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THE LEVEL OF CREATIVE THINKING OF 6-YEAR-OLD CHILDREN AND THE TYPE OF THEIR MULTIPLE INTELLIGENCES

**Poziom myślenia twórczego dzieci 6-letnich
a typ posiadanej inteligencji wielorakiej**

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Abstract

The article presents a research on the correlation between various types of Howard Gardner's intelligences and the level of creative thinking and its three skills, i.e. fluency, flexibility, and originality. The analysis included three hundred and twenty 6-year-old children attending preschools located within the city of Warsaw (Ursus district), including 154 girls and 166 boys. The children who participated in the study attended preschools whose managing body had allowed it, and whose parents had consented to it.

The method used in the study was a diagnostic survey, performed with the application of the following techniques: The Howard Gardner's Multiple Intelligences Test, which allowed the researcher to determine the type of dominant intelligence in a child, Kate Franck's Drawing Completion Test, which measure the level of creative thinking, and the Test of Graphic Associations – the children version designed by Mariola Jąder, which assessed the fluency, flexibility and originality of thinking.

The purpose of the research was to find out whether children's types of multiple intelligences have an impact on their level of creative thinking with respect to the three abilities: fluency, flexibility, and originality of thinking. The study included 320 six-year-old children. The research findings demonstrated that high level of creative thinking in terms of the three studied skills are attained by children whose dominant intelligence types were logical-mathematical and kinesthetic. The dominance of linguistic and interpersonal intelligence was typical of children showing an average level of fluency, flexibility, and originality of thinking; whereas children with dominating intrapersonal and spatial intelligence demonstrated its low levels. Therefore, the type of one's multiple intelligences has an impact on the level of creative thinking.

Without a doubt, the research has not exhausted the topic. The correlation between multiple intelligences and creative thinking necessitates further in-depth analyses.

Keywords: creative thinking, intelligence, Multiple Intelligences Theory, children, kindergarten.

Streszczenie

W artykule przedstawiono badania dotyczące zależności między rodzajami inteligencji wg Howarda Gardnera a poziomem myślenia twórczego i jego trzech zdolności, tj. płynności, giętkości i oryginalności. Badaniami objęto 320 dzieci 6-letnich uczęszczających do przedszkoli na terenie miasta Warszawa (dzielnica Ursus), w tym 154 dziewczynki i 166 chłopców. W badaniach uczestniczyły dzieci z przedszkoli, których dyrekcja wyraziła na to zgodę, i to tylko te dzieci, których rodzice wyrazili na to zgodę.

W badaniach zastosowano metodę sondażu diagnostycznego, którą realizowano za pomocą takich technik, jak: test inteligencji wielorakiej Howarda Gardnera, za pomocą którego ustalono rodzaj inteligencji dominującej u dziecka, test rysunkowy Kate Franck, za pomocą którego zmierzono poziom myślenia twórczego, oraz test skojarzeń graficznych – wersja dla dzieci, opracowany przez Mariolę Jąder, za pomocą którego oceniono płynność, giętkość i oryginalność myślenia.

Wyniki badań pokazały, że wysoki poziom myślenia twórczego w zakresie wszystkich trzech badanych zdolności, uzyskały dzieci, u których dominowała inteligencja logiczno-matematyczna i kinestetyczna. Dominacja inteligencji językowej i interpersonalnej charakteryzowała dzieci, które uzyskały przeciętny poziom płynności, giętkości i oryginalności myślenia. Natomiast dzieci, u których dominowała inteligencja intrapersonalna i przestrzenna, uzyskały w badaniach niski poziom. A zatem typ posiadanych rodzajów inteligencji wielorakiej ma wpływ na poziom myślenia twórczego.

Nie ulega wątpliwości, że temat nie został wyczerpany do końca. Zależność między rodzajami inteligencji wielorakiej a myśleniem twórczym wymaga dalszych pogłębionych badań.

Słowa kluczowe: myślenie twórcze, inteligencja, teoria inteligencji wielorakich, dzieci, przedszkole.

Introduction

The world and the changing reality reflect the processes ongoing in our minds. Ever since the beginnings of human existence, the human being has been creating new and redeveloping old products. The process which preconditions creation is referred to as the creative process. Creative output is a natural consequence of the thinking process occurring in every man, irrespective of age and gender. Creativity is something one may see in the completion of everyday tasks. All and any mental activities relating to the creation of ideas, concluding, abstracting, reasoning, judging, problem solving, memory, learning, creativity, imagination, symbol processing etc. are referred to as creative thinking. In turn, the ability to perceive, analyze and adapt to changes in the surroundings, understand, learn and apply one's knowledge and skills in various situations, is called intelligence. The Theory of Multiple Intelligences by Howard Gardner belongs to the group of contemporary popular intelligence theories. It assumes that people have more than just intellectual abilities – they have many types of intelligence. Therefore, the said intelligences should also have an impact on creative thinking.

The Idea of Creative Thinking

An American psychologist, Joy P. Guilford (1897–1987), conducted extensive research into the creative process. He created a model of intelligence structure, where he distinguished, among other things, convergent thinking operations and divergent thinking operations. Convergent thinking captures mental operations carried out in problematic situations, which in principle have one solution, or one correct answer. In fact, the majority of mathematical tasks are of that nature. Divergent thinking, on the other hand, includes intellectual operations concerning the solving of problems having multiple solutions. They involve the production of multiple solutions, as varied as possible, to the same problem. Any work related to painting a picture or designing a bird feeder is of such nature. The abilities of divergent, multi-directional, open thinking have been recognized to be the most essential elements of creativity, although, one must not forget about other abilities, such as memory, attention span, or the ability to assess one's own inventions. The group of key ingredients (abilities) of creative thinking encompasses:

1. Fluency of thinking. It is the ability to produce words, sentences, concepts, ideas, etc. in a short period of time. The fluency rate is the number of ideas produced within a given time period. The meaning of fluency in the creative process is tremendous, for the greater that ability to produce numerable ideas, the larger the probability of coming up with a truly creative solution which will satisfy strict assessment criteria.

2. Flexibility of thinking. It is the ability to propose products varying in quality and to change the search direction; the ability to adapt methods of problem solving to the changing circumstances. Flexibility is the opposite of rigidity of thinking.

3. Originality of thinking, i.e. the ability to produce contents which are other than what has already been made up. It is the ability to go beyond stereotypical frames, or most obvious solutions, which allows one to see new, unusual aspects of a problematic situation. The better one is at producing solutions that are outstanding, rare in a given group of people, unconventional, which combine two remote associations, which are valued as ingenious and unexpected, sound, adequate to the requirements of a given situation the idea pertains to, the more original the thinking. (Guilford, 1978)

Here, one should emphasize that Guilford examines creative thinking as a process of problem solving. He believes that problem solving and creative thinking are identical phenomena.

Generally, it can be said, that creative thinking is a process of solving open-ended problems, i.e. problems which may be solved in several ways. The process results in products which have yet been unknown, but which are useful to a certain group of people, or to the creator (Eby & Smutny, 1990).

As creative thinking is a driving force for creative activity, its development and shaping is one of the tasks of education. Children have a natural creative potential which, under incorrect teachers' attitudes, may be inhibited. Therefore, one ought to bear in mind how vital it is to provide suitable conditions to develop children's creative

thinking skills. Otherwise, if creative thinking is subdued in a little child, such as state of affairs is most likely to continue later in life.

The preschool age period is critical in terms of acquisition of independent creative thinking abilities. Therefore, we must let children create freely and flexibly rather than have them base their works on the works of others. One must allow the child to examine, explore, search, but also to make mistakes, feel fear, anger, joy, love and, above all, we need to let created works reflect child's personality. It is crucial for creativity development may be inhibited in several "critical periods" of the childhood. The first crisis is observed at the age of five. It is related to excessive self-criticism in children who note that there is a discrepancy between their abilities and skills, and the ability to ideally imitate the reality. This is particularly true in case of activities performed in the presence of other people. The negative impact of the social background may void the child of all creative skills, for intimidation, lack of self-efficacy, the fear to be judged, or submissive attitudes towards others are factors which rid one of initiative and prompt one to listen and, perhaps, criticize, rather than to act. This is intensified by inhibitions typical of creativity, e.g. a tendency for uniformization of group judgments (the so-called group thinking syndrome), a tendency to conform opinions (Asch effect), dependence on group authority figures which constrains imagination (oftentimes – dependence on the perceived authority of the leader) and others. Many obstacles on the road to creativity are a result of inhibitions of socio-economic nature. A child who is afraid to act openly, to take larger risks, would rather not take up any creative activity, even if she or he is equipped with a number of useful skills and abilities. This is essential because preference for a specific type of a creative activity is often a starting point for some later activity in adulthood. Furthermore, it may be an indicator of specific talents which will develop at later periods in a form of a hobby or a professional creative activity (Gloton & Clero, 1976; Guilford, 1978; Hurlock, 1985; Limont, 1996; Lowenfeld & Brittain, 1977; Nęcka, 1994; Zborowski, 1986).

Creative activity has its roots in one's upbringing. However, not always do parents foster child's curiosity and the need to discover or fantasize. Parents tend to rely on a narrow definition of creativity. They pay more attention to child's successes than to the way he or she thinks, acquires, or to what type of personality she or he has. They are more focused on comparing a child to his peers than on what the child can give others. Children's labels make parents act in a manner which intimidates, misguides or exerts pressure on their children. Creative expression is not fostered if children have nothing to say, do not take decisions, do not take responsibility, or never imagine what other people might feel or think. With time, child's open-mindedness gives way to seclusion and confinement – the child becomes one-dimensional, distrustful, and limited. Adult ambitions oust the child's creative spark (Eby & Smutny, 1990).

Another environment that is crucial for child's development is kindergarten. The teacher plays an important role of a manager in every didactic-upbringing process which

is targeted and deliberate. Nonetheless, the role is assumed differently when the teacher is oriented towards creative personality development and differently when one wants to educate imitators (reproducers). In both cases, the teacher plans and organizes students' activities and manages their course. On the one hand, if the goal of the didactic process is to develop creative personalities, it prefers creative goals, above all, open-end problems, and ensures conditions favoring creation and discovering the beneficial 'new'. On the other hand, if one breeds imitators, reproductive objectives are preferred, in particular, close-end problems, and children are offered conditions to acquire and master knowledge and improve one's skills (Kujawiński, 1990; Puślecki, 1999).

Theoretical Assumptions of the Theory of Multiple Intelligences by Howard Gardner

The Theory of Multiple Intelligences by Howard Gardner is an innovative approach to the issue of intelligence, cognitive skills, and learning methods. It was first outlined by the author in his book entitled "Frames of Mind: Theory of Multiple Intelligences", published in 1983. The Theory of Multiple Intelligence assumes that people have more than just intellectual abilities – every person is equipped with a specific system of eight types of intelligence. It happens that an individual has only one dominant type of intelligence, or a specific thinking profile, which is a set of various combinations of its types. He believes that there are no two people, even identical twins, who would have an exact same intellectual profile. In the first intelligence set, Gardner distinguished 7 intelligences which intersperse, better or worse, within one individual creating a specific profile preconditioning problem solving: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, and intrapersonal. Every one of the above intelligences has its inherent features, language, symbols and processes, and might be expressed in different ways. The intelligences may be developed, and consequently, their position and dominance may change throughout one's life. (Eby & Smutny, 1990; Gardner, 1983).

Gardner stipulates that multiple intelligences are, in many ways, a special gift from childhood. Children enjoy using their various intelligences during a spontaneous and unrestricted activity. They explore the world around in an accessible manner. Furthermore, they do not have any imposed patterns to follow in a given situation or when solving problems. The described intelligences do not vanish with time, but they do become latent. Adults continue to think in multiple ways, although their actions do not reflect the types of intelligences to such an extent that children's actions do. Therefore, the pillars of the theory by Howard Gardner are:

1. Diagnosis – every child has a developed profile of intelligence (spectrum) on the basis of which we work during classes. Children know their spectra.
2. Individualization – a selection of several propositions which conform to intelligence profiles (the so-called dominance, e.g. drama during a Math's class).

3. Inspiring educational environment – Lands, Multiple journeys (these are environments of closely cooperating intelligences, or for every individual intelligence – to develop weaker intelligences we use a strong one by designing a set of exercises, games and plays, didactic measures, and other forms of activity).

Therefore, the task of the teacher is to:

- adjust the forms, methods of work, games and play to the interests and skills of the children,
- introduce novelties and create educational space to implement creative ideas,
- stimulate all spheres of activity in children, in particular: language, mathematical-naturalistic, artistic, kinesthetic, communication-information, and social,
- develop intellectual potential and motivation to learn in children (Gardner, 1983, 1993).

H. Gardner emphasizes that it is of utmost importance to recognize and nurture the various types of intelligences (skills) and their various combinations. People differ to such an extent largely due to the various combinations of these intelligence types. If one could avail of the whole gamut of human skills, one would think higher of themselves and become more competent in various domains. Perhaps, one would also become more engrossed with the work for the common good and able to do more for the well-being of the society in general (Gardner, 2009, s. 41).

The Theory of Multiple Intelligences by Howard Gardner is an innovative approach to the issue of intelligence, cognitive skills, and learning methods. As every path-breaking theory, it has its followers and opponents.

The former enumerate countless advantages of theory implementation in schools and focus, above all, on the fact that Howard Gardner's perception of teaching and learning allows one to strengthen children's individuality by adjusting kindergarten- and school-based activities to their abilities and preferences (the process of personalization of the learning process). The evaluation of the curricula based on the Theory of Multiple Intelligences demonstrates that the approach leads to an increase in children's involvement in the learning process, an enhancement of the understanding of discussed contents, a reduction of misconduct, a growth of enthusiasm for task performance, a higher self-assessment and greater self-confidence, an improved atmosphere in a group/class, a brightened child/student-teacher relationship, and better results of standard tests (Callahan, Tomlinson, Moon, Tomchin & Plucker, 1995; Hanafin, 2014; Maker, Nielson & Rogers 1994; Reid & Romanoff 1997).

The opponents of the Theory of Multiple intelligences, such as: Daniel T. Willingham (2004), Deanna Kuhn (2006), Susan M. Barnett, Stephen J. Ceci & Wendy M. Williams (2006), John White (2006, 2008), Beth Visser, Michael C Ashton & Philip A Vernon (2006) and Lynn Waterhouse (2006a, 2006b), ponder over its flaws, such as subjectivity in the assessment of students' predispositions and difficulties which would

be entailed by introducing the concept of a complete individualization of teacher's approach to students given the current schooling system (too populous groups, too much bureaucracy in teachers' work etc.). Finally, Robert J. Sternberg (1983) and Michael Eysenck (1994) claim that they have never encountered any empirical research which would confirm Howard Gardner's theory.

Method

Sample

The object of the research was to establish whether there was a correlation between Howard Gardner's multiple intelligences and creative thinking.

The study was conducted to determine whether there is a correlation between the type of multiple intelligences and the level of creative thinking of six-year-old children.

The analysis included 320 six-year-old children attending kindergartens located within the city of Warsaw (Ursus district), including 154 girls and 166 boys. The parents of the children who participated in the study had consented to it. (The research was conducted in cooperation with Erwina Maria Lewandowska, the teacher of the Public Kindergarten No. 200 of Gąska Balbinka in Warsaw)

Problems and hypotheses of research

The research problem was presented in the following question: Does the type of multiple intelligences of a 6-year-old child have an effect on his or her level of creative thinking with respect to the three abilities: fluency, flexibility, and originality?

The following sub-problems detailed the main research problem:

1. What types of multiple intelligences dominate in the studied children?
2. What is the level of creative thinking in children with respect to the following three features: fluency, flexibility, and originality?
3. Which type of multiple intelligences of six-year-olds exerts a dominant influence on their level of creative thinking and its three abilities: fluency, flexibility, and originality?

In search of answers to the main question, it was theoretically assumed that the level of creative thinking of six-year-olds depends on the child's multiple intelligences.

The following detailed hypotheses were adopted when justifying the selection of the research problem and preparing for the research:

1. It should be assumed, that every child's dominant type of multiple intelligences is different.
2. It is probable that the level of creative thinking in children with respect to the following three features: fluency, flexibility, and originality varies.
3. One may reckon that the level of creative thinking and its three abilities, i.e. fluency, flexibility, and originality is affected most by logical-mathematical and linguistic intelligences.

Instruments

The method used in the study was a diagnostic survey, performed with the application of the following techniques: The Howard Gardner’s Multiple Intelligences Test, which allowed the researcher to determine the type of dominant intelligence in a child, Kate Franck’s Drawing Completion Test, which measure the level of creative thinking, and the Test of Graphic Associations – the children version designed by Mariola Jąder, which assessed the fluency, flexibility, and originality of thinking.

Results

The first stage of the research was to establish what types of multiple intelligences dominated in the studied children. The analyses were conducted using the Multiple Intelligence Test of Howard Garfner. The data obtained are presented in Table 1.

Table 1. Types of intelligences detected in the studied children

Item	Type of intelligence	Number of children											
		Has				Manifests				Does not have			
		Girls		Boys		Girls		Boys		Girls		Boys	
		N	%	N	%	N	%	N	%	N	%	N	%
1.	Logical-mathematical	52	34	75	45	38	25	25	15	64	41	66	40
		N=320, $\chi^2(2)=6.43$, $p<0.05$, $\phi=0.14$											
2.	Linguistic	77	50	75	45	52	34	16	10	24	16	75	45
		N=320, $\chi^2(2)=44.00$, $p<0.001$, $\phi=0,37$											
3.	Kinesthetic	64	41	83	50	13	9	33	20	77	50	50	30
		N=320, $\chi^2(2)=16.47$, $p<0.001$, $\phi=0.23$											
4.	Musical	52	34	33	20	0	0	41	25	102	66	92	55
		N=320, $\chi^2(2)=45.37$, $p<0.001$, $\phi=0.37$											
5.	Spatial	92	59	50	30	24	16	41	25	38	25	75	45
		N=320, $\chi^2(2)=28.56$, $p<0.001$, $\phi=0.30$											
6.	Interpersonal	52	34	50	30	38	25	33	20	64	41	83	50
		N=320, $\chi^2(2)=2.40$, $p>0.05$, $\phi=0.08$											
7.	Intrapersonal	24	16	58	35	38	25	0	0	92	59	108	65
		N=320, $\chi^2(2)=48.72$, $p<0.001$, $\phi=0.39$											

*N – number of observations, χ^2 – chi square, p – significance level, ϕ – Yule's phi coefficient
Source: own research*

The data presented in Table 1 demonstrate that the vast majority of the studied children displayed the following dominant intelligence types: linguistic (95%), kinesthetic (91%) and spatial (89%). Moreover, spatial intelligence was dominant in 59% of the girls, and linguistic intelligence – in 50% of the girls. On the other hand, the dominant type of intelligence in 50% of the boys was kinesthetic intelligence, and in 45% of the boys – logical-mathematical and linguistic types.

Statistical analysis of the results presented in Table 1 showed that the differences between the type of multiple intelligences and the gender of the child, in the case of logical-mathematical and interpersonal intelligence, proved to be statistically significant, and in the case of linguistic, kinesthetic, musical, spatial, and intrapersonal intelligence – statistically highly significant. The strength of the relationship between the type of multiple intelligence and the child's gender turned out to be very low in the case of interpersonal intelligence, low in the case of logical-mathematical, kinesthetic and spatial intelligence, and moderate in the case of linguistic, musical and intrapersonal intelligence. The strength of the relationship between multiple intelligences and the child's gender turned out to be the strongest in the case of intrapersonal intelligence, and the least strong in the case of interpersonal intelligence.

Subsequently, the levels of creative thinking in the studied children were analyzed with the application of Kate Franck's Drawing Completion Test. The relevant data is presented in Table 2.

Table 2. The level of creative thinking in the studied children

Item	Level	Number of children					
		Girls		Boys		Total	
		N	%	N	%	N	%
1.	High	12	8	17	10	29	9
2.	Average	91	59	66	40	157	49
3.	Low	51	33	83	50	134	42
4.	Total	154	100	166	100	320	100
N=320, $\chi^2(2)=12.04$, $p<0.002$, $\phi=0.19$							

N – number of observations, χ^2 – chi square, *p* – significance level, ϕ – Yule's phi coefficient
 Source: own research

On the basis of data presented in Table 2, one may ascertain that 9% of children demonstrated a high level of creative thinking, whereas the greatest percentage of children were those with an average level creative thinking. The same tendency was observed with respect to girls – 8% and 59%, respectively. On the contrary, most of the boys (50%) showed a low level of creative thinking, whereas only 10% exhibited its high level.

The differences between the level of creative thinking and the child's gender were statistically significant. The strength of the relationship between these features was low.

Next, on the basis of Mariola Jäder's Graphic Associations Test – children version, the fluency, flexibility, and originality of thinking were assessed. The data obtained are demonstrated in Tables 3, 4, and 5.

Table 3. The level of fluency of thinking in the studied children

Item	Level	Number of children					
		Girls		Boys		Total	
		N	%	N	%	N	%
1.	High	0	0	25	15	25	8
2.	Average	103	67	83	50	186	58
3.	Low	51	33	58	35	109	34
4.	Total	154	100	166	100	320	100
N=320, $\chi^2(2)=27.12$, $p<0.001$, $\phi=0.29$							

N – number of observations, χ^2 – chi square, *p* – significance level, ϕ – Yule's phi coefficient
 Source: own research

The data shown in Table 3 indicate that high fluency of thinking was attained by 8% of the children, including 15% of the boys. None of the girls exhibited a high level of fluency of thinking. Amongst the girls, the largest group was those whose thinking fluency was at an average level (67%). The majority of the studied children had an average-level thinking fluency. Fluency of thinking dominated at the same level both among the girls and the boys (67% and 50%, respectively).

Differences in the level of thinking fluency according to the child's gender were statistically highly significant. The strength of these relationships was low.

Table 4. The level of flexibility of thinking in the studied children

Item	Level	Number of children					
		Girls		Boys		Total	
		N	%	N	%	N	%
1.	High	0	0	16	9	16	5
2.	Average	89	58	67	40	156	49
3.	Low	65	42	83	50	148	46
4.	Total	154	100	166	100	320	100
N=320, $\chi^2(2)=18.48$, $p<0.001$, $\phi=0.24$							

N – number of observations, χ^2 – chi square, *p* – significance level, ϕ – Yule's phi coefficient
 Source: own research

The analysis of the data presented in Table 4 reveals that high level of thinking flexibility was presented by 5% of the children, including 9% of the boys. None of the girls displayed a high level of thinking flexibility. In general, in case of thinking flexibility, most children demonstrated an average level (49%). Among the girls, the average-level thinking flexibility also dominated the group (58%). On the other hand, the majority of the boys (50%) showed a low level of thinking flexibility.

Differences in the level of flexibility of thinking depending on the child's gender were statistically highly significant. Also in this case, the strength of the relationship between the examined features was low.

Table 5. The level of originality of thinking in the studied children

Item	Level	Number of children					
		Girls		Boys		Total	
		N	%	N	%	N	%
1.	High	0	0	17	10	17	5
2.	Average	65	42	66	30	131	41
3.	Low	89	58	83	4540	172	54
4.	Total	154	100	166	100	320	100
N=320, $\chi^2(2)=16.87$, $p<0.001$, $\phi=0,23$							

N – number of observations, χ^2 – chi square, *p* – significance level, ϕ – Yule's phi coefficient

Source: own research

The data shown in Table 5 demonstrate that high originality of thinking was attained by 5% of the children, including 10% of the boys. None of the girls displayed a high level of thinking originality. The children included in the research were dominated by a group of those with an average level of creative thinking (54%). The same level of originality of thinking was noted in the largest group both among the girls and the boys (58% and 50%, respectively).

In terms of originality of thinking, the differences between the examined features were statistically highly significant and the strength of the relationship between them was low.

Another stage of the research was to correlate the different types of intelligences and the level of creative thinking and its three individual components, i.e. fluency, flexibility, and originality. The data obtained are demonstrated in Tables 6, 7, 8, and 9.

The data presented in Table 6 demonstrate that high levels of creative thinking were attained by children whose dominant intelligence type was linguistic intelligence (22%). In the case of 77% of children, spatial intelligence led to an average level of creative thinking. In children with a low level of creative thinking, interpersonal intelligence dominated (40%).

Table 6. The type of multiple intelligences vs the level of creative thinking in the studied children

Item	Type of intelligence	Number of children					
		High level		Average level		Low level	
		N	%	N	%	N	%
1.	Logical-mathematical	19	15	67	53	41	32
2.	Linguistic	33	22	81	53	38	25
3.	Kinesthetic	10	7	99	67	38	26
4.	Musical	0	0	54	63	31	37
5.	Spatial	13	9	109	77	20	14
6.	Interpersonal	10	10	51	50	41	40
7.	Intrapersonal	9	11	45	55	28	34
N=320, $\chi^2(2)=61.45$, $p<0.001$, $\phi=0.43$							

N – number of observations, χ^2 – chi square, p – significance level, ϕ – Yule's phi coefficient
 Source: own research

The relationships between the types of multiple intelligences and the level of creative thinking turned out to be statistically highly significant. The strength of the relationship between these variables turned out to be moderate.

Table 7. Types of multiple intelligences vs the level of thinking fluency in the studied children

Item	Type of intelligence	Number of children											
		High level				Average level				Low level			
		Girls		Boys		Girls		Boys		Girls		Boys	
		N	%	N	%	N	%	N	%	N	%	N	%
1.	Logical-mathematical	0	0	8	10	39	75	49	65	13	25	19	25
		N=320, $\chi^2(2)=5.97$, $p=0.051$, $\phi=0.13$											
2.	Linguistic	0	0	0	0	64	83	45	60	13	17	30	40
		N=320, $\chi^2(2)=10.00$, $p=0.007$, $\phi=0.17$											
3.	Kinesthetic	0	0	0	0	42	66	29	35	22	34	54	65
		N=320, $\chi^2(2)=13.62$, $p=0.001$, $\phi=0.20$											
4.	Musical	0	0	0	0	21	41	15	45	31	59	18	55
		N=320, $\chi^2(2)=0.21$, $p=0.899$, $\phi=0.02$											
5.	Spatial	0	0	0	0	30	33	32	65	62	67	18	35
		N=320, $\chi^2(2)=12.97$, $p=0.002$, $\phi=0.20$											
6.	Interpersonal	0	0	0	0	13	25	38	75	39	75	12	25
		N=320, $\chi^2(2)=26.52$, $p<0.001$, $\phi=0.28$											
7.	Intrapersonal	0	0	0	0	14	58	9	15	10	42	49	85
		N=320, $\chi^2(2)=15.42$, $p<0.001$, $\phi=0.21$											

N – number of observations, χ^2 – chi square, p – significance level, ϕ – Yule's phi coefficient
 Source: own research

Based on information shown in Table 7, it may be assumed that high level of thinking fluency was attained only by boys whose dominant intelligence type was logical-mathematical (10%). An average level of thinking fluency was typical of girls whose dominant intelligence type was linguistic (83%), and in boys – interpersonal (75%). Finally, a low level of thinking fluency was characteristic of girls whose dominant intelligence type was interpersonal (75%), and in boys – intrapersonal (85%).

In the case of logical-mathematical, linguistic, and musical intelligence, the differences in the level of fluency in thinking were statistically insignificant. In the case of spatial intelligence, the dependence of the level of thinking fluency was statistically significant, and in the case of kinesthetic, interpersonal, and intrapersonal intelligence – the differences turned out to be statistically highly significant. The strength of the relationship in the case of musical intelligence turned out to be very low, and in the other types of multiple intelligences – low. The greatest strength of the dependence of the level of fluency in thinking on the type of multiple intelligences occurred in the case of interpersonal intelligence.

Table 8. Type of multiple intelligence vs the level of thinking flexibility in the studied children

Item	Type of intelligence	Number of children											
		High level				Average level				Low level			
		Girls		Boys		Girls		Boys		Girls		Boys	
N	%	N	%	N	%	N	%	N	%	N	%		
1.	Logical-mathematical	0	0	3	4	36	70	34	46	16	30	38	50
		N=320, $\chi^2(2)=8.12$, $p=0.017$, $\phi=0.15$											
2.	Linguistic	0	0	0	0	58	75	56	75	19	25	19	25
		N=320, $\chi^2(2)=0.009$, $p=0.996$, $\phi=0.005$											
3.	Kinesthetic	0	0	13	15	32	50	37	45	32	50	33	40
		N=320, $\chi^2(2)=11.10$, $p=0.004$, $\phi=0.18$											
4.	Musical	0	0	0	0	21	41	21	65	31	59	12	35
		N=320, $\chi^2(2)=4.36$, $p=0.113$, $\phi=0.11$											
5.	Spatial	0	0	0	0	61	66	15	30	31	34	35	70
		N=320, $\chi^2(2)=17.16$, $p<0.001$, $\phi=0.23$											
6.	Interpersonal	0	0	0	0	31	59	30	60	21	41	20	40
		N=320, $\chi^2(2)=0.002$, $p=0.999$, $\phi=0.002$											
7.	Intrapersonal	0	0	0	0	4	16	26	45	20	84	32	55
		N=320, $\chi^2(2)=5.80$, $p=0.055$, $\phi=0.13$											

N – number of observations, χ^2 – chi square, *p* – significance level, ϕ – Yule's phi coefficient

Source: own research

The results shown in Table 8 reveal that a high level of thinking fluency was reached by boys whose dominant intelligence type was kinesthetic (15%) and logical-mathematical (4%). Both in terms of girls and boys, it was the linguistic intelligence that exerted the greatest impact on an average level of thinking flexibility (75% each). On the other hand, a low level of thinking flexibility was characteristic of girls whose dominant intelligence type was intrapersonal (84%), and in boys – spatial intelligence (70%).

The relationships regarding the type of multiple intelligence and the level of flexibility of thinking turned out to be statistically insignificant in the case of linguistic, musical, interpersonal, and intrapersonal intelligence. In the case of logical-mathematical and kinesthetic intelligence, the dependence of the level of flexibility of thinking was statistically significant, and in the case of spatial intelligence – highly significant. The strength of the relationship between the level of thinking flexibility and the type of multiple intelligences was very low in the case of linguistic and interpersonal intelligences, and low in the remaining types of multiple intelligences. The strongest relationship between the flexibility of thinking and the type of multiple intelligences was noted in the case of spatial intelligence, and the weakest in the case of interpersonal intelligence.

Table 9. Type of multiple intelligence vs the level of thinking originality in the studied children

Item	Type of intelligence	Number of children											
		High level				Average level				Low level			
		Girls		Boys		Girls		Boys		Girls		Boys	
		N	%	N	%	N	%	N	%	N	%	N	%
1.	Logical-mathematical	0	0	8	10	21	40	37	50	31	60	30	40
		N=320, $\chi^2(2)=4.24$, $p=0.120$, $\phi=0.11$											
2.	Linguistic	0	0	0	0	58	75	49	65	19	25	26	35
		N=320, $\chi^2(2)=1.82$, $p=0.403$, $\phi=0.07$											
3.	Kinesthetic	0	0	4	5	22	34	42	50	42	66	37	45
		N=320, $\chi^2(2)=8.24$, $p=0.016$, $\phi=0.16$											
4.	Musical	0	0	0	0	30	57	10	30	22	43	23	70
		N=320, $\chi^2(2)=6.07$, $p=0.048$, $\phi=0.13$											
5.	Spatial	0	0	0	0	41	45	22	45	51	55	28	55
		N=320, $\chi^2(2)=0.004$, $p=0.998$, $\phi=0.003$											
6.	Interpersonal	0	0	0	0	21	40	30	60	31	60	20	40
		N=320, $\chi^2(2)=3.92$, $p=0.141$, $\phi=0.11$											
7.	Intrapersonal	0	0	0	0	4	17	12	20	20	83	46	80
		N=320, $\chi^2(2)=0.17$, $p=0.916$, $\phi=0.02$											

N – number of observations, χ^2 – chi square, *p* – significance level, ϕ – Yule's phi coefficient
 Source: own research

On the basis of the analysis of the data included in Table 9, one can conclude, that a high level of originality of thinking was typical of boys whose dominant intelligence type was logical-mathematical (10%) and kinesthetic (5%). An average level of originality of thinking was attained by both girls and boys with linguistic intelligence as the dominant intelligence type (75% and 65%, respectively). In the case of a low level of thinking originality, the majority were girls whose dominant intelligence type was kinesthetic (66%), and boys who featured spatial intelligence (80%).

The dependence of the originality of thinking on kinesthetic and musical intelligence turned out to be statistically significant, while in other types of intelligence it was statistically insignificant. The strength of the relationship between these traits was very low for linguistic, spatial, and intrapersonal intelligence, and low for logical-mathematical, kinesthetic, musical, and interpersonal intelligence. The strongest relationship between the originality of thinking and the type of multiple intelligences was obtained in the case of kinesthetic intelligence, while the weakest in the case of intrapersonal intelligence.

Conclusions

The purpose of the research was to find out whether children's types of multiple intelligences have an impact on their level of creative thinking with respect to the three abilities: fluency, flexibility, and originality of thinking. The study included 320 six-year-old children. The research findings demonstrated that high level of creative thinking in terms of the three studied skills are attained by children whose dominant intelligence types were logical-mathematical and kinesthetic. The dominance of linguistic and interpersonal intelligence was typical of children showing an average level of fluency, flexibility, and originality of thinking; whereas children with dominating intrapersonal and spatial intelligence demonstrated its low levels. Therefore, the type of one's multiple intelligences has an impact on the level of creative thinking. This conclusion is supported by other research studies.

Ali Abdi and Maryam Rostami (2012) conducted studies aimed at examining the effect of multiple intelligence-based teaching on creative thinking abilities of fifth-grade students (elementary school). The research was a quasi-experimental study with nonequivalent groups. The study was conducted with 30 students in the experimental group and 29 in the control group. The results of the study demonstrated that teaching based on the theory of multiple intelligences significantly improved creative thinking skills when compared with traditional teaching.

Furthermore, also Estrella Fernández, Trinidad García, Cristina Gómez, Débora Areces and Celestino Rodríguez (2019) explored the impact of multiple intelligences on school performance. They investigated 98 third- and sixth-graders (elementary school). Their research findings proved that students' school performance is greatly affected by

logical-mathematical, scientific, and linguistic intelligence. The above results correspond to the expectations because the said intelligences refer to the type of learning commonly followed under the present system of education.

The relationship between creativity and intelligence was further analyzed by Hor Yen Yi, Tajularipin Sulaiman, and Roselan Baki (2011). They examined 1040 randomly selected students. Their research findings demonstrate that creativity is closely correlated with intrapersonal intelligence.

Without a doubt, the research has not exhausted the topic. The correlation between multiple intelligences and creative thinking necessitates further in-depth analyses. Studies should be carried out on a more extensive sample given that research may differ depending on the applied research tool. Perhaps, if other types of tests assessing creative thinking with respect to multiple intelligences are employed, produced results might vary from the findings presented in this study.

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