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Kresli, na co myslíš: Komparativní analýza kreseb předškolních dětí a prvňáků

Draw what's on your mind: Comparative analysis of preschool and primary school children's drawings

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Abstract

Children's drawings provide valuable insights into their mind, their development. The study aimed to compare children's drawings revealing age and sex differences. A total of 204 children aged 5-8 years participated, drawing pictures based on a content-neutral instruction (Draw what's in your mind.). Theme and frequency analysis were conducted. Results showed that preschoolers drew significantly fewer objects (modus = 1) compared to first graders (modus = 11). Preschoolers most often drew vehicles, persons, and symbols, while first graders' drawings vary much within themes and objects. Girls in both age groups depicted more nature-related objects, while boys focused on human-made products. These findings suggest a developmental shift, with preschoolers often drawing what they see or can draw and first graders expressing complex inner contents and experiences. Comparing drawings of preschool children and first graders can enhance our understanding of developmental processes during this period.

Keywords: Drawings. Preschoolers. Firstgraders. Content analysis. Grade differences. Sex differences.

Introduction

Drawing is one of the most natural activities for preschoolers and younger school age kids. Children love drawings (Hsu, 2015) and begin their drawing process as early as they can physically hold a drawing utensil (Farokhi & Hashemi, 2011). Many child development experts have studied the importance of drawing for young kids. Drawing is a game or game-like activity for children (Kouvou, 2016). It has the character of a non-verbal holistic statement, that allows the projection of the child's experience.

The process of this activity promotes many psychological benefits for children, including visual thinking, observation and the analysis of the theme, problem solving, imagination, expression, creativity, as well as more general habits of

thinking such as perseverance, experimentation and reflection (Jolley, Barlow, Rotenberg, & Cox, 2016). Children enjoy drawing because it stimulates the universal desire to express oneself (Farokhi & Hashemi, 2011).

Drawing is a complex process. It involves many interacting components, including the perceptual system, fine and gross motor skills, perceptual feedback, interaction with the drawings of a culture, social interaction and motivation, emotional impact (Cohn, 2012). Both observed groups fall into the developmental period when they are psychophysically able to draw a picture. Both of them fall into the developmental period of preschematic age with illustrative thinking (Piaget & Inhelder, 2019), so the contents of the drawing correspond to the current contents of the child's mind (a child up to about 9 years of age typically draw immediately the first thing that comes to mind). They are in the period of descriptive symbolism, when they draw objects based on past experience: the main features of what they have seen, what they have experienced, what they have already drawn, not on the basis of what they see at the moment - for example, objects located in the room (Anning & Ring, 2004). Both age groups have already developed a mechanism of conceptualization, and executive functions with visual perception or memory recognition planning so they are able to plan comprehensively what they want to draw and draw from memory (Cohn, 2012). In this study is used the technique of free-memory picture (Strauss, 2007), spontaneous drawing (Kolouchová, 2016), that is not defined thematically so that children are not limited by fixed instructions (Kucharská, 2002, p. 58). The characteristics of developmental period imply the choice as an optimal way for research.

In this study, we explore the drawings of preschool children and first-graders. Despite just one school year separating these two groups, we anticipate variations in the number and themes in their drawings, and this expectation is based on several significant factors. Firstly, a pronounced developmental shift occurs during this period, as highlighted in studies by Brod, Bunge, and Shing (2017). This shift is accompanied by substantial changes in neuromotor development (Largo et al., 2001), motor skills (Eriksen, Olsen, & Sigmundsson, 2023), working memory (Hu, Liang, Zhou, Feng, & Zhang, 2023), particularly in visuospatial working memory (Eriksen et al., 2023), visual-motor integration (Pfeiffer et al., 2015), cognitive tempo (Dvorsky, Becker, Tamm, & Willoughby, 2021), and event-related potentials, which serve as neurophysiological markers of perceptual and cognitive processes (Jetha, Segalowitz, & Gatzke-Kopp, 2021). These developmental transformations during these years are also reflected in corresponding brain regions (Jetha et al., 2021; Karipidis, Pleisch, Pietro, Fraga-González, & Brem, 2021). The resulting level of neuropsychomotor skills may find a particular expression in the ability to draw, affecting aspects such as spatial grasp, line quality, the number of objects, and level of detail, among others.

Moreover, various variables like feeding habits, nutritional status, methods of psychosocial stimulation, quality of education (Sharma, Budhathoki, Maharjan,

& Singh, 2023), and the presence of older siblings (Wu et al., 2022) have the potential to influence the developmental process.

Differences are influenced by psychological and social circumstances. Preschoolers are in a phase of discovery and exploration, processing their surroundings in the form of simple objects or symbolic concepts (Baxter, 2005; Gardner, 2011). In contrast, first-graders are already engaged in acquiring more structured knowledge and complex skills within the school environment (Eriksen et al., 2023). These different contexts can not only influence the subjects or themes of their drawings but also the complexity of their artwork, including the number of elements and details.

In the observed age range, children like to draw what they already know and can do, enrich and expand what they have learned into an original drawing or drawing with innovative elements for the child (for example, he can draw a dog, but he draws an elephant, that looks like a four-legged dog with that has an extra trunk). The first theme of the drawings in this age is usually 'a man', spreads out with 'a tree' and 'a house' (Strauss, 2007, p. 37). Natural topics appear to be the most common (Hass-Cohen, Chandler-Ziegler, Veeman, & Funk, 2016). Klobuchar (2016) identified 5 thematic categories in the drawings of preschoolers: figural, natural, technical, construction and fantasy objects. Frost (1958) identified 14 of meaningful objects in drawings at observed age: scenes, houses, boats, plant life, land vehicles, air vehicles, human figures, animal figures, still life, designs, the sun, moon and stars, weapons, letters. Will the same categories appear in the children's drawings in our research, or will we detect new categories? Will be differences between preschoolers and first-graders?

The number of objects drawn differ with age. In preschool age there are typical single-object drawings (Frost, 1958). The number of drawn objects increases with age, culminating around the age of ten (Oguz, 2010). We assume that this will also be reflected in our study and that older children will have more complex drawings with more objects.

Gender differences were observed in previous studies. Girls start drawing earlier. According to Henderson and Pehoski (2005) girls have about a half-year to a year "head start" in drawing. Better drawing performances are given until about twelve years of age (Picard, 2015). They differ in thematic preference. Robert (2012) found that girls rather draw human topics (person), while boys non-human objects (house, tree, car). Alter-Muri and Vazzano (2014) confirmed that boys incorporate into a picture vehicle (most of all vehicle of transportation), weapons, and sports more than girls. Wolpert (2014) states that girls prefer flowers, butterflies and woman persons, boys more mechanical subjects (cars, trains) or soldiers and fighting. Intersex differences were observed in status line drawing or sizes of objects drawn (Barendse et al., 2018), or in using colours (Deaver, 2009). We ask the question, what will be the difference between boys and girls in free drawing in our research?

Study aim

Study aims to describe and analyse the contents of free drawings of children in preschool and first grade; to compare the findings with respect to class and gender; and to compare our results with the current state of knowledge.

Methods

Participants: Data collection took place in the end of the school year (kindergarten June to August, elementary school June). Data were collected by student administrators that were trained on how exactly to proceed. The parents' consents to the involvement of their children in the research were obtained. The administrators implemented data collection as a natural part of teaching in the classroom, the children were used to them and willingly followed their instructions. A total of N=204 children were included in the research, the age range of 5.9-8.1 year, boys slightly predominate among preschoolers, the first-grade group is balanced (see Table 1).

Table 1 : Research sample: descriptives (N=204)

Sex	Preschool	First grade	Total
Boys	34 (55.7 %)	72 (50.4 %)	106
Girls	27 (44.3 %)	71 (49.6 %)	98
Total	61 (100%)	143 (100%)	204

Data acquisition method

After a short activity of calming and emptying the mind (micro-meditation with visualization on the theme of "erasing our inner board") lying on the game carpet, the children were seated to their desks, where blank white A4 papers and crayons were prepared. The children were given content-neutral (so-called invisible) instructions: "Draw whatever comes to mind," and they started drawing. Administrators walked among the children and provided conditions for calm concentrated work. They also made sure that the children did not copy from each other. Whoever felt that the picture was ready, brought their drawing to the administrator, who asked them "What is the name of the picture?" and recorded the answer on the back of the drawing. The sex and age of the child was written on the back side. When the last child in the group finished their drawing, a debriefing followed, the children talked to the administrator about whether and what they like to draw. This was followed by other activities planned in the class' educational plan.

Data processing

Data processing procedure — each image was scanned, the child's ID, age, gender and image name encoded. The obtained data were subjected to thematic analysis of visual data. They were processed through content theme analysis (Glaw, Inder, Kable, & Hazelton, 2017) and frequency analysis procedures.

Intersex and grade differences were tested by non-parametric tests for two independent samples comparing: Mann-Whitney U test (for ordinal variables), Cochran and Mantel-Haenszel test of conditional independence, which is suitable for 2x2 analyses of dichotomous variables.

Results

The actual thematic analysis was carried out in two steps. First, the images were scanned and in Atlas: TI version 8.0, each object in the image was encoded "in vivo" (a specific name of the element in the image was assigned). Secondly, they were grouped into 17 thematic categories (Havigerová et al., 2021), they were grouped into 5 higher order categories (Table 2).

Table 2: Categories of assessment

Animals	a category grouping topics from the animal kingdom (i.e. including homo sapiens)	<ul style="list-style-type: none"> a) Mammal — includes all terrestrial four-legged animals, such as dog, horse, rabbit, b) Bird — winged creature, e.g. bird, peacock, owl, c) Insect — e.g. butterfly, ladybug, bee, wasp, d) Aquatic animal — animals in the water, e.g. fish, aquatic mammals, turtles and other aquatic animals (seahorse, starfish, crab, etc.).
Person	the human figure of a child or adult	
Plants	a category covering topics from the plant kingdom	<ul style="list-style-type: none"> a) Tree — e.g. generally deciduous tree, apple tree, conifer, b) Flower and grass — common meadow flower with petals, roses, sunflowers, water lilies, tufts of grass.
Inorganic	category associating topics from inanimate nature and space	<ul style="list-style-type: none"> a) Ground-line — horizon representing the boundary of the land, often green (as a meadow, natural basis) or blue (sea level, water base, sky), b) Sun c) Cloud d) Rainbow e) Natural object — other natural objects not elsewhere classified, e.g. stone, hill, lake, volcano.
Products	(house, vehicle, tool,	<ul style="list-style-type: none"> a) House — any building or dwelling, e.g. a house with a roof, a cottage, a

	symbol) – a category containing themes that represent the products of human activity, the human spirit:	<p>block of flats, a castle, a square dwelling for Minecraft characters, a kennel for a dog,</p> <p>b) Vehicle — any vehicle independent of propulsion, e.g. car, limousine, caravan, bus, tractor, tank, scooter, airplane,</p> <p>c) Tool or product — products of human activity commonly known by people, e.g. sword, axe, balloon on a string, key, antenna, cake.</p>
Symbol	includes shapes, signs and inscriptions, e.g. heart, victory cup, signature,	
Other	categories containing uncategorized topics	<p>a) Imaginary character — fairy-tale, game (especially from Minecraft and movie characters,</p> <p>b) Other — everything else, not elsewhere classified.</p>

The assumptions for calculations of parametric tests were verified: Kolmogorov-Smirnov normality test for sum-of-objects and sum-of-categories showed that they do not have a normal distribution ($\text{sig} < 0.001$), which is why it is advisable to work with non-parametric methods. Frequency analysis of the number of objects in the picture was performed. A total of 2304 objects were detected in the 204 analysed images. Table 2 shows the results separately for groups of boys and girls in each grade.

Table 3: Themes of objects in the picture: frequency analysis (N=204)

Grade	Sex	N	Sum	Median	Mean	SD	Min	Max
Preschoolers	Boys	34	66	1	1,94	1,79	1	8
	Girls	27	93	1	3,44	4,85	1	23
First graders	Boys	72	1040	9	14,44	13,22	1	49
	Girls	71	1105	13	15,56	10,90	1	49

The results: preschoolers draw significantly less objects (on average 2-4 objects), first-grade children draw more (on average 15-16 objects). Moses extreme reactions test to compare ranges across groups shows that extreme values are more likely to occur in the population of preschool girls

(preschoolers: $\chi^2=0.029$, $p<0.001$, 1 outlier; firstgraders: $\chi^2=1.181$, $p=0.982$, 3 outliers). In both groups girls draw on average 1 to 2 objects more than boys. Mann-Whitney U test shows the average difference of 1 to 2 images is not statistically significant (preschoolers: $U=511$, $p=0.385$; firstgraders: $U=2940$, $p=0.120$).

The number of themes used is shown in Table 3. Preschoolers draw fewer objects, most often a single one, while firstgraders draw ten times more objects, so a match within each group is more likely. Preschoolers most often draw vehicles (almost a third of children), people (a quarter of children) and symbols like heart (a fifth of children), while in firstgraders drawings ground (almost two-thirds of children), sun (half of children) and tool (half of children) are most often found. In both groups, rainbow, imaginary character and aquatic animals' theme are the least represented (preschoolers did not have aquatic animals at all).

Table 4: The number of objects in the picture: sex differences (N=204)

Preschoolers (N=61)			First graders (N=143)		
Rank	Theme	%	Rank	Theme	%
1.	Vehicle	29	1.	Ground-line	65
2.	Person	24	2.	Sun	50
3.	Symbol or text	21	3.	Tool or product	49
4.	House	19	4.	Natural object	45
5.	Sun	16	5.	Person	43
6.	Natural object	9	6.	Symbol or text	37
7.	Ground-line	8	7.	Tree	33
8.	Tool or product	8	8.	Cloud	31
9.	Cloud	8	9.	Flowers	29
10.	Flowers	8	10.	House	27
11.	Mammal	8	11.	Bird	23
12.	Tree	6	12.	Vehicle	20
13.	Bird	4	13.	Mammal	19
14.	Insect	1	14.	Insect	18
15.	Rainbow	1	15.	Rainbow	14
16.	Im. character	1	16.	Im. character	8
17.	Aquatic animals	0	17.	Aquatic animals	7
18.	Other...	0	18.	Other...	4

The values in percentages for each gender are shown in Table 3 for preschoolers and Table 4 for first graders. The statistical significance for the sex difference was assessed by calculating the χ^2 and Eta tests. The Eta is interpreted after multiplying by 100 as a percentage of the explained variance.

Table 5: Themes on the pictures of Preschoolers: chi square and ETA

Theme	% b	% g	χ^2	p	Eta (sex dep.)
Vehicle	52,94	0,00	20,27	<,001	0,577
Sun	2,94	33,33	10,14	0,001	0,408
Flowers	0,00	18,52	6,86	0,009	0,335
Cloud	0,00	18,52	6,85	0,009	0,335
Natural	2,94	18,52	4,11	0,042	0,260
Bird	0,00	11,11	3,97	0,046	0,255
Mammal	2,94	14,81	2,82	0,093	0,215
Tree	2,94	11,11	1,64	0,200	0,164
Rainbow	0,00	3,70	1,28	0,258	0,145
Insect	0,00	3,70	1,28	0,258	0,145
Person	29,41	18,52	0,96	0,326	0,126
Imaginaries	2,94	0,00	0,81	0,369	0,115
Symbol	17,65	25,93	0,62	0,433	0,100
Ground-line	8,82	7,41	0,04	0,841	0,026
Tool	8,82	7,41	0,04	0,841	0,026
House	20,59	18,52	0,04	0,840	0,026

There is a statistically significant difference: boys draw objects from the category Vehicles more often, girls in the categories Sun, Clouds, Flowers, Natural objects, and Birds. Furthermore, we can conclude that preschool girls are more varied from the thematic point of view (they used 14 out of 17 thematic categories overall), while preschool boys are rather monotonous (they used "only" 11 out of 17 categories).

The results for first graders show that the frequency distribution of drawn objects is different for boys and girls in nine topics: Vehicle, Insect, Clouds, Rainbow, Natural objects, Houses, Flowers, Birds and Sun. Compared to preschoolers, there are differences in the topics of Insect, Rainbow (drawn more often by first-grade girls) and Houses (drawn more often by first-grade boys). Both sexes used all categories.

Finally, we will compare sex differences for higher categories. Table 5 shows that, with the exception of animals in preschoolers, girls draw more animals, plants and inorganic themes, boys draw more products of human activities.

Table 6: Themes sex differences: Mann-Whitney test (N=204)

up-theme	preschoolers				firstgraders			
	U	p	m rank boys	m rank girls	U	p	m rank boys	m rank girls
animals	480	0,711	30,3	31,7	3086	0,024	64,6	79,4
plants	581	0,004	27,4	35,5	3172	0,006	63,4	80,6
inorganic	608	0,006	26,62	36,52	3228	0,006	62,66	81,47
products	277	0,003	36,3	24,2	1850	0,003	81,8	62,0

Intersex differences are reflected in the number of objects: girls draw on average 1 - 2 objects more than boys. The result is very variable (the standard deviation is high) and is not statistically significant, yet it can represent generally known intersex developmental differences: girls mature in terms of graphomotorics earlier than boys (Benenson, Gauthier, & Markovits, 2021), according to H Henderson and Pehoski (2005) girls have about a half-year to a year "head start" in drawing. Better drawing performances are given until about twelve years of age (Picard, 2015). Girls seemed to gain a greater sense of achievement and self-esteem through their drawing work (Cooke, Cox, Cox, & Griffin, 2004). They are more willing to draw longer and more intensively, perhaps because the detail of drawing in girls increases with age, while in boys it is more of a permanent feature (Lange-Küttner, 2011). Graphomotor maturity and satisfaction of drawing may explain differences in the number of objects, but note that in our study the difference was not significant.

The thematic focus of the drawings was investigated using frequency analysis. The seventeen themes were used, grouped into 5 higher themes. Age was reflected only in the number of categories used (the older, the more categories are represented in one drawing), not in the preference. Overall, the most frequent objects are from categories: ground-line, person, sun, symbol or text, tool, nature object (lake, mountain, etc.) and vehicle. On the contrary, insects, rainbow, imaginary character and aquatic animal were least represented.

In various research studies, it has been observed that natural subjects tend to be the most prevalent (Hass-Cohen et al., 2016). Within the realm of natural themes, the sun tends to be one of the most commonly depicted elements (Labitsi, 2007). The rationale behind the prominence of the sun in drawings has been explained in a prior study by Havigerová et al. (2021): anthropological reason (a well-known everyday object, a life-giving object, mediates a sense of security), an observational reason (the sun occurs in many stimulus materials, adults like to draw it), and practical reason (simplicity of own drawing – just know the circle and radial lines). The occurrence of clouds, flowers, mammals, and birds can be explained by the same story line (Anderson, Ellis, & Jones, 2017).

The preference for themes differs based on gender. Boys tend to favour themes associated with human products, with preschool boys showing a preference for vehicles and houses. Additionally, boys in the first grade demonstrate a high inclination towards tools and symbols, often accompanied by written inscriptions. Conversely, boys in both age groups display a limited interest in birds, insects, rainbows, and aquatic animals.

In contrast, girls prefer a diverse range of natural themes. During the preschool age, there is a prevalence of themes related to nature and inorganic matter, such as plants, sun, flowers, clouds, and other elements of nature. As girls progress to the first grade, there is an increasing occurrence of themes involving trees, birds, insects, rainbows, and mammals — and draw them with greater details. They also depict tools, persons, and symbols in their drawings. Interestingly,

the least popular topics among girls are houses, vehicles, and imaginary persons. Overall, girls tend to draw more animals, plants, and inorganic themes, while boys depict more products resulting from human activities.

These findings align with previous research studies. Benenson et al. (2021); Robert (2012) found that girls exhibit a preference for and derive greater satisfaction from drawing human subjects (individuals), while boys benefit from drawing non-human objects (houses, trees, cars). Alter-Muri and Vazzano Alter-Muri and Vazzano (2014) verified that boys incorporate vehicles (particularly modes of transportation), weapons, and sports more than girls. Wolpert (2014) asserts that girls gravitate towards flowers, butterflies, and female figures, while boys are more inclined towards mechanical subjects (cars, trains) or depictions of soldiers and fighting. Girls at this age draw their objects more accurately, larger (Barendse et al., 2018), and with more realistic colors than boys (Deaver, 2009).

According to Garner (2012), Golomb (2021), and other scholars, the origins of these preferences may be rooted in the inclination of boys to prioritize action, strength, and movement (such as explosions, violence, battles, and destruction) and girls to prioritize beauty, tenderness, romance, and family life (such as cute little animals, landscapes, games, and children playing).

In a broader context, the sex differences arise from distinct brain development influenced by sex hormones, which exert a specific impact on brain lateralization and are specific to the brain regions or networks involved. As a result, there are variations in abilities related to fine motor skills (Peyre et al., 2019), mental rotation (Beking et al., 2017), visual system (Shaqiri et al., 2018; Vanston & Strother, 2017) and other neuromotor and sensomotor abilities. However, it is important to bear in mind that these differences between the sexes are typical during the preschool years, and over time, the prerequisites for drawing become equalized.

Developmental differences and gender differences in drawings not only have a biological determination given by differences in maturation, but of course psychosocial and educational contexts also play an important role. The influence of the home environment, home literacy, and family educational approach has a significant impact on graphomotor skills, with proximal factors exerting a greater influence than distal factors (Sinvani, Golos, Zagmi, & Gilboa, 2023). The educational process plays a crucial role in fostering the development of diverse skills and interests necessary for the acquisition of drawing skills as well (Wolpert, 2014). To identify the specific factors that affect drawing in the school setting, a separate study would be required. However, it is generally acknowledged that intensive guided graphomotor training in the art class has been empirically demonstrated to positively influence the progress of children at this stage Taverna, Tremolada, Tosetto, Dozza, and Renata (2020). Furthermore, preparatory programs and specialized exercises have the potential to enhance this progress further Taverna, Tremolada, Dozza, et al. (2020). This knowledge provides us with an avenue

to gain a deeper understanding of the unique needs of children and to adapt the educational environment accordingly in order to foster their development and creativity.

Conclusion

This study dealt with free unguided drawing of children. We can summarize the findings as follows. Children can choose typical or new themes for their drawings, with new themes requiring more effort and resulting in original or innovative drawings. Typical themes in child drawings include 'man,' 'tree,' and 'house,' with 17 thematic categories grouped into 5 higher themes. The number of objects in drawings increases with age, reflecting object recognition and working memory development. Preschoolers often draw single-object drawings, while first-graders draw multiple objects, likely due to the significant development of graphomotor skills in the first grade. Gender differences influence drawing content, with boys preferring products of human activity and girls favoring natural themes. These differences are rooted in brain development influenced by sex hormones and societal influences, but they tend to equalize over time.

These findings can be utilized for assessing a child's cognitive and motor development and for identifying potential delays or issues. Recognizing gender differences in drawing content can serve as a foundation for educational strategies. Educators can tailor artistic activities to engage and support both boys and girls, fostering their creative expression and skill development. The results open avenues for further research questions, such as how children choose to draw themes, how personality, creativity and other variables manifests in the draw, how free drawing provides reliable insight into children's cognitive and emotional development, how to create educational materials and diagnostic tools tailored to age and gender, based on free drawing (rather than predetermined themes).

In summary, understanding children's drawing is beneficial for education, psychology, and research, ultimately contributing to a better understanding of how children grow and express themselves. However, it is important to recognize that one drawing alone cannot fully represent a child, as significant inter-individual differences exist among children. Each child is unique and should be comprehensively assessed based on their individual needs and interests. Drawing serves as a valuable tool not only for uncovering general developmental patterns and gender differences but also for identifying individual needs and specificities for each child.

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