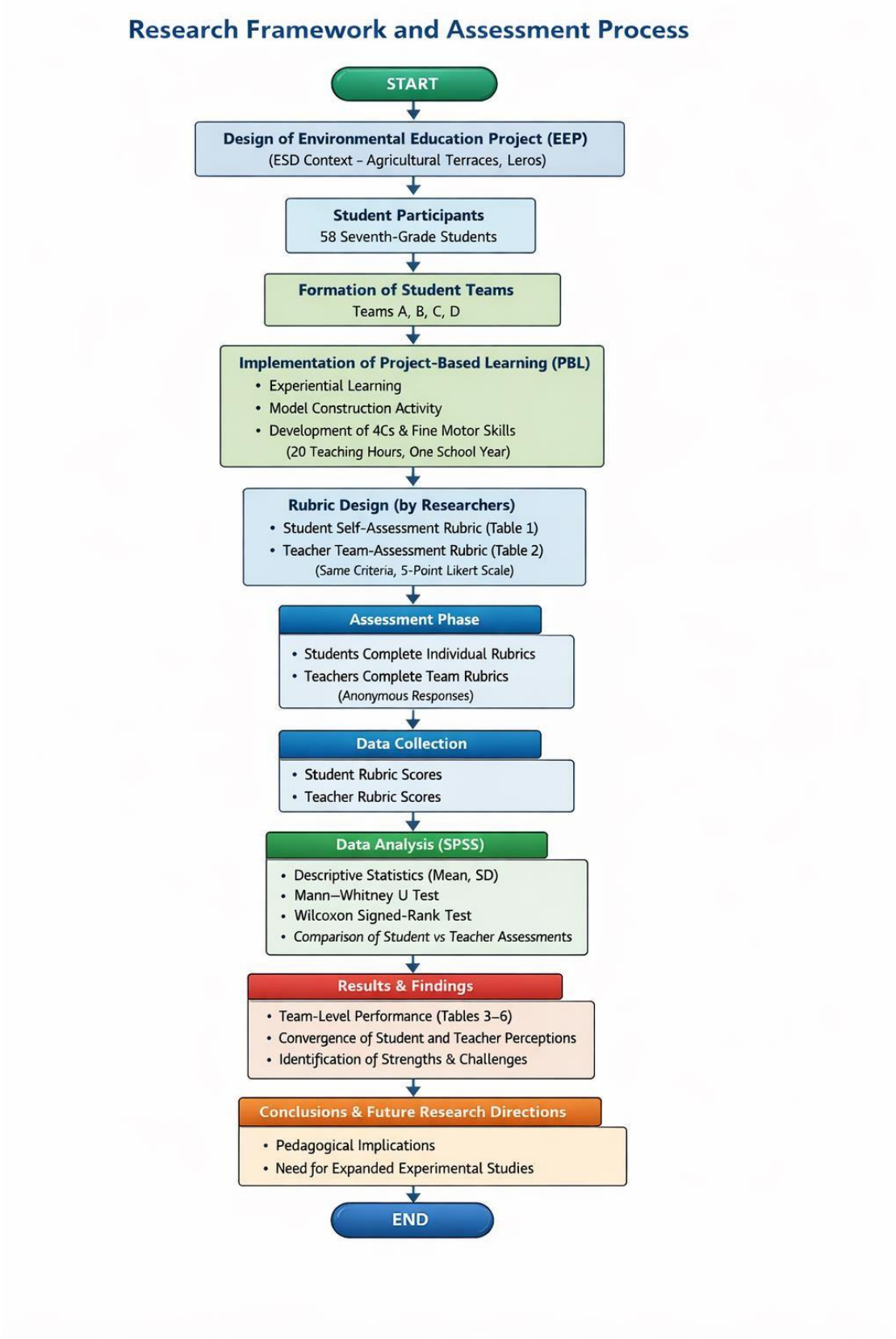

Figure1. Research framework and Assessment Process

Table 3. Results of students' and teachers' assessment rubrics. TeamC.

Table 3. Results of students' and teachers' assessment rubrics. Team C.												
Students						**Teachers**						
Scale	**Good(4)**	**Verygood (5)**	**Score**	**Mean**	**StdDeviation**	**Good(4)**	**Verygood(5)**	**Score**	**Mean**	**StdDeviation**	**Mann-Whitney U(p)**	**Wilcoxon W(p)**
Criteria												
Consistently following the planning of the activity	4(30.76)	9 (69.23)%	61/65 (93.84%)	4.69	0.480	1 (50.00%)	1(50.00 %)	9/10 (90.00%)	4.50	0.707	15.50 (0.678)	0.00 (0.031)
Actively participating in the activity	2(15.38 %)	11 (84.61%)	63/65 (96.92%)	4.85	0.376	1 (50.00%)	1(50.00 %)	9/10 (90.00%)	4.50	0.707	17.50 (0.328)	0.00 (0.031)
Providing support to the team	2(15.38 %)	11 (84.61%)	63/65 (96.92%)	4.85	0.376	1 (50.00)	1(50.00 %)	9/10 (90.00%)	4.50	0.707	17.50 (0.328)	0.00 (0.031)
Communicating ideas to the team, listened carefully ,respected others' opinion	3(23.07 %)	10 (76.92%)	62/65 (95.38%)	4.77	0.439	1 (50.00)	1(50.00 %)	9/10 (90.00%)	4.50	0.707	16.50 (0.507)	0.00 (0.031)
Acceptinganyformofconstructivecriticism,compromisingandnegotiating	3(23.07 %)	10 (76.92%)	62/65 (95.38%)	4.77	0.439	1 (50.00%)	1(50.00 %)	9/10 (90.00%)	4.50	0.707	16.50 (0.507)	0.00 (0.031)
Exercisingfinemotorskills	2(15.38 %)	11 (84.61%)	63/65 (96.92%)	4.85	0.376	1(50.00 %)	1(50.00 %)	9/10 (90.00%)	4.50	0.707	17.50 (0.328)	0.00 (0.031)
Total responses	13 (100%)					2(100%)						
Totalteamscore	377/390(96.66%)					53/60(88.33%)						

Table4.Resultsofstudents'andteachers'assessmentrubrics. TeamD.

Table 4. Results of students' and teachers' assessment rubrics. Team D.													
Students							**Teachers**						
Scale	**Moderate(3)**	**Good(4)**	**Verygood(5)**	**Score**	**Mean**	**StdDeviation**	**Good(4)**	**Verygood(5)**	**Score**	**Mean**	**StdDeviation**	**Mann–WhitneyU(p)**	**WilcoxonW(p)**
Criteria													
Consistentlyfollowingtheplanningoftheactivity	1(5.26%)		18(94.73%)	93/95(97.89%)	4.89	0.459	1(50.00%)	1(50.00%)	9/10(90.00%)	4.50	0.707	27.0(0.078)	0.00(0.031)
Activelyparticipatinginthe activity	1(5.26%)	4(21.05%)	14(73.68%)	89/95(93.68%)	4.68	0.582	1(50.00%)	1(50.00%)	9/10(90.00%)	4.50	0.707	23.0(0.595)	0.00(0.031)
Providingsupporttotheteam		3(15.78%)	16(84.21%)	92/95(96.84%)	4.84	0.375	1(50.00%)	1(50.00%)	9/10(90.00%)	4.50	0.707	25.5(0.291)	0.00(0.031)
Communicatingideas to theteam,listenedcarefully,respectedothers'opinion	1(5.26%)	4(21.05%)	14(73.68%)	89/95(93.68%)	4.68	0.582	2(100%)		8/10(80.00%)	4.00	0.000	14.0(0.468)	0.00(0.031)
Acceptinganyformofconstructivecriticism, compromisingandnegotiating	1(5.26%)	4(21.05%)	14(73.68%)	89/95(93.68%)	4.68	0.582	2(100%)		8/10(80.00%)	4.00	0.000	14.0(0.468)	0.00(0.031)
Exercisingfineemotorskills		2(10.52%)	17(89.47%)	93/95(97.89%)	4.89	0.315	1(50.00%)	1(50.00%)	9/10(90.00%)	4.50	0.707	26.5(0.167)	0.00(0.031)
Total responses	19(100%)						2(100%)						
Totalteamscore	545/570(95.61%)						52/60(86.66%)						

Table 5. Results of students'and teachers' assessment rubrics. TeamA.

Table 5. Results of students' and teachers' assessment rubrics. Team A.															
Students								**Teachers**							
Scale	**Acceptable(2)**	**Moderate(3)**	**Good(4)**	**Verygood(5)**	**Score**	**Mean**	**StdDeviation**	**Moderate(3)**	**Good(4)**	**Very good(5)**	**Score**	**Mean**	**StdDeviation**	**Mann–WhitneyU(p)**	**WilcoxonW(p)**
Criteria															
Consistentlyfollowingtheplanningoftheactivity		1(8.33%)	1 (8.33%)	10 (83.33%)	57/60(95.00%)	4.75	0.622		1 (50.00%)	1 (50.00%)	9/10(90.00%)	4.50	0.707	15.5 (0.445)	0.00 (0.031)
Activelyparticipatingintheactivity			3 (25.50%)	9 (75.00%)	57/60(95.00%)	4.75	0.452		1 (50.00%)	1 (50.00%)	9/10(90.00%)	4.50	0.707	4.5 (0.107)	0.00 (0.031)
Providingsupporttothe team	2(16.66%)	1(8.33%)	1 (8.33%)	8 (66.67%)	51/60(85.00%)	4.25	1.215	1 (50.00%)	1 (50.00%)		7/10(70.00%)	3.50	0.707	12.5 (1.000)	0.00 (0.031)
Communicating ideas tothe team,listenedcarefully,respectedothers'opinion	3(25.50%)		2 (16.66%)	7 (58.33%)	49/60(81.66%)	4.08	1.311	1 (50.00%)	1 (50.00%)		7/10(70.00%)	3.50	0.707	8.0 (0.659)	0.00 (0.031)
Acceptinganyformofconstructivecriticism,compromisingandnegotiating		1(8.33%)	1 (8.33%)	10 (83.33%)	57/60(95.00%)	4.75	0.622		1 (50.00%)	1 (50.00%)	9/10(90.00%)	4.50	0.707	15.5 (0.445)	0.00 (0.031)
Exercisingoffinemotorskills		1(8.33%)	1 (8.33%)	10 (83.33%)	57/60(95.00%)	4.75	0.622		1 (50.00%)	1 (50.00%)	9/10(90.00%)	4.50	0.707	15.5 (0.445)	0.00 (0.031)
Totalresponses	12(100%)							2(100%)							
Totalteamscore	328/360(91.11%)							50/60(83.33%)							

Table 6. Results of students' and teachers' assessment rubrics. TeamB.

Table 6. Results of students' and teachers' assessment rubrics. Team B.															
Students								**Teachers**							
Scale	**Acceptable(2)**	**Moderate(3)**	**Good(4)**	**Verygood(5)**	**Score**	**Mean**	**StdDeviation**	**Moderate(3)**	**Good(4)**	**Very good(5)**	**Score**	**Mean**	**StdDeviation**	**Mann–WhitneyU(p)**	**WilcoxonW(p)**
Criteria															
Consistentlyfollowingtheplanningofthe activity	2(14.28 %)		4 (28.57 %)	8 (57.14 %)	60/70(85.71 %)	4.29	1.069		2(100 %)		8/10(80.00%)	4.00	1.069	20.0(0.336)	1.00 (0.063)
Activelyparticipatingintheactivity	3(21.42 %)		2 (14.28 %)	9 (64.28 %)	59/70(84.28 %)	4.21	1.251		2(100 %)		8/10(80.00%)	4.00	0.000	20.0(0.330)	1.00 (0.063)
Providing supportto the team	3(21.42 %)		4 (28.57 %)	7 (50.00 %)	57/70(81.42 %)	4.07	1.207	1 (50.00 %)	1 (50.00 %)		7/10(70.00%)	3.50	0.707	12.5(0.863)	1.00 (0.063)
Communicating ideas tothe team,listenedcarefully,respectedothers' opinion	2(14.28 %)	2(14.28 %)		10 (71.42 %)	60/70(85.71 %)	4.29	1.204		2(100 %)		8/10(80.00%)	4.00	0.000	20.0(0.314)	1.00 (0.063)
Acceptinganyformofconstructivecriticism,compromisingandnegotiating	3(21.42 %)	2(14.28 %)	1 (7.14%)	8 (57.14 %)	56/70(80.00 %)	4.00	1.301	1(50.00%	1 (50.00 %)		7/10(70.00%)	3.50	0.707	12.5(0.860)	1.00 (0.063)
Exercisingoffinemotorskills	2(14.28 %)		3 (21.42 %)	9 (64.28 %)	61/70(87.14 %)	4.36	1.082		1 (50.00 %)	1 (50.00 %)	9/10(90.00%)	4.50	0.707	15.0(0.927)	1.00 (0.063)
Totalresponses	14 (100%)							2(100%)							
Totalteamscore	353/420(84.04%)							47/60(78.33%)							

Table7.Summary Table across Teams A-D

Table 7.Summary Table across Teams A-D							
Team	**Students' Total Score (%)**	**Students' Mean**	**Teachers' Total Score (%)**	**Teachers' Mean**	**Wilcox on W**	**p-value**	**Interpretation**
A	328/360(91.11)	4.51	50/60(83.33)	4.50	0.00	0.031	Significant difference
B	353/420(84.04)	4.20	47/60(78.33)	4.00	1.00	0.063	No significant difference
C	377/390(96.67)	4.78	53/60(88.33)	4.50	0.00	0.031	Significant difference
D	545/570(95.61)	4.76	52/60(86.66)	4.50	0.00	0.031	Significant difference