

## The Study of Light as an Experimental Factor in Observing the Development of Children's Artistic Abilities in Kindergarten

URIANNI MERLIN\*<sup>1</sup> AND MATJAZH DUH<sup>2</sup>

Playing with light and shadow is an inexhaustible stimulus for preschool children to develop divergent thinking and artistic expression. Creativity develops through artistic expression, and the experience enriches and matures thematically through the more conscious use of artistic language. The aim of the experimental study was to measure the level of artistic development in children aged five and six years. The level of creative, optical-thematic and artistic development was observed. In the study, two different programmes with implemented activities (experimental factors) were planned and compared with a control group. The first programme (experimental factor EP1) was described as modern and adapted to the children's interests and incentives, while the second programme (experimental factor EP2) was prepared in advance and called traditional. A total of 161 children aged five and six years took part in the study. In order to measure the level of general artistic development, test drawings were made at the beginning and end of the experiment. These were analysed by a team of experts according to the aforementioned developmental aspects. The results of the experimental group with the traditional approach showed a statistically significantly higher performance in monitoring creative development than the control group. Within the two experimental programmes, the children in the EP1 programme achieved statistically better results in the aspect of creative development than the children in the EP2 programme. The results show that a well-designed programme for playing with light and shadow can have a positive effect on children's artistic development.

**Keywords:** art, artistic exploration of light, approach to planning, artistic development

1 \*Corresponding Author. Faculty of Education, Juraj Dobrila University of Pula, Croatia; umerlin@unipu.hr.

2 Faculty of Education, University of Maribor, Slovenia.

## Študija svetlobe kot eksperimentalni dejavnik pri opazovanju razvoja otrokovih umetniških zmožnosti v vrtcu

URIANNI MERLIN IN MATJAŽ DUH

~ Igra s svetlobo in senco je za predšolske otroke neizčrpna spodbuda za razvoj divergentnega mišljenja in umetniškega izražanja. Z umetniškim izražanjem se razvija ustvarjalnost, z zavestnejšo uporabo umetniškega jezika pa se izkušnja bogati in tematsko dozoreva. Namen eksperimentalne študije je bil izmeriti stopnjo umetniškega razvoja pri otrocih, starih pet in šest let. Opazovali smo raven ustvarjalnega, optično-tematskega in umetniškega razvoja. V študiji sta bila načrtovana dva različna programa z izvedenimi dejavnostmi (eksperimentalni dejavniki) ter primerjana s kontrolno skupino. Prvi program (eksperimentalni dejavnik EP 1) je bil opisan kot sodoben ter prilagojen interesom in spodbudam otrok, drugi program (eksperimentalni dejavnik EP 2) pa je bil vnaprej pripravljen in poimenovan kot tradicionalni. V študiji je sodelovalo 161 otrok, starih pet in šest let. Za merjenje stopnje splošnega umetniškega razvoja so bile na začetku in koncu eksperimenta izdelane testne risbe. Te je skupina strokovnjakov analizirala glede na zgoraj omenjene razvojne vidike. Rezultati eksperimentalne skupine s tradicionalnim pristopom so pokazali statistično znatno boljšo uspešnost pri spremljanju ustvarjalnega razvoja kot pri kontrolni skupini. Znotraj obeh eksperimentalnih programov so otroci v programu EP 1 dosegli statistično boljše rezultate z vidika ustvarjalnega razvoja kot otroci v programu EP 2. Rezultati kažejo, da ima lahko dobro zasnovan program za igro s svetlobo in senco pozitiven učinek na otrokov umetniški razvoj.

**Ključne besede:** umetnost, umetniško raziskovanje svetlobe, pristop k načrtovanju, umetniški razvoj

## Introduction

Creativity is a multifaceted and complex aspect of human expression, encompassing a variety of forms, including fine arts, performing arts, music, literature, dance, etc. During the preschool years, it is extremely important for children's overall development to provide them with experiences in different areas. By listening to music, for example, the children develop their hearing and repeat the words they hear, while some also dance to music, thus developing many diverse abilities. By listening to fairy tales and looking at illustrations, "children develop their vocabulary, they develop imagination and the capacity of longer concentration" (Duh, 2016, p. 73). Artistic creativity involves creating original ideas, exploring new concepts and techniques, and conveying emotions, experiences and perspectives through artistic media.

According to numerous authors, artistic expression – and creativity in general – originates from individual diversity, the key being a supportive environment as well as the process and product of creativity. The image of a creative person can also be extended to the idea of creativity as the essence of human existence and its manifestation in all areas of human activity (Herzog, 2009). Some authors associate the source of the majority of the research in this area with Anglo-American countries and explain the possible aspects from which creativity can be seen as: scientific, social, practical, pedagogical, etc. Paraphrasing the 5-factor Kaufman model (2012, in Županić Benić, 2021), the areas in which creativity is expressed are: personal/everyday, studio, performance, technical/scientific and artistic. Rogers (1970) noted some time ago that creativity is not limited to one area, and that there are no basic differences in the creative process, regardless of whether it concerns painting a picture, composing a symphony, inventing a new device, developing a scientific theory, etc. Considering the wide application of creative abilities, Karlavaris and Kraguljac (1981) see great importance in the development of art pedagogy and the artistic expression of the child. Guilford empirically confirmed the factors of creativity that, according to the author, arise from divergent thinking: "The creative processes of contemporary art are based on new solutions for societal problems, the production of ideas and the creation of new relations, while the focus is transferred from the artifact to the process, as there can be creative thinking even when there is no tangible product" (Guilford, 1968, p. 121 in Vuk et.al., 2015, p. 55).

## Artistic Expression

Artistic creativity is not limited to a specific skill or talent, but encompasses a wide range of abilities and approaches. Creativity is one of the aspects that develop through artistic expression. In their work, Herzog, Lopert and Duh (2017) present different understandings of creativity that have the same meaning in the sense of something new and innovative (Huzjak & Županić Benić, 2017), but with certain nuances. Duh and Büdefeld (2018) claim that creativity is the ability to connect previously unrelated ideas and products. The authors emphasise the aspect of thinking and view creativity as the possibility of developing new ideas and using existing knowledge to find new solutions, whereby the new solution must have value. Sternberg and Lubart (1999) define creativity as the ability to create new, original work, such as products and solutions that are useful and adaptable within a given framework. Zupančič (2017) cites Addison's thought from 2010, according to which creativity is not understood as a quality that one possesses, but as a potential that demonstrates the dynamic interrelationship between people and their environment, which has been developed in most people under suitable social and pedagogical conditions.

Today, we know that we can measure creativity by analysing its factors. To measure creativity, Lemons (2011) suggests four factors that can be measured by drawings: fluency, flexibility, redefinition and originality. Kim (2006), on the other hand, suggests that fluency, originality and elaboration can be observed in activities in which participants complete a drawing. Fluency, originality, flexibility and elaboration are evaluated in tasks that test divergent thinking (Pelowski et al. 2017).

Six categories are used to measure creativity today: sensitivity to problems (perception of artistic values), elaboration (organisation and use of artistic elements), flexibility (adaptation by means of artistic expression), fluency (a wealth of artistic ideas), originality (unusual and individual realisation) and redefinition (which also connects the redefinition of previous art experiences into new art structures) (Tomljenović, 2015). Several authors (Duh, 2004, 2018; Duh & Büdefeld, 2018; Herzog, 2008, 2009) categorise the factors of artistic creativity into two groups. The first factors promote quantity and enable artistic creativity (redefinition, fluency and elaboration), while the other factors activate quality and promote artistic creativity (originality, flexibility and sensitivity to artistic language). According to Herzog (2009), redefinition is seen as the conscious redefinition of an idea, material or a visual impression into something new. This can be encouraged by consciously set activities, such as the redefinition of a work of art (Petrač, 2015).

Fluency is also related to creativity and refers to the tendency to generate multiple or unusual responses to artistic problems (Sawyers & Canestaro, 1989). The fluency of ideas is expressed by motor dexterity as a factor of creativity, which enables various fine operations and richer artistic procedures for the realisation of these ideas (Herzog, 2009).

Elaboration is also a quantitative component and indicates the ability to develop new ideas and plan future procedures. Elaboration can be recognised as an individual's ability to provide details to produced ideas, which can also be linked to creative interpretation (Botella et.al., 2018). Besemer (1998) calls elaboration the synthesis of something that is well thought out and attractive.

According to Duh et al. (2016), originality is expressed in unexpected artistic solutions, in connecting unusual and imaginative ideas.

Flexibility, in the form of the child's dexterity and adaptation to expressive means, is seen in the relationship between the child and the technical material, ranging from clumsy and rough use to successful mastery of techniques and exceptional motor skills in the adequate use of technical materials and means. Such openness to adaptation enables the ability to engage flexibly with new things (DeYoung, 2006). Sensitivity to artistic language is a factor where one immediately notices what is important in the artistic interpretation of motifs (Duh, 2004). Karlavaris (1974) states that sensitivity towards artistic language is the ability of the individual to recognise and experience an artistic motif and to choose the appropriate material for the interpretation and creation of a new artistic whole.

Creativity factors in drawing refer to the experience of the observed environment or inner feeling, transposition and search for artistic solutions through the composition of artistic elements – point, line, shape, colour, texture and volume – with regard to compositional elements, motor and technical possibilities, and adaptation to materials.

In addition to the creative aspect, artistic expression also develops the optical-thematic aspect of artistic development in such a way that the representation of the artistic motif will be thematically enriched and of higher quality depending on the child's experiences: "Optical-thematic development, or artistic-intellectual development, coincides with the stage of intellectual development and is a measure for determining the phases of a child's artistic expression" (Herzog, 2018, p. 977). Given the elemental nature of the representation of 'self', optically thematic vision analyses the representation of the human figure at the very beginning, and then everything else that is shown in the drawing. According to the criterion of scale (Karlavariis, 1974), the artwork can be analysed by observing which elements of the human figure are depicted and how

they are depicted. The head, the torso, the arms, the legs, the clothing and other details can be indicated in such a way that they can not only be guessed, but can be clearly identified, and can also have the aesthetic value of original and individual expression.

Artistic expression thus develops an optical-thematic aspect that is creative and formative, demonstrating a richer and more conscious use of artistic language. The visual aspect analyses the work from the perspective of artistic language, i.e., the analysis of artistic form, which provides information on how particular thematic content is artistically understood and processed, within which lies the essence of art (Petrač, 2015). This artistic language analysis, which we call the formative aspect of the artwork in the present paper, implies knowledge and recognition of artistic language and compositional elements. The elements of visual language are line, shape, colour, texture, volume and space (Jakubin, 1989; Kandinsky, 2001; Petrač, 2015; Tanay, 1989), as well as compositional elements such as contrast, harmony, rhythm, balance, proportion, dominance and unity (Jakubin, 1989). Individuality is highly recognisable in handwriting, and the formative aspect therefore follows the art of mastering art techniques and the compatibility of this aspect with artistic language; in short, the formative aspect follows the harmony of the artistic structure, technique, idea, message and suggestiveness of individual artistic expression.

### Research Problem

The aim of the present experimental research of children's artistic expression was to measure the extent to which children's artistic expression develops through creative, optical-thematic and formative development. A seven-month study was conducted with children aged 5–6 years on the subject of light and shadow. The prevalence of a holistic approach to the study of light and shadow is an indicator that there are different developments even among educators when it comes to this topic. In the urban preschool institutions of Reggio Emilia, visual aids are used for creative purposes. Experience has shown that children who use different light sources in their environment, e.g., projectors, overhead projectors, mirrors, illuminated zones in shadow areas, are significantly more satisfied (Ceppi & Zini, 2001).

According to the experience of pedagogue Malaguzzi (2010), the study of light and shadow as physical phenomena leads to major changes in children's approach to the problem at the age of 4–5 years. Children begin to observe reality with greater attention, their views of reality become more numerous and their ability to mentally organise actions (the actions of objects and associates)

grows to the extent that it begins to give exceptional meanings and develops greater flexibility in reasoning (Malaguzzi, 2010).

Considering that the basis for designing and enabling free activities is listening to the child and observing his/her cognitive processes, rather than clumsily proposing activities regardless of the child's interests, the idea arose to introduce two experimental programmes into the research. The first experimental programme (EP1) was based on children's interests and was called modern, while the second was a predetermined experimental approach (EP2), which was called traditional. The latter was developed on the basis of a great deal of pedagogical experience and research, as well as on pilot projects carried out over the past year. The experimental programme, according to which the children explored light and shadow, is described in more detail by Merlin (2023). The preschool teachers in the experimental groups received the same basic incentives and visual aids, i.e., common instructions during approximately 50 sessions, which included basic visual aids and materials, as well as artistic expression through drawing, painting, sculpture and graphic techniques. While encouraging artistic expression, the preschool teachers monitor and accompany the process of artistic creation with analytical observation. The development of art culture in children aged 5–6 years is often characterised by playful exploration. Children can participate in open art activities that encourage them to experiment, take risks and enjoy the creative process, without the pressure of achieving a specific result. Playful exploration of art and design nurtures their creativity, curiosity and confidence.

The aim of the present research is to analyse the effect of the experimental approaches EP1 and EP2 in comparison to a control group of children KP (using an approach based on the usual implementation of the content of the valid curriculum) in order to shed light on the development of artistic expression of children aged 5–6 years in the County of Istria. The effect of studying light on the children's artistic expression was measured according to the developmental aspects of artistic expression: optical, thematic, creative and formative.

### *Research Hypotheses*

The following hypotheses were formulated in the study:

- H1: At the end of the research, the children of the EP1 group will show better results in artistic expression than the children of the KP group.
- H1.1: At the end of the research, the children of the EP1 group will show better results in terms of optical-thematic development than the children of the KP group.
- H1.2: At the end of the research, the children of the EP1 group will show

better results in terms of creative development than the children of the KP group.

- H1.3: At the end of the research, the children of the EP1 group will show better results in terms of formal development than the children of the KP group.
- H2: At the end of the research, the children of the EP2 group will show better results in artistic expression than the children of the KP group.
- H2.1: At the end of the research, the children of the EP2 group will show better results in terms of optical-thematic development than the children of the KP group.
- H2.2: At the end of the research, the children of the EP2 group will show better results in terms of creative development than the children of the KP group.
- H2.3: At the end of the research, the children of the EP1 group will show better results in terms of formal development than the children of the KP group.
- H3: At the end of the research, the children of the EP1 group will show better results in artistic expression than the children of the EP2 group.
- H3.1: At the end of the research, the children of the EP1 group will show better results in terms of optical-thematic development than the children of the EP2 group.
- H3.2: At the end of the research, the children of the EP1 group will show better results in terms of creative development than the children of the EP2 group.
- H3.3: At the end of the research, the children of the EP1 group will show better results in terms of formal development than the children of the EP2 group.

## **Method**

### *Participants*

The experiment measured the impact of the light research programme on the artistic development of children aged five and six years. It was conducted using two variants of the pedagogical approach, applied to children from eight educational groups (four EP1 and four EP2). Four control educational groups also participated in the study.

**Table 1**

*Number (f) and percentage (f%) of participating children regarding gender and group*

Groups \ Gender	Female		Male		Total	
	<i>f</i>	<i>f%</i>	<i>f</i>	<i>f%</i>	<i>f</i>	<i>f%</i>
EP1	23	44.2	29	55.8	52	100
EP2	28	44.8	32	55.2	58	100
KP	24	47.1	27	52.9	51	100
Total	73	45.3	88	54.7	161	100

The distribution of the sample regarding gender is even. To ensure the required number of participants, the experiment was conducted with 220 children aged 3–7 years, of which 161 aged 5–6 were included in the analysis. Out of a total of 161 children, 73 were female and 88 were male, as shown in Table 1.

**Table 2**

*Number (f) and percentage (f%) of participating children regarding the kindergarten location*

Groups \ Location	Urban		Rural		Total	
	<i>f</i>	<i>f%</i>	<i>f</i>	<i>f%</i>	<i>f</i>	<i>f%</i>
EP1	30	57.7	22	42.3	52	100
EP2	31	53.4	27	46.6	58	100
KP	25	49.0	26	51.0	51	100
Total	86	53.4	75	46.6	161	100

The control groups (KP) included 51 children: 25 from urban kindergartens and 26 from rural kindergartens. These children were taught according to the regular programme from two urban and two rural educational groups. As shown in Table 2, there was an even distribution of participants regarding the kindergarten location. A total of 12 educational groups were selected by deliberate sampling so as to achieve a balance between kindergartens from urban and rural environments as well as regarding the location of the kindergarten within the region, i.e., the central and coastal regions of Istria. The final sample comprised six urban groups (86 children) and six rural groups (75 children). Furthermore, in cooperation with the professional pedagogical service and the director, and in agreement with the teachers, it was decided whether the group would work according to the programme or freely, considering the previous tendencies of their work.

### *Instruments*

In order to test creativity and artistic ability in this experiment, a test was used that had previously proved to be reliable, valid and sensitive for measuring the artistic abilities of children aged 3–18 years. The test features of the instrument were not measured. These findings were obtained by studying the literature from earlier research (Karlavaris, 1974; Duh, 1996, 1997; Duh et al., 2016; Herzog, 2018). The criteria measured by this test are the optical-thematic (intellectual), creative and formative aspects. With the help of a specific evaluation scale taken from previously conducted research by art methodologists Karlavaris (1974) and Duh (1996), the level of creativity and the artistic abilities of the participating children were determined according to a test drawing produced by each child.

Tests using imagination drawing have been widely used due to their ability to elicit original, free expression (Chan & Zhao, 2010). The test was conducted among the children of the control and experimental groups before the start of the experimental programme (initial test) and after the experiment (final test), in order to gain insight into the initial and final state of their artistic expression and to measure the impact of the experimental approaches. All of the children had the same time, technical means and instructions for the realisation of drawings. The final test drawing for measuring artistic abilities is a variation of the initial test drawing. They are distinguished by a variant of the motif (monster/alien), which serves to give the children the feeling that they are drawing something new, thus enabling them to retain the innovative enthusiasm of a new motif, as in the case of the initial test drawing.

In the optical-thematic aspect, we followed the representation of a human figure: how it is represented, what is shown and in what way. The depiction of the head, the body, the arms, the legs and the clothing, as well as other details, were allocated a specific number of points, with between 1 and 3 points being given for each element. The convincingness of the whole movement was also allocated a specific number of points. Since the children depicted many other objects and animals in the test drawings besides the figures, the criteria scale was adapted to the motif of the test drawing. In the creative aspect, stimulating and enabling aspects of the creativity factor were evaluated: sensitivity to problems, elaboration, flexibility, fluency of artistic ideas with motor dexterity as an enabling factor, originality and artistic redefinition. Formative development refers to the level of mastery of artistic means of expression (artistic language), in order to achieve a suggestive artistic expression, which for this age group means a process from spontaneous mastery of artistic language to conscious use in the form of a multiplication of lines, shapes, textures (colour and valence are not

analysed) and the primary relations between artistic elements, repetition and rhythm for the display of volume, and the relations of size, direction, balance, dominance and unity for the display of space.

In the description of the criterion scale for the assessment of art works, Karlavaris (1974) lists the criteria for variants of deviations, such as deviations of the children's artistic types (described in more detail in the author's book from 1991), methodological-form deviations and the influence of school and preschool teachers, and deviations under the influence of the environment (rural-urban). The latter was, for instance, manifested in the more frequent display of balloons during birthdays among children from urban areas, but this did not affect the scoring. The test drawing assessment team did not observe socio-cultural deviations and deviations under the influence of national tradition and contemporary fine art, although there was an evident influence of mass virtual culture. Deviations due to mental disability and giftedness were not recorded from the beginning.

#### *Data Processing Procedure*

The test drawings were analysed by a team of experts who assessed each drawing on the basis of 33 different criteria. The drawings of the initial and final test were first evaluated in terms of optical-thematic development, then in terms of design and creative development.

Data processing was done with the help of the statistical software SPSS. Mean values and standard deviations were measured, and statistical differences in the levels of artistic expression were determined by covariance analysis between the groups (EP1, EP2 and KP). Analysis of covariance was used without numerical assumptions, due to the statistically significant difference of the initial state between the experimental groups prior to the start of the research.

## **Results**

### *Results of the Test Drawings of the Children of the EP1 Group Compared to the Children of the KP Group*

Given the statistically significant differences in the initial state between the groups, the difference between the results of children's artistic expression in the test drawings of the EP1 group compared to the KP group was measured by the ANCOVA test without using numerical assumptions. The results show that there is no significant statistical difference between these two groups for optical-thematic development ( $F = 1.288$ ,  $P = 0.259$ ), creative development ( $F = 0.381$ ,  $P = 0.538$ ) or formative development ( $F = 0.086$ ,  $P = 0.769$ ).

Arithmetic means show uniform values, i.e., a higher value of the KP group in the optical-thematic view ( $M = 52.50$ ) and a higher value of the EP1 group in the creative view ( $M = 41.13$ ), while the arithmetic means of the EP1 and KP groups are equal in the formative view (EP1,  $M = 18.44$ , KP,  $M = 18.74$ ). The results are shown in Table 3.

**Table 3**

*ANCOVA of the results of artistic expression of the children of the EP1 group compared to the children of the KP group*

Artistic expression	Groups	N	M	SD	Leven's test				ANCOVA	
					F	g1	g2	P	F	P
Optical and thematic development	EP1	52	50.44	14.39	0.314	1	100	0.576	1.288	0.259
	KP	50	52.50	15.20						
Creative development	EP1	52	41.13	12.26	2.896	1	100	0.092	0.381	0.538
	KP	50	37.70	10.44						
Formative development	EP1	52	18.44	4.15	3.175	1	100	0.078	0.086	0.769
	KP	50	18.74	4.82						
Artistic development	EP1	52	110.02	24.39	0.343	1	100	0.559	0.334	0.564
	KP	50	108.94	27.84						

Based on these results, hypothesis H1, which assumed that the children of the EP1 group would show better results in artistic expression than those of the KP group at the end of the study, cannot be confirmed, nor can hypothesis H1.1, according to which the children of the EP1 group would show better results than those of the KP group with regard to optical-thematic development. Furthermore, hypothesis H1.2, which suggested that the children of group EP1 would show better results than those of the KP group with regard to creative development (fluency, flexibility, originality, sensitivity to problems, elaborations, redefinitions), and hypothesis H1.3, according to which the children of the EP1 group would show statistically significantly better results than those of the KP group with regard to formative development, are not confirmed either. This is confirmed by the ANCOVA results of the differences between the EP1 and KP groups in artistic development in general, which show no statistically significant differences ( $F = 0.334$ ,  $P = 0.564$ ), with a somewhat higher arithmetic mean for the EP1 group ( $M = 110.02$ ) than the KP group ( $M = 108.94$ ).

What connects groups EP1 and KP is that the children attend a kindergarten without any strict and specific programme. Such uniform results could

be the result of the children and preschool teachers not being burdened, or being less burdened, by a plan and programme that must be satisfied. Their intrinsic motivation for research and attendance resulted in uniform, even higher values (visible in the Table 3), which were due to a calm and familiar atmosphere of cooperation between children and educators.

### *Results of the Test Drawings of the Children of the EP2 Group Compared to the Children of the KP Group*

When comparing the results of the artistic expression of the children of the EP2 group and those of the KP group, measured by ANCOVA (presented in Table 4), statistically significant differences in the creative form of artistic expression are evident ( $F = 12.970$ ,  $P = 0.000$ ), with a higher arithmetic mean of the experimental group EP2 ( $M = 41.06$ ). The results for optical-thematic development ( $F = 0.310$ ,  $P = 0.579$ ) and formative development ( $F = 0.270$ ,  $P = 0.605$ ) show a higher arithmetic mean of the KP group, although statistically insignificant. Overall, with a large but statistically insignificant difference ( $F = 2.774$ ,  $P = 0.099$ ), the EP2 group ( $M = 110.31$ ) has a higher arithmetic mean than the KP group ( $M = 108.94$ ).

**Table 4**

*ANCOVA of the results of artistic expression of the children of the EP2 group compared to the children of the KP group*

Artistic expression	Groups	N	M	SD	Leven's test				ANCOVA	
					F	g1	g2	P	F	P
Optical and thematic development	EP2	58	52.48	14.87	0.086	1	106	0.770	0.310	0.579
	KP	50	52.50	15.20						
Creative development	EP2	58	41.06	11.28	0.322	1	106	0.572	12.970	0.000
	KP	50	37.70	10.44						
Formative development	EP2	58	16.75	6.21	4.746	1	106	0.031	0.270	0.605
	KP	50	18.74	4.82						
Artistic development	EP2	58	110.31	26.54	0.774	1	106	0.381	2.774	0.099
	KP	50	108.94	27.84						

It follows from the above that hypothesis H2, which assumed that the children of the EP2 group would show better results in artistic development than those of the KP group, can be partially confirmed. The assumption of hypothesis H2.1, according to which the children of the EP2 group would show

better results regarding optical-thematic (intellectual) development than those of the KP group, cannot be confirmed. Hypothesis H2.2, which assumed that the children of the EP2 group would show better results regarding creative development than those of the KP group, can be confirmed. Hypothesis H2.3, according to which the children of the EP2 group would show better results in formal development than those of the KP group, cannot be confirmed. The large difference in artistic expression is generally an indicator that hypothesis H2 can be partially confirmed, while the statistically significant difference in creative vision showed that the experimental programme carried out with the EP2 group made a contribution to the significant development of creative artistic expression in children aged five and six. From these results, shown in Table 4, it can be concluded that hypothesis H3, which asserted that the children of the EP1 group would show better results in artistic expression than those of the EP2 group, can be partially confirmed.

#### *Results of the Test Drawings of the Children of the EP1 Group Compared to the Children of the EP2 Group*

Comparisons of the results of the children of the EP1 group and those of the EP2 group developed from the need to assess whether children develop more artistic expression in a free environment, in which preschool teachers follow their interests and set further stimuli and activities accordingly, or by working according to a predetermined programme.

The results of the ANCOVA test show no statistically significant differences regarding optical-thematic development ( $F = 1.992$ ,  $P = 0.161$ ) and formative development ( $F = 0.072$ ,  $P = 0.789$ ).

The arithmetic mean for optical-thematic vision is higher in the EP2 group ( $M = 52.48$ ), while for the formative aspect it is higher in the EP1 group ( $M = 18.44$ ). A statistically significant difference is evident in creative vision ( $F = 7.215$ ,  $P = 0.008$ ), with a higher arithmetic mean of the experimental group EP1, which indicates that, although the experimental programme contributes to the development of creative vision, as shown in Table 5, artistic expression during the free exploration of light contributes more significantly to the development of creativity.

Overall, the differences in the results between groups EP1 and EP2 are also interesting, as they show an almost statistically significant difference in artistic expression in general ( $F = 3.809$ ,  $P = 0.054$ ), with higher arithmetic means of experimental group EP2 ( $M = 110.31$ ), which worked according to the programme. It can therefore be concluded that the proposed light research programme has a positive effect on the development of artistic expression. These

groups are both concerned with the research of light, but they differ in their approach to activity planning.

**Table 5**

*ANCOVA results of artistic expression of the children of group EP1 compared to the children of group EP2*

Artistic expression	Groups	N	M	SD	Leven's test				ANCOVA	
					F	g1	g2	P	F	P
Optical and thematic development	EP1	52	50.44	14.39	0.011	1	108	0.917	1.992	0.161
	EP2	58	52.48	14.87						
Creative development	EP1	52	41.13	12.26	0.875	1	108	0.352	7.215	0.008
	EP2	58	41.06	11.28						
Formative development	EP1	52	18.44	4.15	13.148	1	108	0.000	0.072	0.789
	EP2	58	16.75	6.21						
Artistic development	EP1	52	110.01	24.39	1.905	1	108	0.170	3.809	0.054
	EP2	58	110.31	26.54						

From these results, shown in Table 5, it can be concluded that hypothesis H<sub>3</sub>, which suggested that the children of the EP<sub>1</sub> group would show better results in artistic expression than those of the EP<sub>2</sub> group, can be partially confirmed. The assumption of hypothesis H<sub>3.1</sub>, according to which the children of the EP<sub>1</sub> group would show better results related to optical-thematic (intellectual) development than those of the EP<sub>2</sub> group, cannot be confirmed. The results showed a statistically significant difference between the groups with regard to the measure of creative development ( $F = 7.215$ ,  $P = 0.008$ ), with the children who took part in the experimental programme (EP<sub>1</sub>) achieving a better result. This confirms hypothesis H<sub>3.2</sub>. Hypothesis H<sub>3.3</sub>, according to which the children of the EP<sub>1</sub> group would show better results with regard to formal development than those of the EP<sub>2</sub> group, cannot be confirmed.

## Discussion

The results provide a picture of the quality of the experimental programme and its statistically significant impact on the development of creativity in children aged five and six years. In addition to indicating the value of a well-designed creative development programme for preschool teachers who are less inclined to change activities regarding children's interests, the results also

confirm that the topic of light research is an excellent stimulus for creativity. However, the programme still needs to be refined with regard to its initial idea of developing optical-thematic and shape vision through the method of observation and transposing the 'seen' into a richer artistic language when developing shape vision.

The results can be confirmed and enriched by the experience of preschool teacher Uljanić (1999), which we find in the text entitled *Project Light*. The author describes how it was not easy to lead a project without predetermined topics, activities and goals, where it was necessary to simply leave it to the children to lead and to learn with them. Uljanić describes how the more 'advanced' children attract other children with their results and get them interested in the work, even if only in the form of imitating the 'bigger children'. In the present research, despite the flexibility of the topic itself and the designed programme, it was shown that the children of the EP1 group, whose 'programme' is derived from the children themselves, display more creativity than those of the EP2 group.

Divergent thinking, from which creativity arises, is characterised by research and unpredictability (Kadum, 2019), which is in line with the statistically significantly better results of creative development in the groups that researched 'freely' and unpredictably. In order to achieve this, preschool teachers simply need to be prepared to monitor, coordinate and legitimately respond to children's unpredictability. Preschool teachers who need more specific planning of work with children, and thus greater reliability of high-quality execution of artistic-creative work, can use the light research programme proposed by Merlin (2023). The results of the research show that this programme (EP1) contributes significantly to the development of creativity compared to the control group.

In the research, we were interested in the role of the experimental programmes (EP1 and EP2) in relation to the development of artistic expression. We find that the experimental programmes had a positive effect on the integrity of the children's artistic expression. For those preschool teachers who are closer to the topic and are more inclined to work with children without a predetermined programme, light research can contribute to significant enrichment and release of potential for creative development.

## Conclusion

After many years of working with children, light research is a topic that still retains a certain freshness and is an inexhaustible source of research. A great deal of the literature on Reggio pedagogy emphasises the encouragement of divergent thinking that is reflected in the present study. This is confirmed by the statistically significantly better results regarding creative development in all of the experimental groups in the present research, regardless of the approach to planning. Herein lies the significant scientific contribution of this work. The limitations of the study are that the results refer to the narrow region of the Istria County and cannot be extended to a larger area and sample. Moreover, the results refer only to children aged five and six. It would be interesting to see the results of other age groups of children following this experiment.

Since this is a representative sample, it can be assumed that the children's artistic expression, especially creativity, develops significantly through their intrinsic motivation without the burden of 'doing' a programme that is given in advance to the preschool teachers and that the preschool teachers merely assign to the children. It is important that all participants, both children and preschool teachers, approach the research creatively, while developing sensitivity to artistic language, fluency and originality in searching for solutions, redefinition and elaboration in their transposition, and flexibility through mutual listening, adaptation and joint creation.

In the future, the research could be supplemented to include teachers in the measurement, in order to evaluate the types of artistic expression they employ, especially the development of creativity, and to connect these results to those of the children in their group. This connection can only be guessed at by the present research, although it certainly exists. The research could also be extended to measure other developmental skills, as the theme – the motif of light – fits very well with other areas of the preschool curriculum.

In this way, with the already tested programme and research methodology, it is possible to obtain more comprehensive results following the complete development of the child and their active relationship with the environment (Licul, 2020), which is the fundamental goal of raising and educating children today.

## Disclosure Statement

The authors have no conflict of interest to declare.

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## Biographical note

**URIANNI MERLIN**, PhD, is a lecturer of art didactic at the University of Pula. She lectures at the Faculty of Education in department for elementary education and the graduate program. For the last few years, she has been actively studying and researching the alternative art educational programs: Reggio, Steiner, and homeschooling as well as the use of visual arts and nature in preschool and school children.

**MATJAŽ DUH**, PhD, is a full professor of art pedagogy and art didactic at the University of Maribor. He lectures at the Faculty of Education in department for elementary education and the graduate program for masters and doctoral studies. He is an active researcher. For the last few years, he has been actively researching the use of contemporary media in art education, the development of art creativity and art appreciation, problems of the ongoing paradigm inside art education, the development of artistic expression and other similar work.