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Research Article

Dynamic assessment of creative skills: Transfer between graphic, verbal, and mathematical domains in primary school children

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In recent years, interest in the dynamic nature of creativity from a socio-cognitive perspective has increased. However, few studies have been conducted to assess creative potential dynamically. The present study attempted to investigate whether creative strategies mediated within a dynamic assessment of creativity in the graphic domain were transferred to and emerged in the verbal and mathematical domains. Seventy-one 11- and 12-years old children were divided into three sub-groups. The first received complete pre- and post-testing in graphic, verbal and mathematical domains and mediation of creative skills in graphic tasks; the second received the same as the first with the addition of transfer prompts, and the third did not receive any mediation on creative skills but only took the tests. The results demonstrated that internalized mediated skills were spontaneously transferred to and emerged in verbal creativity but not in mathematical. However, some transfer effect was found in mathematical creativity only in the group that was prompted to do so. The study's findings are considered of significant interest in assessing and in the instructional applications of creativity.

Keywords: Creative potential; Creativity transfer; Dynamic assessment; Primary education

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1. Introduction

Creativity refers to the ability to produce work that is both novel and appropriate to its context (Beghetto & Kaufman, 2014). Runco and Jaeger (2012) proposed that, according to a standard definition, "Creativity requires originality and effectiveness." In recent years, increased attention has been given to the dynamic nature of creativity. For example, creativity has been described as a "dynamic personal parsimonious process" (Runco, 2019). According to Corazza's (2016) dynamic definition, creativity emerges through the interaction of various factors, not just the person. These factors, including the environment, the process, the product itself, the way the product is represented (i.e., how it is perceived), and the estimator (the individual who evaluates the creativity), all influence the creative potential that is ultimately realized

"Potential" is defined as the probability of developing, achieving, or succeeding in reaching a desired future state (Lubart et al., 2019). Although developing students' creative potential has been

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the focus of many studies concerned with creativity in education, current methods have not fully captured its essence. This is because students' creative potential emerges from a dynamic interplay, rather than from a single static measurement. Standardized psychometric tests of creative thinking administered only once do not capture this dynamic process.

The present paper aims to contribute to the recent literature on the dynamic nature of creativity. It presents a study of Dynamic Assessment [DA] of creativity and focuses on the transfer of creative skills from graphic to verbal and mathematical domains. In particular, it investigates whether mediated creative thinking skills in graphic tasks facilitate the transfer of creative skills in primary school children during verbal and mathematical tasks within a DA situation. Furthermore, the present study examines whether dynamically assessing creativity in one domain may provide information about children's potential for the transfer of creative skills in other domains. The study explores the diagnostic value of DA for identifying how creativity can be fostered across domains, moving beyond the domain-generality/specificity debate in creativity research.

1.1. Dynamic Assessment for the Evaluation of Emerging Cognitive Skills

Dynamic Assessment stands as a tool for evaluating not only a learner's current abilities but, more importantly, their potential for acquiring new cognitive skills. It has its theoretical foundation in Lev Vygotsky's Sociocultural Theory (Vygotsky, 1978) and Reuven Feuerstein's theory of structural cognitive modifiability (Feuerstein et al., 1991; Feuerstein & Jensen, 1980). These theories posit that cognitive abilities are not simply fixed traits but instead they develop and emerge within a historical and sociocultural context.

Dynamic Assessment capitalizes on this understanding by going beyond static assessment methods. It aims to assess not only a learner's current level of ability but also their potential for acquiring new cognitive skills. DA is not merely a test but rather an assessment context that incorporates assistance such as instruction and feedback within the testing situation (Elliott, 2003). In commonly employed DA practices in educational settings, the assessor conducts an initial evaluation, followed by targeted support and guidance, and then a subsequent re-evaluation to measure the effect of the assistance (Haywood & Wingenfeld, 1992). In DA contexts, the assistance provided is often referred to as "mediation." (The terms "mediation," "intervention," and "training" are used interchangeably throughout this paper, as they refer to the same process). The term "mediation," rooted in the Vygotskian educational tradition, denotes a form of support that extends beyond simply helping students complete a specific assessment task or meet a particular educational objective (Haywood & Lidz, 2007; Haywood & Wingenfeld, 1992).

The main goal is not simply teaching students how to complete the task. Instead, it focuses on equipping them with mental tools that facilitate understanding and internalizing the cognitive processes underlying the task, ultimately leading to their emergence as higher-order skills and tools (Lidz & Gindis, 2003). In essence, it seeks to promote children's development by enabling them to generalize and transfer the mediation they have internalized in a given task and context, with the aim of supporting the emergence of these skills in new tasks and contexts (Popham, 2006). The fundamental difference between DA and static normative assessment lies in its emphasis on the learning outcomes that emerge through a mediated process, rather than on a score derived from a static measurement that may not reflect the learner's potential (Haywood & Lidz, 2007).

The various models of DA differ in the sequence of testing and mediation, as well as in the type of mediation employed. When used during instruction, assessment and mediation are embedded within teaching and learning interactions. This form of formative DA is commonly referred to as "the cake approach" (Grigorenko & Sternberg, 1998). However, for diagnostic or research purposes, the "sandwich with graduated prompting" approach is most frequently used (Grigorenko & Sternberg, 1998). According to the sandwich format, examinees are assessed through an initial test (pre-test), then receive individual mediation tailored to their personal needs, strengths, and weaknesses, and are subsequently reassessed through a second test (post-test)

(Grigorenko & Sternberg, 1998). The assessment result is evaluated either by considering both the pre- and post-tests (Haywood & Lidz, 2007) or the post-test alone (Grigorenko & Sternberg, 1998). The outcome is therefore not a static estimate of the child's cognitive abilities but rather a reflection of cognitive potential expressed through individually adapted mediation (Elliott, 2003).

Applying DA to evaluate children's creative potential has only relatively recently attracted some research interest. Some studies (Zbainos & Sagia, 2022; Zbainos & Tziona, 2019) investigated DA of creative potential within an educational context and demonstrated that it could be a more helpful tool for the diagnosis of students' full creative potential than static testing. Another study within the DA paradigm (Dumas et al., 2021) followed an experimental design to determine whether prompting for generating unusual ideas improved divergent thinking. The results demonstrated that 65.65% of undergraduate students who participated in the study improved their divergent production after prompting and were classified as "prompted shifters." In conclusion, DA offers a valuable alternative to static assessment methods. By focusing on cognitive abilities and the role of mediation, DA provides educators with a deeper understanding of a learner's potential for growth. However, the transfer of creative skills across domains—despite its importance for both diagnostic assessment and pedagogy—has only been investigated in a fragmented and occasional manner.

1.2. Transfer of Learning and Creative Skills

Cognitive transfer, the influence of past learning on current and future learning (Haskell, 2001), allows learners to leverage existing knowledge across domains, fostering new abilities (Detterman, 1993; Scherer et al., 2019). While the transfer of school knowledge to real-world situations was previously debated (Detterman, 1993), recent studies suggest its feasibility across subjects and domains, especially with appropriate pedagogy (Pai et al., 2015; Scherer et al., 2019). The diverse perspectives on transfer feasibility likely stem from its complex and multidimensional nature (Barnett & Ceci, 2002). Transfer can vary in several dimensions such as the context in which it occurs (near vs. far transfer), the content, the domain (e.g., knowledge, physical skills), and the modality (e.g., presentation format).

Transfer of learning relies on a deep understanding of the transferred skill and its contextual relevance (Brown, 1989). Research suggests several underlying cognitive processes for transfer, including analogy (Forbus et al., 1995; Gick & Holyoak, 1983; Kubricht et al., 2017) and the retrieval of production rules (Singley & Anderson, 1989). Recent work emphasizes the transfer of "primitive elements"—basic information-processing units that move and compare single pieces of information regardless of their specific content and facilitate transfer even between seemingly unrelated tasks (Taatgen, 2013). Proactive cognitive control strategies (Braver, 2012), closely related to primitive elements and triggered by anticipation rather than solely by task demands, may be crucial for such transfer (Arslan et al., 2017; Taatgen, 2016). Given the established role of cognitive control in creativity (Benedek & Fink, 2019; Chrysikou, 2019), one may hypothesize its role in the transfer of creative skills. However, the influence of cognitive control on the transfer of creative skills has not yet been investigated.

Transfer of learned skills across domains is central to DA It is regarded as a systematic formation of mediated mental actions and concepts retained over time and expressed in new tasks within an assessment (Haenen, 1996; Kozulin & Garb, 2002). As Poehner et al. (2017) argue, DA goes beyond assessing current ability; it evaluates how well learners generalize learned skills to new situations (transfer propensity). Tests designed for DA in areas such as deductive reasoning often include tasks specifically intended to assess this transfer (Campione et al., 1985; Resing et al., 2016; Vogelaar & Resing, 2018).

Despite its recognition as a transferable skill (Craft, 2005), assessing how creativity transfers across contexts remains largely underexplored (Sawyer, 2012). Early research suggests that transfer can be promoted through analytical teaching methods (Mayer, 1989). The question of transferring creative skills across different domains has been addressed indirectly in research on the domain

generality/specificity of creativity (Baer, 2012). Two earlier studies (Baer, 1994, 1996) investigated task-specific divergent-thinking training for seventh graders. They found that students in the divergent-thinking training groups performed significantly better than those in the control group on tasks such as storytelling, story-writing, and poetry-writing as judged by experts, indicating a positive transfer of divergent thinking training to creative performance. However, it was claimed that training alone did not fully account for the observed transfer (Baer, 1994). Studies by Sternberg and colleagues (Grigorenko et al., 2002; Sternberg, 2002; Sternberg et al., 1998) showed that teaching for successful intelligence (which includes creativity) improved students' standardized test scores. However, the broad scope of these programs makes it difficult to isolate the specific impact of creativity training. A more recent study (Cheng, 2016) examined how a thematic higher education course on toys influenced the transfer of creative learning to students' personal lives. Using primarily qualitative methods, the study found that transfer was reported in creative thinking strategies, conceptions, attitudes, and thinking styles or habits—but not in creative abilities.

Despite growing interest in transfer across domains, the mechanisms by which creative skills specifically transfer and emerge remain insufficiently examined.

This study aimed to investigate whether mediated creative strategies lead to the emergence of creative skills transferable to new contexts. It explored this in two ways: first, by examining if using these strategies fostered the development of creative skills, and second, by investigating how these acquired skills could be applied effectively in other contexts. The research questions are the following:

RQ 1) Does mediation of creative strategies in the graphic domain lead to greater development of creative skills in primary school children compared to those who receive no mediation?

RQ 2) Are the creative strategies mediated in the graphic domain spontaneously transferred to and expressed in the verbal domain?

RQ 3a) To what extent are mediated creative strategies from the graphic domain transferred to the mathematical domain?

RQ 3b) Does prompting for transfer enhance the emergence of creative strategies in the mathematical domain?

2. Method

2.1. Research Design

This study employed a quasi-experimental design with pre-test and post-test measures, incorporating both control and experimental groups. The objective was to examine the potential transfer of creative thinking strategies mediated through Dynamic Assessment in the graphic domain to other domains—specifically, verbal and mathematical creativity. The intervention followed the "sandwich" model of Dynamic Assessment (Grigorenko & Sternberg, 1998), which consists of a pre-test phase, an individualized mediation phase, and a post-test phase (see Table 1).

2.2. Participants

The sample consisted of 71 primary school students, aged 11 to 12 years, drawn from four classes in the 5th and 6th grades of a private primary school in Greece. A convenience sampling strategy was employed due to accessibility, as one of the researchers was a teacher at the school. The school primarily serves students from middle-class socioeconomic backgrounds, and the overall academic performance of the student body is generally considered above average in comparison to public schools.

Of the total participants, 35 students (49.3%) were enrolled in the 5th grade and 36 students (50.7%) in the 6th grade. Girls comprised 59.2% of the sample (n = 42). Participants were assigned to three subgroups (see table 1): (a) a control group that received no mediation; (b) an experimental group that received mediation in graphic tasks without explicit transfer prompts (non-transfer DA group); and (c) an experimental group that received mediation in the graphic domain with explicit

transfer prompts (transfer DA group). All participants completed equivalent pre- and post-tests in the graphic, verbal, and mathematical domains. This design enabled the examination of both the effects of mediation and the extent to which creative strategies were transferred either spontaneously or through prompting across domains.

Table 1
Phases and subgroups of the study

	Subgroups		
Phases	*Control*	*Non-transfer-DA*	*Transfer-DA*
Phase I			
Pre-testing EPoC Graphic, Verbal, and Mathematical	Yes	Yes	Yes
Phase II			
Mediation in EPoC Graphic	No (extra school exercises)	Yes (without transfer prompts)	Yes (with transfer prompts)
Phase III			
Post-test with EPoC Graphic, Verbal, and Mathematical	Yes	Yes	Yes

2.3. Data Collection

Data were collected between January 2019 and June 2020 using a three-phase procedure, structured in accordance with the "sandwich" model of Dynamic Assessment. All participants completed equivalent pre- and post-tests in graphic, verbal, and mathematical creativity using the Evaluation of Potential Creativity [EPoC] battery (Lubart et al., 2019).

The first phase involved pre-testing across all three domains. Graphic and verbal tasks were administered in person at the school, while the mathematical test was conducted online due to the COVID-19 lockdown. The online sessions were supervised via videoconferencing to ensure consistent administration procedures.

In the second phase, individual mediation sessions were conducted with students in the two experimental groups. These sessions were delivered remotely via video conferencing and lasted approximately 30 to 45 minutes per student. The mediation protocol was structured based on prior research (Zbainos & Sagia, 2022) and targeted metacognitive strategies, analogical thinking, and the internalization of creative processes. Tasks involved both abstract and concrete stimuli and were designed to promote both divergent and convergent creative thinking. Mediators adapted the content and pacing of the sessions to each student's responses. For participants in the transfer subgroup, additional prompts were provided to encourage the application of the learned strategies in other domains. An overview of the mediation structure and goals is presented in Table 2.

Table 2
Overview of the mediation protocol

Tasks and aims	*Prompts*
Divergent thinking / Concrete and abstract stimulus	
Understanding	Comprehension of instructions
Metacognition	Awareness of the process of divergent thinking -Metacognitive – executive strategies a. Multiple contextualization of the stimulus b. Creative analogies metaphors
Consolidation	
Convergent thinking / Concrete and abstract stimuli	
Understanding	Comprehension of instructions
Metacognition	- Awareness of the process of convergent thinking - Creative metarepresentations - Metacognitive strategies for combination
Consolidation	

The final phase consisted of post-testing in the same three domains, using parallel forms of the EPoC battery. Each test comprised two subscales: divergent-exploratory thinking and convergent-integrative thinking. The graphic version required students to produce multiple drawings based on abstract or concrete stimuli and to integrate given visual elements into a coherent design. The verbal tasks involved producing multiple story beginnings and endings or completing narrative prompts under specific constraints. The mathematical version, administered in a computerized format, included tasks involving arithmetic transformations and geometric combinations governed by explicit rules. Testing conditions and time limits were standardized across all participants. This structure allowed for the assessment of within-subject gains, group comparisons, and the examination of potential transfer effects across domains.

2.4. Data Analysis

Data analysis was conducted to evaluate both the direct effects of mediation on creative performance in the graphic domain and the transfer of mediated strategies to the verbal and mathematical domains. A combination of repeated-measures analyses of variance [ANOVAs], paired-samples *t*-tests, and univariate analyses of covariance [ANCOVAs] was performed using IBM SPSS Statistics.

To address the first research question concerning the effect of mediation, a two-way mixed-design repeated-measures ANOVA was conducted. Time (pre-test vs. post-test) served as the within-subjects factor, and group (experimental vs. control) as the between-subjects factor. When significant interaction effects were identified, paired-samples *t*-tests were used to examine within-group changes, and ANCOVAs were carried out to compare post-test scores while controlling for pre-test performance.

To explore the second and third research questions regarding transfer, similar analytical procedures were applied to verbal and mathematical creativity scores. Subgroup comparisons (non-transfer DA, transfer DA, and control) were conducted to determine whether explicit prompting influenced the emergence of creative strategies in other domains. Effect sizes (Cohen's d and partial eta squared) were calculated to estimate the magnitude of observed effects.

Separate analyses were also performed for the divergent and convergent sub-scores of each EPoC domain to determine whether mediation effects and transfer patterns differed across types of creative thinking.

2.5. Ethical Procedures

The study received ethical approval from the Curricula Department of the Directorate General of Studies of Primary and Secondary Education of the Hellenic Ministry of Education and Religions (registration number Φ.15/158487/ΕΑ/204426/Δ1), following a positive recommendation by the Institute of Educational Policy of the Hellenic Ministry of Education (registration number 50/05-12-2019). The research protocol was reviewed and approved as adhering to appropriate methodological and ethical standards for research involving minors.

Prior to participation, written informed consent was obtained from the parents or legal guardians of all students. All procedures complied with ethical guidelines for research with children, including the voluntary nature of participation, the right to withdraw at any time, and the confidentiality and secure handling of all collected data.

3. Results

3.1. Initial Statistics

The correlations among the pre- and post-test scores across the three creativity domains are presented in Table 3. Pre-test scores revealed a moderate correlation between verbal and graphic creativity, whereas correlations between mathematical creativity and the other two domains were small and not statistically significant. Correlations between pre- and post-test scores were moderate for both verbal and graphic creativity, while the correlation between mathematical pre-

and post-test scores was substantially higher. This pattern suggests that students who performed well in the mathematical creativity pre-test tended to maintain high performance in the post-test to a greater extent than in the other two domains.

Table 3
Pearson's bivariate correlations among variables

	1	*2*	*3*	*4*	*5*	*6*
1. Graphic Pre-	1					
2. Verbal Pre-	.45**	1				
3. Math Pre-	.12	.16	1			
4. Graphic Post-	.41**	.46**	.23	1		
5. Verbal Post-	.17	.39**	.05	.64**	1	
6. Math Post-	.21	.28*	.66**	.33**	.18*	1

Note. * $p < .05$, ** $p < .01$

Participants' mean scores demonstrate a general improvement between pre- and post-testing (see Table 4). As expected, they tended to perform better on the second, parallel form of the EPoC assessments in graphic, verbal, and mathematical domains.

Table 4
Descriptives of pre and post-test EPoC scores by groups.

			Groups / Subgroups			
Tests	*Time*	*Scores/ Sub-scores*	*Control (n=36)*	*DA -total (n=35)*	*DA non-transfer (n=17)*	*DA transfer (n=18)*
Graphic	Pre-test	Total	19.17 (3.08)	18.17 (3.23)	17.47 (3.87)	18.83 (2.41)
		Divergent	11.03 (2.10)	9.37 (2.00)	8.82 (1.94)	9.89 (1.97)
		Convergent	8.14 (1.78)	8.80 (1.94)	8.65 (2.32)	8.94 (1.55)
	Post Test	Total	19.08 (3.05)	21.28 (3.73)	21.47 (2.53)	21.11 (5.21)
		Divergent	11.06 (2.37)	11.60 (2.19)	11.65 (1.46	11.56 (2.75)
		Convergent	8.03 (1.52)	9.69 (2.35)	9.82 (1.91)	9.56 (2.78)
Verbal	Pre-test	Total	17.69 (3.53)	17.57 (3.73)	17.41 (4.00)	17.72 (3.57)
		Divergent	10.06 (2.16)	10.11 (2.40)	10.12 (2.69)	10.11 (2.17)
		Convergent	7.64 (2.36)	7.46 (2.47)	7.29 (2.66)	7.61 (2.38)
	Post Test	Total	18.97 (3.04)	20.91 (3.33)	21.17 (2.12)	20.67 (4.21)
		Divergent	11.11 (1.86)	12.46 (1.85)	12.82 (1.07)	12.11 (2.35)
		Convergent	7.86 (7.86)	8.46 (2.33)	8.35 (1.46)	8.56 (2.97)
Math	Pre-test	Total	15.47 (3.32)	16.11 (3.65)	15.41 (4.54)	16.78 (3.39)
		Divergent	7.75 (2.39)	8.54 (2.82)	7.94 (2.75)	9.11 (2.85)
		Convergent	7.72 (1.99)	7.57 (2.38)	7.47 (2.67)	7.67 (2.14)
	Post Test	Total	14.75 (3.51)	16.86 (3.16)	15.53 (2.85)	18.11 (2.99)
		Divergent	7.28 (2.54)	8.77 (2.43)	8.06 (1.89)	9.44 (2.77)
		Convergent	7.47 (1.66)	8.08 (1.67)	7.47 (1.55)	8.67 (1.61)

3.2. The Effect of Mediation in DA

To investigate the first research question regarding the effect of mediation during the administration of the EPoC graphic divergent-abstract task, a series of analyses of variance were conducted. First, the interaction effect of time × group was examined using a two-way mixed-design repeated-measures ANOVA, with time (pre- and post-test scores) as the within-subjects factor and group (DA total – with mediation – and control – with no mediation) as the between-subjects factor. The interaction effect was found to be statistically significant, $F(1, 69) = 15.49$, $p < .01$, $\eta^2 = .18$. This result indicates a significant interaction between time and group, showing that changes in total graphic creativity scores over time differed between the two groups.

Further analyses were conducted to examine the source of the interaction effect. Paired-samples *t*-tests were conducted separately for the DA and control groups, comparing participants' pre- and post-test scores on the graphic creativity task. The results showed a statistically significant increase in the DA group, $t(34) = -4.39$, $p < .001$, $d = .85$, indicating a large effect size. In contrast, the control group did not exhibit a statistically significant difference between pre- and post-test scores. These findings suggest that the observed interaction effect can be attributed to the improvement in the DA group following mediation.

Next, a one-way analysis of covariance was conducted to examine the effect of mediation on post-test performance. The post-test graphic creativity score was entered as the dependent variable, group (DA vs. control) as the independent variable, and pre-test score as a covariate to control for baseline differences. The results revealed a statistically significant difference in post-test performance between the groups, $F(1, 69) = 16.74$, $p < .01$, $\eta^2 = .20$. This finding indicates that mediation had a significant effect on the graphic creativity scores of students in the DA group, as reflected in their improvement from pre- to post-test.

Regarding the EPoC graphic sub-scores, the interaction effect of time × group was found to be statistically significant for the divergent subscale, $F(1, 69) = 18.19$, $p < .01$, $\eta^2 = .21$, but not for the convergent subscale, $F(1, 69) = 3.51$, $p > .05$. A paired-samples *t*-test conducted within the DA group showed that the improvement in convergent thinking was not statistically significant, $t(70) = -1.40$, $p > .05$. However, a one-way ANCOVA using the graphic convergent post-test sub-score as the dependent variable, group as the independent variable, and pre-test as a covariate, revealed a statistically significant group effect, $F(1, 68) = 9.97$, $p < .01$, $\eta^2 = .12$, although the effect size was small. These findings suggest that the mediation had a measurable effect on graphic convergent sub-scores, though its impact was limited. Moreover, the analysis of sub-scores indicates that the increase in the total graphic post-test score was primarily driven by gains in divergent thinking. It may therefore be concluded that the mediation was more effective for supporting divergent than convergent creative performance.

3.3. Transfer of Creative Skills from Graphic to Verbal Tasks

Subsequent analyses addressed the second research question, examining whether the effects of mediation on graphic creativity would transfer and emerge in the domains of verbal and mathematical creativity. The statistical procedures employed mirrored those described above: a repeated-measures ANOVA was conducted to assess the effect of mediation on verbal creativity, with time (total verbal pre-test and post-test scores) as the within-subjects factor and group (DA – with mediation – and control – without mediation) as the between-subjects factor. The analysis revealed a statistically significant interaction, $F(1, 69) = 5.85$, $p < .05$, $\eta^2 = .07$. This result suggests that mediation in the graphic domain had a significant effect on students' total verbal creativity scores.

As in the previous analyses, to further examine the interaction effect, paired-samples *t*-tests were conducted separately for the two groups, comparing within-subject differences between pre-test scores in graphic creativity and post-test scores in verbal creativity. The results demonstrated that the DA group improved significantly, $t(34) = -4.99$, $p < .001$, $d = .94$, as did the control group, $t(34) = -2.22$, $p < .05$, $d = .39$, though with a smaller effect size. A one-way ANCOVA was then performed using post-test verbal creativity scores as the dependent variable, group as the independent variable, and verbal pre-test scores as the covariate. This analysis revealed statistically significant differences between the two groups in post-test performance, $F(1, 69) = 8.20$, $p < .01$, $\eta^2 = .11$. These findings suggest that mediation in the graphic domain had a significant transfer effect on verbal creativity performance. When the two DA subgroups (with and without transfer prompts) were compared, no statistically significant difference was observed between them, indicating that the transfer was spontaneous and that prompting did not meaningfully enhance the transfer of strategies from graphic to verbal creativity.

The analysis of the effect of mediation on the sub-scores for divergent and convergent thinking yielded results similar to those found for the graphic creativity sub-scores. The interaction effect of time × group was statistically significant for the divergent EPoC verbal sub-scores, $F(1, 69) = 4.66$, $p < .05$, $\eta^2 = .06$, but not for the convergent sub-scores, $F(1, 69) = 1.31$, $p > .05$. A paired-samples *t*-test comparing the DA group's mean pre- and post-test scores in convergent thinking did not reveal a statistically significant improvement. In addition, a one-way ANCOVA using the verbal convergent post-test sub-score as the dependent variable, group as the independent variable, and pre-test verbal convergent score as a covariate, showed a non-significant effect, $F(1, 68) = 1.78$, $p > .05$. Thus, consistent with the findings in the graphic domain, a transfer effect in the verbal domain was observed only for divergent thinking, not for convergent thinking. These results suggest that the DA post-test scores in graphic creativity reflect students' divergent thinking ability, but only partially capture their convergent thinking skills.

3.4. Transfer of Creative Skills from Graphic to Mathematical Tasks

To investigate the third research question concerning the transfer of creative abilities to the mathematical domain, similar analyses were conducted. The interaction effect of time × group (DA total vs. control) was not statistically significant, nor was the interaction of time × subgroup (DA non-transfer, DA transfer, and control). However, a one-way between-subjects ANCOVA was conducted to examine the effect of mediation by comparing the three subgroups' post-test scores while controlling for pre-test performance. This analysis revealed a statistically significant group effect, $F(2, 67) = 1.33$, $p < .01$, partial $\eta^2 = .17$. A Bonferroni post hoc comparison showed that the DA-transfer subgroup performed significantly better on the mathematical creativity post-test than the other two subgroups.

Furthermore, three paired-samples *t*-tests were conducted separately for each subgroup to compare pre- and post-test scores. The results demonstrated that the DA-transfer group showed a statistically significant improvement, $t(17) = -2.11$, $p < .05$, $d = 0.41$, while no significant differences were observed in the DA non-transfer and control groups. These findings suggest that mediation in the graphic domain had a small but statistically significant effect on the development of mathematical creativity among students who were explicitly prompted to apply the strategies they had learned. In conclusion, Dynamic Assessment results in graphic creativity appear to reflect a limited but observable degree of mathematical creative potential.

4. Discussion

This section interprets the study's main findings in light of prior theory and research, with a focus on how mediated creative strategies may transfer across domains. Emphasis is placed on understanding the practical and pedagogical value of DA, examining its role in fostering creativity, diagnosing learning potential, and supporting inclusive education. The discussion is organized around three key themes: cross-domain transfer and educational relevance, limitations of the study, and directions for future research.

4.1. Cross-Domain Transfer and Pedagogical Significance

This section explores the diagnostic and pedagogical implications of DA of creativity. Rather than revisiting the well-documented domain generality versus specificity debate (Plucker & Beghetto, 2004), the focus is on how the current findings inform our understanding of how mediated strategies may transfer across creative domains and how such processes can guide assessment and instructional practices. The correlations among pre- and post-test scores suggested a closer relationship between graphic and verbal creativity than between either of these and mathematical creativity. This aligns with existing research highlighting representational overlap between verbal and graphic domains (Barbot et al., 2016; Palmiero et al., 2010; Storme et al., 2017) Such overlap may stem from similar semiotic or imagistic processes that underlie both verbal and visual creative thinking. On the other hand, mathematical creativity may rely more on formalized symbolic structures and domain-specific knowledge (Dumas et al., 2024; Schoevers et al., 2020) which may

explain the weaker correlations observed. These findings support Barnett and Ceci's (2002) taxonomy of transfer, which suggests that the likelihood of transfer is influenced by contextual and content similarity.

The results addressing the first research question demonstrated that students who received mediation in the graphic domain exhibited significantly greater gains in creative performance, especially in divergent thinking, compared to those in the control group. These gains suggest that students were able to internalize the strategies modeled during mediation and apply them in novel graphic tasks. This outcome is consistent with previous studies on DA of creativity (Zbainos & Tziona, 2019) as well as findings in other domains such as problem solving and second language acquisition (Poehner & Lantolf, 2005; Vogelaar & Resing, 2018). The effectiveness of mediation in revealing latent potential reinforces the theoretical claim that DA taps into the zone of proximal development (Vygotsky, 1978), identifying capacities that might remain hidden in static assessments. Notably, the mediation did not significantly enhance convergent thinking, which may be attributed either to the greater cognitive demands of integrative tasks or to contextual factors such as screen fatigue during online mediation sessions. This outcome supports the view that creativity is not a fixed trait but a teachable skill, particularly when instruction targets metacognitive processes such as abstraction, planning, and reflection.

The second research question explored whether the strategies mediated in graphic tasks would transfer spontaneously to verbal creativity. Indeed, students in both experimental subgroups showed significant improvement in verbal creative performance, regardless of whether they received explicit transfer prompts. This spontaneous transfer suggests that the strategies taught in the graphic domain—such as recontextualization, analogy-making, and abstraction—were sufficiently generalizable to be applied in verbal tasks. Theoretical models of analogical reasoning (Gentner, 2010, 2017; Forbus et al., 1995) support this finding by emphasizing the structural alignment between source and target domains as a precondition for transfer. This result also resonates with recent work in creativity research arguing for the role of transferable metacognitive and representational strategies in early-stage creative development. Such strategies are thought to enable learners to abstract and adapt problem-solving procedures across tasks, even when surface-level features differ. These metacognitive strategies may serve as foundational tools for creative thinking that can bridge domain boundaries. This highlights a pedagogical opportunity: in domains that are cognitively or representationally close, metacognitive strategies like analogical mapping and recontextualization can be taught and activated through task design, promoting spontaneous transfer without explicit prompting.

In contrast, the third research question revealed that transfer to the mathematical domain was limited and depended on explicit prompting. This suggests that mathematical creativity may require more specialized representational formats and abstract conceptual structures than those used in graphic tasks (Arslan et al., 2017; Taatgen, 2013). In domains that are more distantly related, students are less likely to transfer creative strategies on their own. In such cases, explicit instructional support becomes necessary to help them make meaningful connections between different types of tasks. This interpretation is supported by computational and developmental models (Arslan et al., 2017; Dumas et al., 2024; Taatgen, 2013), which propose that transfer in conceptually distant tasks depends on high-level cognitive control and deeper knowledge structures. Thus, in the present study, only students who were prompted appeared able to apply general creative thinking strategies to mathematical tasks, highlighting the importance of tailored support when facilitating far transfer. For educators, this underscores the need to design explicit bridging activities when moving from open-ended creative tasks to more structured domains like mathematics, helping students recognize when and how to apply creative strategies in unfamiliar formats.

These findings carry several important educational implications. First, they validate DA as a diagnostic tool capable of revealing both students' current functioning and their capacity for learning with assistance. By differentiating gainers, non-gainers, and negative gainers, DA allows

for the development of individualized learning profiles that are better suited for personalized and differentiated instruction (Carruthers & MacLean, 2019; Tomlinson, 2014). This approach moves beyond binary distinctions such as 'gifted' versus 'average' and acknowledges the dynamic and contextual nature of creative potential. Second, the observed transfer across domains—especially when prompted—suggests that DA outcomes in one domain may serve as indicators of latent potential in others, particularly when the domains are cognitively proximal.

Third, these findings have implications for inclusive and equitable education, especially in settings aiming to support diverse learners through adaptive instructional methods. The study contributes to ongoing discussions about how educational systems can identify and nurture creative potential beyond static measures. Dynamic assessment aligns with pedagogical models that emphasize relational, situated, and strengths-based approaches to learning (Glăveanu & Beghetto, 2021). As Haywood and Lidz (2007) argue, DA can be a powerful tool for ensuring that students from diverse backgrounds and learning profiles are given equitable opportunities to demonstrate and develop creative abilities. Its adaptive format and focus on potential rather than performance make it well-suited for use in differentiated instruction models. Future research should explore how DA can be systematically integrated into inclusive educational practices across a range of socio-cultural contexts. Studies could examine how different teacher beliefs, training backgrounds, or institutional cultures influence the uptake and fidelity of DA in diverse classrooms, as well as its long-term effects on equity in creative development outcomes.

4.2 Limitations

Several limitations of this study should be noted. The hybrid data collection format—necessitated by the COVID-19 pandemic—may have affected student engagement and consistency, particularly during extended online sessions, Variations in attention, fatigue, and access to a quiet learning environment could have introduced variability in the mediation process and performance outcomes. In addition, the relatively small and demographically homogeneous sample limits the generalizability of the findings. Experimental studies with larger and more diverse populations are needed to better understand how developmental factors, socio-cultural background, and educational settings interact with the mechanisms of DA and cross-domain transfer.

4.3. Future Directions for Research

Future studies could explore how different modes of mediation delivery—such as in-person versus digital formats—impact the effectiveness of creative strategy acquisition and transfer. Additionally, longitudinal research could assess whether the benefits of mediation persist over time and translate into broader academic and creative performance. Researchers should also explore how DA can be implemented at scale in classroom settings, particularly in under-resourced schools, and how teacher professional development might support its effective use. Finally, cross-cultural studies could illuminate how socio-cultural values and curricular expectations shape both the perception and practice of creativity assessment and instruction.

In conclusion, this study reinforces the view that DA is a valuable approach to uncovering and fostering creative potential in education. It demonstrates that mediated strategies can transfer across domains, particularly between those that are cognitively aligned. Where domain distance is greater, structured prompting plays a key role. These insights contribute to a more nuanced and dynamic understanding of how creativity develops and how it may be supported in classroom settings.

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Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author upon reasonable request.

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