Digital Transformation Landscape in the Fourth Industrial Revolution (4IR) Era

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4th Visual Informatics International Seminar 2018

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Preface

We are indeed honoured to bring you this collection of articles from the 4th Visual Informatics International Seminar 2018 (VIIS'18) which was held in the Universiti Kebangsaan Malaysia or the National University of Malaysia (UKM), located in Bangi, Selangor from 13 to 15 November 2018. VIIS'18 was organised by the Institute of Visual Informatics (IVI), UKM together with the National Professors' Council (MPN) and several local public universities. IVI is the leading centre of excellence in Malaysia that focuses on research and innovation in the field of Visual Informatics rooted in Computer Science, Information Systems and Information Technologies disciplines.

Research on visual informatics is becoming increasingly important, as the world enters the fourth major industrial revolution (4IR) era which is characterised by a fusion of technologies: blending the physical, digital, biological and art worlds. This becomes a challenge for all disciplines, economies and industries, and has even challenged ideas about what it means to be human in the advent of advanced robotics and Artificial Intelligence technologies. Hence, this year VIIS'18 brings latest state-of-the-art theme: "Digital Transformation Landscape in the Fourth Industrial Revolution (4IR)" to cater the current needs on visual informatics. VIIS '18 aims to provide an excellent opportunity to share and exchange knowledge, technologies and applications in the field of visual informatics for academics, professionals, engineers, and industrial players worldwide. There is no doubt that every VIIS has encouraged the further advancement of visual informatics through fruitful discussions among researchers, experts, practitioners and specialists.

VIIS '18 was mainly organised by the research students in IVI. VIIS'18 provides a platform for research students to learn the full process of organising an academic seminar. Students were actively involved from the planning phase until the end of the seminar. This year, we received 33 submissions and 20 papers were selected for oral presentation. In addition, to encourage research students to present and discuss their research, several students were also invited to participate in the poster presentation during the seminar.

On behalf of the organising and programme committee of VIIS'18, we thank all authors who have contributed to the volume. We would like to thank the participants of the conference for their thought provoking ideas and active participation in the conference. We would also like to express our gratitude and heartfelt thank you to every staff and students of the Institute of Visual Informatics (IVI), Faculty of Information Science and Technology (FTSM), UKM and all committee members for their remarkable effort and unwavering dedication to ensure the success of VIIS '18. We also would like to express our appreciation to the the Grand Challenge or Arus Perdana Grants of UKM (AP-2017-005/1, AP-2017-005/2 & AP-2017-005/3) for their support in this seminar and publication of this proceedings.

13th November 2018

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Intellectual Intelligence Analysis on Figural Creativity Levels for Elementary School Students

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Abstract. Intelligence quotient (IQ) is commonly used as a benchmark for the quality of human resources. However, we also need to emphasise the ability of creative thinking (figural creativity) to create skilled human resources and productive, creative and quality generation. This study aims to analyse the relationship between intellectual intelligence and figural creativity in elementary school students using quantitative analysis. We used the random sampling technique to gather 84 10-year-old students from 4 different sub-districts as participants in this study. We also employed coloured progressive matrices (CPMs) and the figural creativity test (TKF) to determine students' intellectual and creativity levels. Statistical Product and Service Solutions was used to analyse the test results to prove the relationship between intellectual intelligence and figural creativity. This is indicated by the significance value obtained at $0.04 < 0.05$. Test results corroborate that intellectual ability is related to the ability to think creatively. However, from the entire sample, 32% of the students have excellent intellectual ability but inversely with the ability to think creatively. Thus, the stimulation of students' figural creativity is necessary.

Keywords: Figural Creativity, Intelligence, TKF, CPM

1 Introduction

Humans are gifted with multiple potentials of intelligence (multiple intelligences). Intelligence is commonly interpreted as intelligence quotient (IQ). IQ is generally used as a measure of one's level of intelligence [14, 34, 38, 39]. In addition to IQ, creativity is also an important factor to improve learning outcomes. The development of creativity is crucial. It is contained in MPR-RI Decree No. 11/MPR/1983 as, according to Utami Munandar, "The education system needs to be tailored to the needs of development in all fields that require different types of skills that can simultaneously improve productivity, creativity, quality, and work efficiency" [33]. Education starts from within the family which consists of two main components consisting of parents and children.

Students with potentials should learn to improve the quality of education. Furthermore, it can help parents know the potential of their children at an early age to facilitate their development. Several IQ tests are used to explore the potentials of children [33]. The ability to think creatively and child learning outcomes are measured by creativity and achievement tests, respectively [15, 22, 33, 40].

In this study, we analyse the intellectual intelligence for creativity among 10-year-old elementary school children. The purpose of this work is to know the relationship between intellectual intelligence and figural creativity among children. In this study, coloured progressive matrices (CPMs) and the figural creativity test (TKF) are used to determine the levels of intellectual intelligence and figural creativity. Statistical analysis was conducted to determine the relationship between the CPMs with TKF

2 Background of the Study

2.1 Intelligence

Affirmed that intelligence is the ability to adjust [11, 20, 21]. They affirmed that intelligence is the ability to understand and act appropriately on a situation at hand. Thus, intelligence is related to the ability to adapt to a situation at hand.

Corroborated that intelligence is the ability to learn [18, 25, 38]. A person with a high intelligence level is easy to train and readily learns from experiences. Verified that intelligence is the ability to think abstractly [9, 11] and the ability to understand and think about abstract ideas and symbols.

From the experts' views, intelligence is a general ability (general factor) [6, 9, 28]. In this case, the test results assert that intelligence, in general, is a person's ability to adjust, learn or think abstractly [17]. The results of the aptitude test cannot indicate which specific areas or special abilities are likely to be mastered.

Intelligence test measures a person's ability or intelligence [17]. Several types of commonly used intelligence tests are available. Group intelligence tests consist of CPMs for 5- to 14-year-old children, advanced progressive matrices for 14- to 20-year-old children and standard progressive matrices for 20- to 70-year-old adults [2, 8, 35]. Individual intelligence tests consist of the Wechsler Adult Intelligence Scale (WAIS) and the Wechsler Intelligence Scale for Children (WISC) [3, 5, 12, 29].

Two test kits that will be used in this study are Colored Progressive Matrices (CPM) as a measure of intellectual intelligence and Figural Creativity Test (TKF) as a measuring tool for figural creativity.

2.2 Coloured Progressive Matrices

Two forms of CPMs are available, namely, printed books and board-shaped pictures, which are similar to the printed book. The test material consists of 36 items/drawings. This item is grouped into 3 sets, that is, A, AB and B [16, 24]. Items are compiled from

easy to difficult. Each item consists of a large hollow image, below which are six closing pictures. The students' task is to select one from the images to cover the drawbacks in the big picture. Basically, both forms, in the implementation of the test, give the same result and are intended to attract the attention of small children [10, 30, 36].

Raven [24] confirmed that CPM test is intended to reveal logical thinking and space observation skills and the ability to seek and understand the relationship between a whole and its parts. Thus, integration skills and analytical thinking are included.
Differences in opinion among experts in interpreting the term creativity exist. Creativity is a cognitive ability that produces new ways of looking at a problem or a situation in terms of practices and new ideas. Validated that creativity is the ability to create new combinations based on data, information or elements that exist. Created results are not always new things but can also be a combination of things that already existed. Elucidated that reflectiveness is defined as a person's ability to produce composition, new products or ideas that were previously unknown. Activity forms can be imaginative or thought-provoking rather than merely summarising.

These forms can be the creation of new patterns and a combination of previously acquired information or experiences that have real intent and purpose, not just fantasy. The form of creativity can be a product of art, literature or scientific products and procedural or methodological. Proved that creativity is a process that not only aims at results but also leads to create something new, different, unique, oral or written and concrete or abstract that is valuable. Creativity arises from divergent thinking, whereas problem-solving comes from convergent thinking, a different creativity with intelligence. Creativity can arise on the basis of acquired knowledge and as a form of imagination that leads to achievements, such as painting, building construction with beams, or Lego [1, 7, 19, 23, 26].

On the basis of a study in Utah, tasks are assigned to know the creative potential of different students of different ages from preschool (95%–98%), elementary school (50%–70%), high school and college students (30%–50%) to adults 20%. Corroborated that creativity evolves from childhood and reaches its peak in producing creative things at the age of 30–40, after which creativity tends to stagnate or decrease [27, 31, 37].

2.3 Figural Creativity Test

TKF is an adaptation of the Circle Test made by Torrance. TKF first used by Utami Munandar in 1977. In this study to observe the level of creativity used TKF. The creativity measured through the TKF is the ability to form new combinations of given elements reflected in fluency, flexibility and originality in giving ideas and abilities to develop, elaborate and enrich (an elaboration) an idea [4, 13, 32]

3 Material and Method

3.1 Participant

The study began with a field observation of private elementary schools. The schools were selected by a cluster sampling technique. 4 schools were randomly selected from 11 sub-districts provided. Each sub-district was represented by one school randomly chosen. Each schools were randomly selected 20 students, total sample were 84 students.

3.2 Measures and Procedure

The CPM tests was conducted to determine the level of intellectual intelligence of students. In the CPM test, the students were required to complete 3 sets of questions, that is, A, AB and B, each of which consisted of 12 questions. Raw scores were obtained by giving a value of one for every correct answer and zero for every wrong answer. When a raw score was obtained, it was converted into a percentile according to the chronological age. The next will be classified as grade and intellectual capacity.

This study aimed to find out the correlation between intellectual intelligence and figural creativity on elementary school students based on the hypothesis that a relationship exists between the two.

Tabel 1. The Level of IQ based on Standford Binet standard

Grade SPM	Range IQ based on Standford Binet	Classification
Grade I	120-139	Superior
Grade II	110-119	High Average
Grade III	90-109	Average
Grade IV	80-89	Low Average
Grade V	68-79	Borderline Mental Retardation

The TKF test was conducted to determine the figural creativity of students. In this test the students were required to create an image from a given form, complete the drawing based on several lines, and make various images from a given circle as a stimulus. Scoring on this test will assess some aspects of fluency, flexibility, originality and elaboration. A raw value was obtained on the basis of the assessment of the four aspects.

This value will be converted to the standard value and then the amount of a raw value into a creative quotient score.
At TKF level there are four levels of Superior, High average, Average, and Low Average. Each has intervals; Superior 120-127, High average 111-119, Average 91-110, and Low Average 80-90.

4 Results and Discussion

Table 2 shows that the experimental results affirm a level of intellectual intelligence all of students. Total sample were 84 students, and they fill five level of intellectual intelligence. Table 2 shows composition of the students in this study. The students were divided into 5 subgroup based on their intellectual intelligence level.

Table 2. Frequency Intellectual Intelligence Level

CPM level	Frequency	Percent	Cumulative Percent
Grade I	25	29.8	29.8
Grade II	35	41.7	71.4
Grade III	21	25.0	96.4
Grade IV	2	2.4	98.8
Grade V	1	1.2	100.0
Total	84	100.0	

The test results were analysed with Pearson's correlations. Table 3 shows that the correlation analysis between intellectual intelligence and figural creativity which the significance value 0.043 < 0.05. Therefore, a positive relationship exists between intelligence and the figural creativity levels of the students. Thus, the hypothesis is accepted.

Table 3. Correlation between the CPM and TKF test results

		TKF Score
CPM Score	Pearson Correlation	.221*
	Sig. (2-tailed)	.043
	N	84

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4 shows the figural creativity level of the subgroup based on intellectual intelligence level.

Table 4. Intellectual intelligence level and Figural Creativity Level Crosstabulation

CPM Level	TKF Level				Total
	Superior	High Average	Average	Low Average	
Grade I	1	2	14	8	25
Grade II	0	5	24	6	35
Grade III	0	1	12	8	21
Grade IV	0	0	0	2	2
Grade V	0	0	0	1	1
Total	1	8	50	25	84

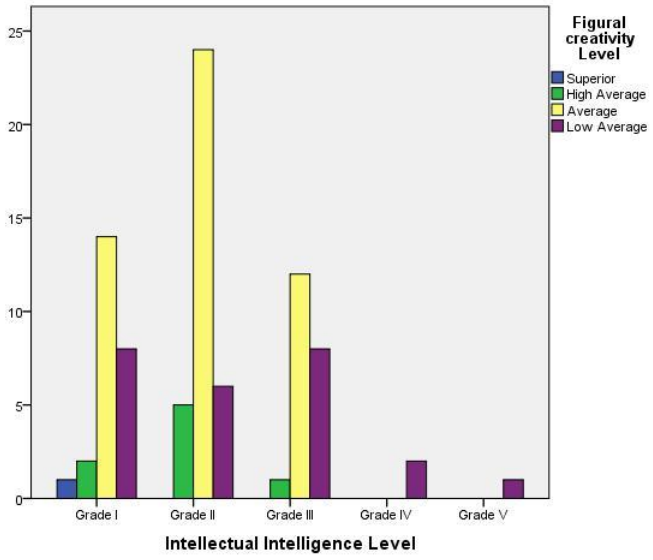

Fig. 1. CPM and TKF test results

The second analysis was conducted to find out "whether the level of figural creativity of students who have intellectual grade I, grade II, grade III, grade IV, and grade V".

Table 5. Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
TKF	84	95.95	8.214	85	120
CPM Level	84	2.04	.870	1	5

Table 5 shows descriptive statistics of figural creativity score from all sample. Mean of figural creativity score = 95.95, standard deviation = 8.214, with minimum score = 85 and maximum score = 120.

Table 6. Descriptive Statistics J-Test

	TKF Score
Observed J-T Statistic	948.000
Mean J-T Statistic	1190.000
Std. Deviation of J-T Statistic	121.382
Asymp. Sig. (2-tailed)	.046

4.1 Grouping Variable: CPM Level,

Table 6 shows that J-test statistic value = 948.0, mean=1190.0, standard deviation 121.3, and the result asymp.sig(2-tailed) value = 0.046 < 0.05. Based on the result, the second analysis were rejected. A very important finding in this study is the higher the level of intellectual intelligence level, the higher the figural creativity level.
Another important finding is that certain students have the “Grade I” CPM level (intelligence levels are high average), but the figural creativity levels are “Low average”.
Table 7 shows, the 84 participants in the test, 25 have the “Grade I” CPM level, but eight students (32%) of them have the figural creativity levels “Low average”

Table 7. TKF test results on the percentage of students who have the Grade I CPM level

		Frequency	**Percentage (%)**
TKF level	Superior	1	4
	High average	2	8
	Average	14	56
	Low average	8	32
Total		25	100

On the basis of the data, authors argue that not all children with high average intelligence levels will have high average figural creativity levels, too. Thus, stimulation is needed for figural creativity.
Learning tools that allow for experimentation and exploration to deliver varied information will hopefully provide stimulation to children from several sides.
On the basis of the results of previous research and discussion, we can conclude that a positive correlation exists between students' intellectual intelligence and figural creativity with a significance value at 0.043< 0.05.

5 Conclusion

Not all elementary students with high CPM scores have high TKF scores. Some have high CPM scores but with low TKF scores. Differences in information, learning tools and family background greatly affect the level of creativity of each student.

For the improvement and alignment of creativity with IQ, learning facilities in the form of teaching and supporting materials that stimulate the creativity of elementary school students are needed. These facilities should be given To schools where they will be evenly utilised by all elementary school students.

This study is limited to using a sample of one city with a sample size of 80 students. Only private schools are used as sampling sites. CPM is chosen as the measuring tool because it can be used for collective testing in children

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