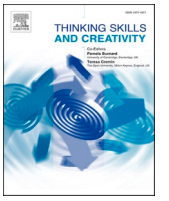
Thinking Skills and Creativity 59 (2026) 102023

Contents lists available at ScienceDirect

Thinking Skills and Creativity

journal homepage: www.elsevier.com/locate/tsc



Assessing creativity in early childhood: How future teachers balance conformity and originality

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ARTICLE INFO

Keywords:
Evaluation of creativity
Early childhood education
Teacher training
Evaluation document

ABSTRACT

Creativity is an essential skill in contemporary education systems, particularly in early childhood, where it is stimulated by exploratory activities and the expression of thought through the creation of ideas or the production of new objects. However, its assessment remains a major challenge, particularly for future teachers, who have to reconcile the emergence of creativity with the requirements of training plans. This dual injunction reveals a hesitancy on the part of professionals regarding the definition of creativity and the ways in which its manifestations in students can be assessed.

This study explores how future teachers of early childhood integrate evaluation criteria measuring the development of creativity into their evaluation documents. It aims to understand which dimensions of the creative process and theoretical models, such as the 3Ps and the OECD Creative Assessment Grid, are mobilised in an evaluative context. Two hypotheses guided this work: (1) trainee teachers give priority to technical and observable dimensions, often to the detriment of the creative process, and (2) transversal aspects, such as originality and collaboration, are underrepresented.

To test these hypotheses, 153 evaluation documents produced by student teachers at the HEP Vaud were analysed using a specific grid. The study combined an analysis of proportions, correlations and a hierarchical classification of evaluation criteria.

The results reveal that emphasis is placed on technical and methodological criteria, such as respect for constraints and diversity of materials, while less tangible dimensions, such as originality and collaboration, are marginally taken into account. These trends reflect the systemic challenges involved in assessing creativity that is non-linear and exploratory in nature in early childhood. These initial elements are in line with previous research which emphasises the predominance of observable and measurable aspects of the evaluation of creativity, to the detriment of the creative process, which is more complex to identify. The study also highlights a preference for assessing individual performance to the detriment of more collaborative dynamics. This observation highlights the need to reassess the way in which creativity is understood and taught in teacher training programmes.

In conclusion, this research highlights the importance of equipping future teachers with tools to assess both tangible outcomes and intangible processes, paving the way for a balanced and effective approach to promoting creativity in young learners in a rapidly changing educational landscape.

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https://doi.org/10.1016/j.tsc.2025.102023
Received 24 January 2025; Received in revised form 22 August 2025; Accepted 27 September 2025
Available online 28 September 2025

1. Introduction

Creativity is recognised as an essential skill in 21st century education systems (Taguma et al., 2018). Research shows that it is a central aspect of solving complex problems ans adapting to social and technological transformations (Pearson & Sommer, 2011; Treffinger et al., 2002). This recognition has led to a rise in the assessment of creativity in international education policies, as evidenced by the inclusion of creative thinking tasks in the PISA assessments (Bouckaert, 2023; Saroyan, 2022). Although numerous theoretical frameworks have been developed to conceptualise it (Lubart et al., 2015; Barbot et al., 2022), its concrete implementation in teachers' practices remains complex.

In early childhood, creativity plays a central role in learning through play, exploration and expression (Burnard & White, 2008). Yet assessing creativity in pupils remains a challenge for teachers, given that teaching practices often have to combine the emergence of creativity with compliance with training objectives. This dual injunction observed in the literature reveals a hesitancy on the part of professionals regarding the very definition of creativity (Allehyani, 2023; Ata-Akturk & Sevimli-Celik, 2020) and how to assess its manifestations in students (Selkrig & Keamy, 2017). Although assessing creativity presents potential challenges throughout a teacher's career, teachers in initial training face particular difficulties due to their emerging pedagogical identity, limited practical experience, and the complexity of integrating theoretical models into classroom practice (Cheung & Mok, 2018). Furthermore, future teachers often perceive their initial training as insufficient to prepare them to assess complex skills such as creativity (Bereczki & Karpati, 2018), leading to uncertainty that can undermine the quality of teaching (Ata-Akturk & Sevimli-Celik, 2020) and, as a result, limit themselves to assessing more tangible and measurable aspects of students' work (Sawyer, 2022).

In this context, this ambivalence highlights the need to explore how pre-service teachers translate their theoretical knowledge into their emerging practices of assessing creativity. This is not only to improve emerging practices that promote the development of creativity, but also to improve initial training. Thus, this article proposes to analyse the creativity assessment practices of future early childhood teachers, based on a study of assessment documents produced following a training module specifically allocated to creativity.

1.1. Creativity as an essential skill in early childhood

In this study, we postulate that creativity is a universal and developable ability (Besançon & Lubart, 2015; Lubart et al., 2015), and that its individual potential results from the interaction of cognitive, affective, environmental, and social factors, according to Lubart's multivariate model (2015). We therefore define it as a complex process resulting in an original creative production adapted to the contexts of the situation in which it is implemented (Barbot et al., 2022; Besançon & Lubart, 2015; Lubart et al., 2015; Vandaudenard et al., 2016). In the context of early childhood, it refers to the expression of thought through the creation of ideas or the production of new objects (Isbell & Yoshitawa, 2020; Wright, 2010). These authentic activities encourage students' active participation and enable them to develop their creativity through meaningful interactions and experiences (Mokwunye & Anyanwu, 2023). A number of contextualised pedagogical practices, such as experimenting with materials, mastering tools and expressing ideas visually, enable the development of creative, social and emotional skills (Hoffmann & Russ, 2012; Vandaudenard et al., 2016), which helps to build children's confidence and autonomy (Burnard & White, 2008; Essa & Burnham, 2019). Through these practices, social interactions, which take the form of collaborative work or discussions, also play an essential role in the development of creativity in early childhood. They encourage the exchange of ideas and collective learning (Mokwunye & Anyanwu, 2023).

1.2. Approaches to assessing creativity

Research in education, particularly in the field of creativity, often confuses measurement, evaluation, and assessment (Brookhart & McMillan, 2019). We therefore make the following distinction between measurement, which consists of assigning numbers to a latent construct (e.g., fluidity, originality); assessment, which consists of systematically collecting qualitative or quantitative evidence (e.g., consideration of constraints, mastery of a procedure); and evaluation, which is the value judgment (e.g., by weighting each element) assigned in relation to the evaluation framework in place (Brookhart & McMillan, 2019).

In this context, the assessment of creativity in schools is generally based on two main complementary approaches: process analysis and product analysis (Van der Schyff et al., 2018). The former focuses on how ideas are generated and developed, examining dimensions such as divergent thinking, flexibility or the ability to develop original solutions (Plucker et al., 2023). The second focuses on the characteristics of the final product, such as its originality or contextual relevance (Besançon & Lubart, 2015; Bonnardel & Lubart, 2023). Despite these theoretical approaches, assessing young students' creativity poses specific challenges for teachers. Teachers often tend to focus on the visible and measurable aspects of students' productions (Rosenfeld, 2014), to the detriment of the more complex and less tangible processes that underpin creativity. This tendency stems in particular from the often informal and exploratory nature of creative activities in early childhood, as well as the variability in pupils' level and style (Barbot et al., 2011). This complicates the development of clear and observable assessment indicators (David et al., 2022; Patston et al., 2017). In addition, the focus on the finished product does not guarantee an honest reflection of in-depth learning (Boyd & Cutcher, 2015; Rosenfeld, 2014). Finally, the difficulty in creating observable indicators for more abstract or inaccessible dimensions during product evaluation (such as divergent/convergent thinking, analogy or the effect of collaborative interactions), complicates this task (Mastracci, 2020; Newton & Newton, 2009). These aspects, particularly those linked to collaborative interactions, play a crucial role in the emergence of creativity, but they are often undervalued by teachers in assessment documents (Craft, 2008; Gaillot, 2021). Thus, teachers have to juggle

between taking into account aspects of the creative process, such as flexibility or originality, and the constraints of educational programmes, which tend to make them favour an assessment that focuses more on the final product (Sawyer, 2022; Sawyer & Henriksen, 2024). Even if this practice incorporates certain components of the creative process, it remains insufficient to attest to the development of pupils' creative abilities.

Tools such as checklists or anecdotal notes, used to assess progress in artistic and creative activities, could offer more nuanced perspectives (Wafa et al., 2023). Furthermore, observing children's spontaneous and interactive behaviour during creative activities could help to capture these less tangible dimensions (Wafa et al., 2023). Finally, the importance given to the product of the creative process and the limited consideration of collaborative interactions in young children indicate a focus on the pupil's activity when measuring the development of creative abilities. These limitations, among others (Bereczki & Kárpáti, 2018), hinder teachers' ability to identify the progression of their pupils' creative abilities (Karwowski et al., 2020; Patston et al., 2017), which in turn influences their own perception of creativity and the implementation of teaching practices that promote this skill (Massy et al., 2025).

1.3. Training in assessing creativity in early childhood

The multifaceted nature of creativity requires measurement tools that are adapted to its components (Barbot et al., 2022). However, there is still a lack of specific tools for early childhood, where a flexible and contextualised approach is required (Eckhoff, 2011). In recent years, models such as the five creative habits model developed by Lucas et al. (2013) and innovative methods such as tracking applications or collaborative platforms (Kurok et al., 2023) have emerged. Despite this, teachers often perceive their preparation as insufficient to assess this skill in their students (Cheung & Mok, 2018). The training of future teachers therefore plays an important role in helping to integrate creativity and its evaluative practices into the new generation of teachers.

In response to this challenge, the Haute École Pédagogique in the canton of Vaud has set up a training module for evaluating creativity in early childhood [see Appendix A for a detailed breakdown of content and time allocation]. This training component aims to overcome the methodological challenges associated with assessing creative abilities, by introducing specific frameworks adapted to the training context. The models studied include the creativity assessment grid proposed by the OECD (Vincent-Lancrin et al., 2020), which is based on a separation between process and product, grading students' acquisition by levels of achievement ranging from 1 (untapped skills) to 4 (exceptional skills). This framework provides a basis for scaling explicit indicators, enabling teachers to monitor and anticipate the presence of creativity-related elements and assess students' progress at different stages of the project. Conversely, Mastracci's 3P model (2011, 2020) offers broader entry points for assessing creativity, integrating three interdependent dimensions: the creative process (the approach; the manifestation of creative thinking skills, etc.), the creative product (originality, adaptation to context, technical mastery, etc.) and the creative person (interpretation of choices made, convincing communication, etc.). Unlike the OECD's skills-based approach, the 3P model explicitly highlights the personal and behavioural dimensions of creativity, promoting a more general understanding of students' creative development.

In addition, the module incorporates concrete tools, such as problem-solving tasks, work on critical thinking strategies, the creative process notebook (Botella & Lubart, 2019) and the creation of observation grids adapted to early childhood. These training practices and pedagogical conditions have been identified as particularly effective in developing the skills that will enable future teachers to document and analyse pupils' creative expressions in a school setting (Kaplinskyi et al., 2024; Kurok et al., 2023). These tools, in line with neuropedagogical approaches, help to make the invisible visible by structuring assessment around measurable dimensions (Kaplinskyi et al., 2024). Although these models provide important indications for a better understanding of the assessment of creativity in schools, their practical implementation remains a challenge due to their lack of specific relevance to early childhood

1.4. Aims of the study

The theoretical evidence presented above shows that assessing creativity in young children is a complex task for teachers. Firstly, cognitive and subjective biases favor an over-representation of observable aspects of creativity, such as compliance with constraints in students' productions (Sawyer, 2022; Sawyer & Henriksen, 2024), often to the detriment of creative process and collaboration (Craft, 2008). Secondly, although some practicing teachers have been trained, many consider their preparation insufficient to fully integrate creativity assessment (Cheung & Mok, 2018). Yet, for pre-service teachers, there is little empirical data documenting the proportion of criteria actually used in their assessments and the relationships between these criteria.

This raises a primary research question: how do selected criteria coexist and cluster in early childhood assessment documents? This can be broken down into two sub-questions: (1) to what extent are process-oriented criteria (e.g. divergent/convergent thinking, repeated trials) balanced with product-oriented criteria (e.g. compliance with constraints, technical mastery)? (2) To what extent are cross-cutting aspects such as originality and collaboration taken into account in the indicators of evaluation documents?

Based on our theoretical framework, two hypotheses are proposed: (H1) future teachers attach greater importance to the technical and observable dimensions of student productions, to the detriment of aspects linked to the creative process (Rosenfeld, 2014; Sawyer & Henriksen, 2024); (H2) because of their cross-cutting nature, certain aspects such as originality and collaboration will be poorly integrated into assessment documents (Craft, 2008; Gaillot, 2021; Sawyer, 2022).

In addition to answering the questions by analyzing assessment documents produced at the end of initial teacher training in early childhood, this research maps the actual use of the criteria to better grasp the effect of specific training in creativity evaluation on emerging practices in early childhood.

2. Materials and methods

2.1. Participants

This study is based on an analysis of assessment documents produced by 153 future early childhood teachers enrolled in the third year of training at the Haute École Pédagogique du canton de Vaud (HEP Vaud). The participants, aged between 19 and 56 ($M = 26.73$, $SD = 8.45$), were being trained to teach children aged between 4 and 8. Of these, 8 % were men and 92 % women. The gender distribution of the study participants is representative (Chi^2 (1153) = 1.15, $p = .22$) of the percentages of the student population at the HEP Vaud (10.19 % men and 89.91 % women, HEP Vaud, 2023). Finally, participation, through the use of assessment documents produced by students, was informed and voluntary. Furthermore, in order to guarantee the anonymity of participants, all assessment documents analysed were anonymised by assigning students a number, then we assigned a new random number (between 1 and 1000) before analysis. This was done to ensure that no personal or institutional information could be identified or influence the analysis of the assessment documents.

2.2. Data collection

The study took place during the fourth semester of initial teacher education at the University of Teacher Education, Vaud (Switzerland). Students attended a compulsory six-week module entitled Evaluating Creativity in Early Childhood [see Appendix A for a detailed breakdown of content and time allocation]. The time of collection was chosen to ensure a representative assessment of the skills acquired by the future teachers, while reflecting their priorities and their developing pedagogical approaches.

The data used in this study comes from 153 assessment documents completed by participants, which include indicators (quantitative or qualitative evidence of the achievement of the assessed learning objective) demonstrating the progress made by the student in a subject area. Specifically, they specify the objectives, criteria, indicators and an assessment scale for one or more learning objectives. These assessment documents were designed by participants at the end of a training module for assessment in creative and manual activities, focusing on the integration of creativity into early childhood teaching practices.

2.3. Materials

The assessment documents were analysed using the Creativity Analysis Grid (CAG), a structured tool designed to systematically identify the nature of creativity-related indicators [see Appendix B for a detailed visualization of the elements]. This grid integrates multiple theoretical frameworks, including the 7C model (Lubart, 2017), focusing on dimensions such as originality, divergent and convergent thinking, and contextual adaptation; the 3P model (Mastracci, 2020), addressing creativity through three dimensions—creative process, product, and creative personality; and the OECD grid (Vincent-Lancrin et al., 2020) which emphasizes criteria such as “process” and “product” in the assessment of creative abilities in schools.

The CAG is therefore structured around two components: (a) Dimensions of creativity: Originality, divergent and convergent thinking, collaboration and adaptation to context; (b) Theoretical references: Verification of the integration of theoretical elements from training, such as the OECD’s skills framework or the 3P model. This combination aims to identify elements from the theoretical frameworks for creativity assessment training and to identify the underlying dynamics (individual vs. collective; tangible vs. process) in the assessment documents analysed.

A preliminary exploratory study was carried out to qualitatively assess the validity of the observation grid. Three evaluators (age: $M = 24$ years; $SD = 1$) applied the GAC to a representative sample of assessment documents created by pre-service teachers. Inter-rater fidelity was examined through a quantitative comparison of ratings made on each of the grid’s criteria. The results show a high degree of consistency in the analyses, as no significant discrepancies were observed between raters, underlining the reliability of the tool.

2.4. Analysis plan

Quantitative analysis of the 153 assessment documents was carried out in three complementary phases. Firstly, to ensure methodological consistency and objectivity[1] in the content analysis of the assessment documents, the presence of each criterion of the creativity analysis grid (GAC) was coded in binary form (1 = present, 0 = absent[2]). Next, using Jamovi®, we calculated the proportions of occurrence of each of these criteria to determine their relative weight in the assessment practices. Finally, we explored the relationships between the criteria by calculating Phi correlation coefficients, then performed an ascending hierarchical classification to identify clusters of consistent criteria. The interpretation of these clusters highlighted the pedagogical trends (individual vs. collective) and assessment priorities (process vs. product) that emerge among future early childhood teachers.

[1] A subset of 33/153 documents (≈22%) was double-coded on 35 criteria (1,155 document×criterion pairs): $\kappa = 0.973$ (95% CI [0.963, 0.984]); Po = 0.986; PABAK = 0.972; $\alpha = 0.973$. The remaining documents were coded by a single rater using the same protocol.

[2] In accordance with Neuendorf`s (2017) manifest content approach, this coding is based exclusively on what is explicitly written in the assessment documents of future teachers, without interpretative inference.

2.5. Validity and limits

The assessment documents analysed come from a specific context (HEP Vaud) and reflect the practices of a relatively homogenous population. As a result, the results must be interpreted with caution due to the specific nature of the data. Further studies could enrich these results by examining diversified educational contexts.

3. Results

3.1. Descriptive analysis of creativity criteria in assessment documents

An analysis of the 153 assessment documents produced by future teachers of early childhood reveals significant variations in the integration of creativity criteria. The criteria most frequently included in the documents were: compliance with product constraints (93 %); use of several techniques (91 %); achievement of creative objectives (88 %); validation of the student's choice (82 %) and use of several materials (79 %). These results underline the particular attention paid to technical and methodological aspects, as well as the attention paid to ensuring that the students' creations meet the objectives defined beforehand. On the other hand, certain criteria are under-represented, in particular those relating to the originality of the production (13 %), collaboration between the students (6 %) and external resources (0 %). This breakdown reveals a tendency to assess creative skills on an individual basis, giving priority to tangible and measurable aspects of productions, to the detriment of more abstract creative processes.

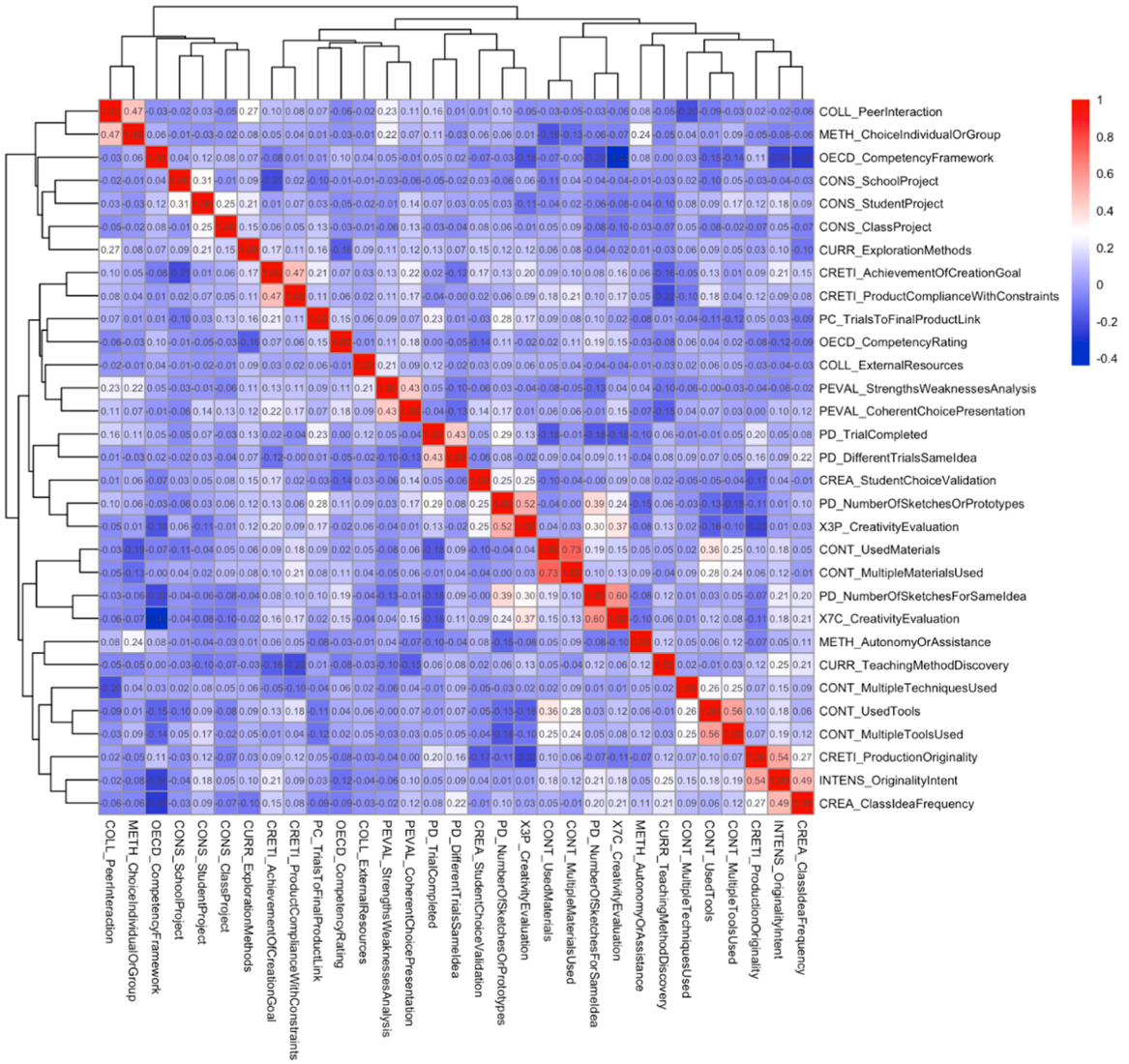

Fig. 1. Heatmap of correlations between creativity assessment criteria for early childhood.

3.2. Links between the various criteria

Phi correlations were calculated to explore the relationships between the different assessment criteria (see Fig. 1). The analyses show significant correlations between several criteria.

First of all, a significant correlation ($r = +0.466$, $\chi^2 = 33.32$, $p < .001$) was observed between consideration of the number of sketches and prototypes produced (PD_NumberOfSketchesOrPrototypes) and the presence of elements of the 3P model (3P_CreativityEvaluation). This indicates that future teachers who include in their assessment document indicators relating to the number of sketches or prototypes frequently associate these elements with the 3P dimensions (Process, Product, Creative person).

A strong and significant relationship ($r= +0.586$, $\chi^2 = 52.70$, $p < .001$) also appeared between achieving the creation goals (CRETI_AchievementOfCreationGoal) and complying with the constraints imposed in the task (CRETI_ComplianceWithConstraints). This relationship indicates that the assessment of productions through the achievement of creative objectives is often linked to compliance with specific constraints.

With regard to collaborative interactions, a significant relationship ($r= +0.54$, $\chi^2 = 43.83$, $p < .001$) was identified between interactions with classmates (COLL_PeerInteraction) and students' choice of work method (METH_ChoiceIndividualOrGroup). This relationship indicates that future teachers who encourage interaction between students in their assessment documents are also those who allow students greater autonomy in choosing their work method.

Furthermore, a correlation ($r= +48$, $\chi^2 = 35.25$, $p < .001$) between intentionality (desire to do something original) and the frequency of ideas within the class group (CREA_ClassIdeaFrequency) suggests that teachers who assess the originality of students' productions also take into account the frequency of ideas within the class group.

Finally, a correlation ($r= +0.51$, $\chi^2 = 39.16$, $p < .001$) linked to divergent thinking was observed between the number of student trials (PD_TrialCompleted) and the number of trials for an idea (PD_DifferentTrialsSameIdea).

By highlighting significant associations between different criteria, these results suggest an underlying organisation of the dimensions assessed. This observation led us to examine the possible presence of clusters in the data in order to better understand the groupings between the evaluation criteria.

3.3. Clusters and criteria in early childhood assessment documents

A bottom-up hierarchical classification of the CAG criteria identified four distinct clusters, grouping the criteria according to their similarities (see Fig. 2).

3.3.1. Cluster 1: structure and use of resources

This cluster groups together criteria focusing on the use of various material resources and the structuring of pupils' productions. In

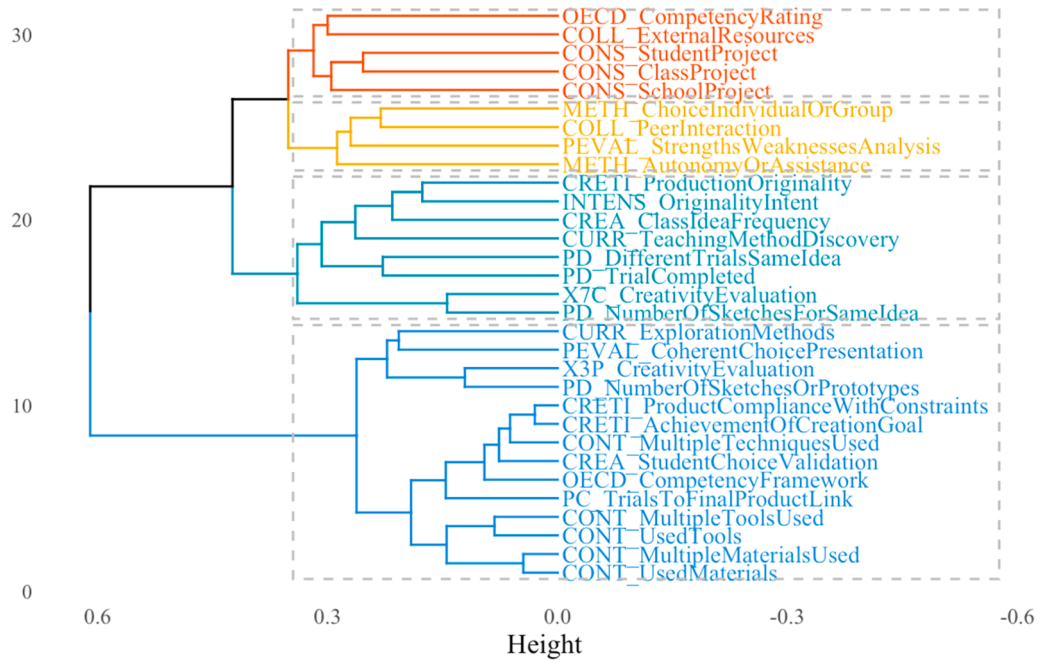

Fig. 2. Hierarchical clustering (Ward.D2) on distances derived from Phi. Note: The horizontal axis shows Ward.D2 clustering height (larger values = lower similarity); the vertical axis lists criteria (no scale). Dashed rectangles indicate the four clusters. Each cluster highlights specific priorities in the assessment practices of future teachers.

their assessment documents, future teachers of early childhood education seem to attach great importance to the diversity of materials and techniques used, and to the way in which productions comply with objectives and constraints (Table 1). The criteria for validating pupils' choices and exploring methods indicate that structure is valued in the creative process.

3.3.2. Cluster 2: collaboration and context

The criteria for this cluster show a marked emphasis on collaboration between pupils and on valuing group projects (Table 2). The choice of working individually or in groups, as well as class and school projects, indicate that creativity is evaluated as a process that benefits from social interaction and inclusion in a community setting.

3.3.3. Cluster 3: originality and exploration

The criteria for this cluster focus on the originality and diversity of attempts, indicating that early childhood teachers favour an approach to creativity that values the exploration and generation of original ideas (Table 3). The criterion of frequency of ideas in the classroom shows particular attention to pupils' ability to distinguish themselves from their previous proposals by generating new ideas, while incorporating the identification of intentionality.

3.3.4. Cluster 4: production assessment and consistency

This cluster brings together criteria relating to the evaluation of production, the coherence of choices and the diversity of attempts in the ideas research phase (sketches, prototypes) (Table 4). The criteria also include competency frameworks and the presence of models from teacher training (3P, 7C). This underlines the development of creative skills through a reflective approach on the part of the pupils (particularly through their comments), where the productions are justified in a systemic way.

These results show that, although certain creativity criteria are correlated and coherently integrated, others remain isolated or little exploited, such as social and collaborative interactions.

4. Discussion

The aim of this study was to explore how future teachers of early childhood mobilise the different criteria of creativity in their assessment documents. More specifically, the aim was to analyse the way in which criteria derived from the creative process, the OECD model (Vincent-Lancrin et al., 2020) and the 3P model (Mastracci, 2020) are integrated and interact in the assessment of pupils' production. The results show that future teachers of early childhood education pay marked attention to methodological dimensions and the conformity of productions to expectations, as shown by the 'structure and resources' and 'evaluation and coherence of productions' clusters. On the other hand, abstract criteria such as originality and collaboration remain under-represented. These observations reflect pedagogical priorities centred on technical mastery and conformity, reflecting a relatively conservative approach to assessing creativity.

Two hypotheses were put forward prior to this study: 1) future teachers attach greater importance to the technical and observable dimensions of pupils' productions, to the detriment of the creative process; 2) because of their cross-cutting aspect, certain aspects such as originality and collaboration will be poorly integrated into assessment documents. The results of the proportions and correlation between the criteria confirm the uneven integration of creativity criteria in the assessment documents produced by future teachers of early childhood education. The latter emphasise technical criteria (e.g. the use of materials and tools) and methodological criteria, such as the use of multiple techniques and compliance with product constraints. This focus on the technical dimensions (tangible and measurable) is in line with the observations of Rosenfeld (2014) and Sawyer (2022), who highlight the tendency of teachers to favour easily observable elements, to the detriment of the creative process, which is more complex to identify (David et al., 2022). This practice, observed among future teachers and identified through the 'evaluation and coherence of productions' clusters, can be explained by the complex aspect of evaluation which, as the correlations have shown, places great importance on the instructions in the assessment documents. Although Massy et al. (2025) showed a reduction in the complexity of the concept of creativity through students 'perceptions, these results indicate the resistance of future teachers' ingrained assessment practices. However, this preference

Table 1
Criteria for the first cluster structure and use of resources.

Criteria for the cluster	Description
CURR_ExplorationMethods	Indicates that students had the opportunity to explore different methods.
CONT_UsedMaterials	Focuses on multiple materials (e.g. various paint colours, paper, etc.).
CONT_UsedTools	Focuses on multiple tools (e.g. paintbrushes, stamps, etc.).
CONT_MultipleToolsUsed	Takes into account students' use of multiple tools.
PC_TrialsToFinalProductLink	Analyses the link between the different trials (prototype, model, sketch, etc.) completed by the student and the final product.
OECD_CompetencyFramework	Applies the competency framework comprising the dimensions "Search," "Imagine," "Do," and "Reflect" when assessing students' abilities.
CREA_StudentChoiceValidation	Validates the student's choices.
CONT_MultipleTechniquesUsed	Takes into account students' use of multiple techniques.
CRETI_AchievementOfCreationGoal	Checks whether the student has achieved the set creative goal.
CRETI_ComplianceWithConstraints	Checks whether the final product meets the specified constraints.

Table 2
Criteria for the second collaboration cluster and context.

Criteria for the cluster	Description
METH_AutonomyOrAssistance	Indicators showing that the teacher allows students to choose whether to work independently or with assistance.
COLL_PeerInteraction	Takes into account the student's interactions with classmates.
METH_ChoiceIndividualOrGroup	Indicators showing that students have the choice to work individually or in groups.
CONS_StudentProject	Indicates whether the student's final output is part of the student's own (individual) project.
CONS_ClassProject	Indicates whether the student's final output is part of a class project.

Table 3
Criteria for the third cluster originality and exploration.

Criteria for the cluster	Description
PD_TrialCompleted	Indicates that one or more trial(s) were carried out by the student.
PD_DifferentTrialsSameIdea	Indicates that different trials were carried out for the same idea proposed by the student.
CURR_TeachingMethodDiscovery	Mentions the pedagogical approach used by the teacher to introduce techniques (e.g. experimentation by students, teacher demonstrations).
CREA_ClassIdeaFrequency	Considers how frequently the idea/product appears within the class group.
INTENS_OriginalityIntent	Takes into account the student's intention to create something original.
CRETI_ProductionOriginality	Considers the originality of the final product created by the student.

Table 4
Criteria for the fourth cluster evaluation and consistency of productions.

Criteria for the cluster	Description
PD_NumberOfSketchesForSameIdea	Indicates the number of sketches or prototypes created for the same idea.
7C_CreativityEvaluation	Integrates the dimensions of the 7C framework (e.g. Collaboration, Context, Curriculum) to measure student creativity.
PD_NumberOfSketchesOrPrototypes	Indicates the total number of sketches or prototypes produced by the student.
3P_CreativityEvaluation	Takes into account the three dimensions of the 3P model (Creative Process, Product, Creative Personality) in evaluation.
OECD_CompetencyRating	Uses a rating system (from 1 to 4) to assess the extent to which students achieve the targeted competencies.
PEVAL_StrengthsWeaknessesAnalysis	Involves the student's analysis of the strengths and weaknesses of their ideas.
PEVAL_CoherentChoicePresentation	Ensures the student presents a coherent explanation of the choices made.

may reflect deeper cognitive biases in favor of tangible evidence of learning, as well as the influence of previous educational experiences where assessment often favours concrete results over more abstract developmental processes. Furthermore, the very structure of teacher training and its practical content (OECD, 3P, etc.) can inadvertently reinforce these tendencies by emphasizing explicit objectives and clearly defined outcomes, thereby influencing the assessment choices of teachers in initial training to align closely with predefined technical and methodological standards. Thus, we hypothesise that the elements included in the assessment documents are probably a response to the explicit expectations of teacher training, which emphasises compliance with objectives and achievement of results, as much as an echo of the practices experienced during their school career.

Conversely, dimensions such as originality and collaboration remain marginalised in assessment documents. The underrepresentation of these more abstract dimensions reflects teachers' difficulty in evaluating the creative process. This difficulty can be explained by the informal and exploratory nature of creativity in early childhood (Gaillot, 2021). Indeed, creative and manual activities at this age are based mainly on experimentation, spontaneous discoveries and individual or group explorations, which do not necessarily follow a linear and observable path. For example, a child may move from one idea to another without the process being immediately visible or structured. This non-linear and often unpredictable nature of the process makes it difficult to develop clear and measurable evaluation indicators, unlike technical criteria (e.g. use of materials or compliance with constraints). However, the results indicate that future teachers attach importance to in-depth exploration, whether diversified or focused on a specific idea. This is achieved by valuing the multiplicity of trials (number of ideas) through the consideration of repeated trials around a single idea.

Finally, the fact that little account is taken of collaborative interactions in the evaluation criteria highlights a predominantly individualised approach to creativity, a point also made by Craft (2008). This conclusion is supported by the results obtained: criteria related to collaboration, such as interactions between students, are among the least represented in the assessment documents. Moreover, the Phi correlations show that the collaborative dimensions have weak or absent links with the other criteria. For example, collaboration between interactions between students and the criteria of originality or creative objectives are insignificant, underlining their weak integration in the assessment documents and, by extension, in the assessment practices of future teachers. These results indicate a marginalisation of collective aspects in the understanding and evaluation of creativity by future teachers of early childhood. This suggests an underlying preference for individualistic and product-oriented assessment practices, reflecting deeper pedagogical beliefs that learning is primarily an individual cognitive process rather than a socially constructed experience (Craft, 2008; Gaillot, 2021). Such an approach risks limiting recognition of the essential role that social interactions play in promoting creative thinking and problem solving, particularly among young children whose creative expressions are often reinforced through collaborative exchanges (Mokwunye & Anyanwu, 2023). Thus, the limited attention paid to collaborative dynamics could indicate uncertainty or a lack of

preparation among teachers in initial training regarding how to effectively observe, document, and evaluate collaborative processes in classroom activities (Bereczki & Karpati, 2018). This shortcoming highlights the importance of improving teacher training programs by explicitly integrating the collaborative dimensions of creativity into formative assessment practices from early childhood onwards.

4.1. Pedagogical implications

The results of this study highlight important implications for the training of future teachers of early childhood education, particularly with regard to the creation and integration of creativity indicators into their assessment practices. Firstly, it seems essential to take greater account of originality and the creative process in training. At present, new generations of teachers tend to give priority to criteria attesting to tangible results (such as the final product), to the detriment of the underlying processes, such as divergent thinking or iterative reflection. Although criteria related to divergent thinking are present in 40 % of the documents studied, this proportion remains moderate and indicates that this dimension is not yet fully integrated into assessment practices. In order to reinforce this consideration, it would be useful to add practical exercises specifically designed to help future teachers identify, document and evaluate abstract dimensions of creativity to the current training programme. For example, the use of innovative methods such as tracking applications or collaborative platforms (Kurok et al., 2023) would provide teachers with a better understanding of the variability of stages among students while using some of these aspects to generate observable criteria (Kaplinskyi et al., 2024).

Furthermore, the results show that collaborative activities are poorly integrated into the assessment practices of future teachers. This reflects a predominant focus on individual performance, to the detriment of collective creativity. Yet collaboration is a key dimension of creativity, particularly in an educational environment where social interaction plays a decisive role in the development of skills (Mokwunye & Anyanwu, 2023). It therefore seems important to make future teachers aware of this collective dimension and to provide them with practical examples to help them assess it (Craft & Jeffrey, 2008; Gaillot, 2021; Wafa et al., 2023). This approach could incorporate, during collaborative practical work, a specific evaluation or measurement grid demonstrating the potential developed by this approach. From a psychological point of view, the under-representation of dimensions such as originality and collaboration raises questions about how future teachers perceive creativity. Research could look at the social representations and cognitive biases that influence the valorisation of technical aspects to the detriment of process.

Another implication of these results is the need to promote a balanced approach between the assessment of products and that of creative processes. Disciplinary didactics trainers could draw more heavily on all the theoretical frameworks currently available, such as the 3P model developed by Mastracci (2011, 2020), the OECD creativity assessment grid and, why not, integrate aspects of the 7Cs of creativity (Lubart, 2017) or creative habits (Lucas et al., 2013). This approach is in line with results showing that early childhood trainers have a more complete definition of the concepts of creativity (Yeung & Bautista, 2024; Saroyan, 2022). A focus on this aspect could help future teachers in the development of early childhood assessment documents. This approach would contribute to a more general vision of assessment, combining the analysis of final productions with that of the creative dynamics at play in the proposed activities. In short, these recommendations call for a change in current teacher training, to better prepare future teachers to integrate creativity into their assessment practices.

4.2. Study limitations

The results of this study are limited by their specific context. The participants came from a single institution (HEP Vaud), which limits the generalisability of the results to other educational contexts. Moreover, although rigorous, the quantitative approach could be supplemented by mixed methods to deepen the analysis of evaluative practices. Future research could include classroom observations to explore how creative criteria, derived from assessment documents, are applied in practice. Finally, a comparison between educational cycles (early childhood vs. upper elementary) could enrich the understanding of pedagogical priorities.

5. Conclusion

The aim of this study was to report on the priorities and shortcomings of emerging assessment practices related to creativity among future early childhood teachers trained in this type of assessment. The main findings highlight that technical and methodological criteria are predominantly used, while more abstract criteria, focused on the process and collaborative dimensions, remain marginal. Thus, when designing their assessment documents, teachers focus their attention on criteria related to constraints and the results of the final product, to the detriment of elements related to the creative process and collaborative dynamics. This trend reflects persistent tensions in teacher training, particularly with regard to mastery of tools and methods capable of measuring the development of creative abilities beyond tangible results alone. Our results call for a strengthening of initial training through a revision of the guidelines. This revision aims to focus assessment more on the creative process and to promote collaborative approaches (both in the approach and in the criteria). It will better prepare teachers and develop their assessment skills in line with contemporary creativity requirements and objectives (identified as an essential skill to be cultivated in our young students so that they can flourish in a constantly changing world). Ultimately, training teachers to assess and promote creativity remains a complex objective, but it is a key step in fostering the deployment of creativity from the earliest age, in order to meet a dual imperative: preparing children to meet the challenges of tomorrow, while cultivating their potential today.

Ethical approval

This research did not involve human or animal experimentation requiring formal ethical approval. All data were collected in accordance with institutional guidelines and with informed voluntary participation.

Originality and prior publication

The authors confirm that the manuscript is original, has not been published previously, and is not currently under consideration for publication elsewhere, either in part or in whole.

Author agreement

All authors approve the content of the revised manuscript and consent to its submission to Thinking Skills and Creativity. The order of authorship has been agreed upon by all authors

CRediT authorship contribution statement

Guillaume Massy: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **John Didier:** Writing – review & editing, Methodology. **Maud Besançon:** Writing – review & editing, Supervision, Methodology, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Details of the training module on assessing creativity in early childhood (12 h in total over 12 weeks)

Training focus	Summary of content	Estimated duration
General framework for the assessment	Theoretical content: Developmental approach, distinguishing between measurement and assessment, Rogiers model, OECD creative task assessment grid (2018), Mastracci model (2011), DFJC grid (2022), etc.	Approx. 3 h (25 % of the total duration)
Assessment by training area	Practical work on evaluating the areas of the training framework: technical learning (movements and production); perceptual learning (description and vocabulary); creativity (processes, constraints, metacognition); cultural learning (specific features of artifacts and vocabulary)	Approx. 4 h (33 % of the total duration)
Creation of assessment documents	Analysis, creation, and iterative drafting of assessment documents specific to the level of education: communication sheet providing contextualized feedback on learning progress; criteria-based assessment grid.	Approx. 5 h (42 % of the total duration)

Note: Teaching methods used: theoretical lessons, practical workshops, and collaborative assessment tasks, among others.

Appendix B. Details of the creativity analysis grid (GAC)

Criteria for analyzing creativity in assessment documents			
7C - Assessing Creativity	Create - Creative process Process, purpose, and product.	Divergent thinking	Indicates that one or more trial(s) were carried out by the student. Indicates the total number of sketches or prototypes produced by the student. Indicates that different trials were carried out for the same idea proposed by the student. Indicates the number of sketches or prototypes created for the same idea.
		Evaluative thinking	Ensures the student presents a coherent explanation of the choices made. Involves the student's analysis of the strengths and weaknesses of their ideas.
		Convergent thinking	Analyses the link between the different trials (prototype, model, sketch, etc.) completed by the student and the final product.
		Intentionality	Takes into account the student's intention to create something original.
	Collaboration	Sources of knowledge	Take into account whether the student has sought external resources, such as the teacher, books, digital media, or discussions with family members.
		Interaction	Takes into account the student's interactions with classmates.
	Context	The material	Focuses on multiple tools (e.g. paintbrushes, stamps, etc.). Focuses on multiple materials (e.g. various paint colours, paper, etc.). Takes into account students' use of multiple tools. Take into account the students' use of multiple materials. Takes into account students' use of multiple techniques.

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Criteria for analyzing creativity in assessment documents			
		Working method	Indicates that students had the opportunity to explore different methods. Indicators showing that the teacher allows students to choose whether to work independently or with assistance.
	Creation - Creative product	Originality	Considers how frequently the idea/product appears within the class group. Considers the originality of the final product created by the student.
		Quality	Checks whether the student has achieved the set creative goal. Checks whether the final product meets the specified constraints.
	Consumption	Usefulness to the class, school, or learning	Check if the student's final project is part of a school project. Indicates whether the student's final output is part of a class project. Indicates whether the student's final output is part of the student's own (individual) project.
	Curricula -Study program	Type of pedagogy	Mentions the pedagogical approach used by the teacher to introduce techniques (e.g. experimentation by students, teacher demonstration). Certifies that students had the opportunity to explore different methods (e.g., brainstorming, perspective shifting, associative method).
	Creative designer	Validates the student's choices.	
Specific section on training in creativity assessment			
Creativity models/ tools used to assess	OECD	Uses a rating system (from 1 to 4) to assess the extent to which students achieve the targeted competencies. Applies the competency framework comprising the dimensions "Search," "Imagine," "Do," and "Reflect" when assessing students' abilities.	
	3P	Takes into account the three dimensions of the *3P* model (Creative Process, Product, Creative Personality) in assessment.	
	7C's	Integrates the dimensions of the *7C's* framework (e.g. Collaboration, Context, Curriculum) to measure student creativity.	

Data availability

The authors do not have permission to share data.

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