# Intelligent Quotient, Developmental Profiles, and Early Science Literacy in Primary School

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Abstract : Intelligent quotient (IQ), developmental profile, and early science literacy have an important role for students at the beginning of primary school learning. This study aims to obtain a profile picture of Intelligent Quotient (IQ), progression profile, and early science literacy. The research method used is the preliminary to developmental research with mixed method technique (quantitative and qualitative). The IQ data and development profile are analysed using expo facto. Meanwhile the early science literacy data was analysed using the open questions. The results showed that learners in the first year of elementary school are able to acquire the concept of science through pictures and language activities. The image of science becomes a means to increase the literacy of science. Intelligent question and developmental profile levels are related to the ability of science literacy at the initial level. Thus, the results of this study contribute to provide activities that integrate language and other activities of science.

## 1 INTRODUCTION

The old view of Intelligent Quotient (IQ) or intelligence in cognitive measurement shows that the quality of intelligence is high. The quality of this intelligence is seen as an aspect that influences one's success in learning. In addition, other views conclude that emotional maturity factors predominantly influence one's success in life. Emotional maturity is one part of the child's developmental profile. The profile of child development is characterized by aspects of creativity, social, motor, cognitive, language, imagination, and emotion. A survey of a group of parents concluded that many children that are less successful due to emotional difficulties. One aspect relating to emotional maturity is language skills (Zafari and Biria, 2014).

Language ability is nothing more than a person's ability to contain words or sounds combined with a whole sentence/ sentence that can be understood by himself or others. A person that is able to make the words of the image also have entered literacy (Chang, 2012a). Literacy is the ability of individuals to read, write, talk, calculate and solve problems of/ with the level of expertise required in work, family, and society. However, the emotional and literacy aspects develop through education. Therefore, in the early days of school education, it is necessary to know the development profile of the child's IQ. Children should be prevented from delaying language skills (Nelson et al., 2011). For children that have IQs, developmental profiles and literacy skills will both affect their level of learning readiness. The level of child's learning readiness can be measured by these three factors of a psychologist assessment. The three variables IQ, development profile and literacy skills that exist in a person can interact and even influence each other. Several studies have shown that IQ affects the level of readiness of children. Similarly, aspects of the child's self-development profile can affect the readiness and success of the child's learning. The good teacher knows and understands the state of the progression profile of the students. This child development profile involves creativity, social, motor, cognitive, imaginative, emotional, and linguistic aspects. Language aspects are closely related to literacy skill including literacy to science and the environment. Understandably, the ability of science literacy can influence the care of learners in the natural surroundings. So the development of the

profile of learners will be in line with the competence of their science literacy.

A number of studies suggest that there is a close connection between the intellectual ability and language skills (Lean et al., 2018). Similarly, the intellectual and linguistic abilities in children predict their long-term ability (Brumberg and Shah, 2015) more easily. Therefore, to understand these two capabilities, it requires various means: visual, verbal and literal expression of real objects such as visualization of science literacy (Akmajian et al., 2017; Zakia et al., 2017). Simple visualization of images with concrete object themes can make it easier for children to understand aspects of the development profile.

In connection with the case above, the study is intended to find out the dynamic progression of the students ' profile, and the strategy for the development of the profile. The question arises from the assumption that the development of this child profile is dynamic. The dynamics of this developmental profile will occur at any time when the child experiences learning and interacts with others. In order that teachers understood the state of children' readiness to learn and provided appropriate stimulation, it is necessary to learn about IQ profiles, self-development and literacy science. This study wanted to reveal the profile of IQ, developmental profile, and science literacy of learners and see the relationship between IQ, development profile and science literacy.

## 2 METHOD

This study is a follow-up research from a series of development research using mixed method. This study using the data in psychological measurement results from the beginning of the learning process, such as IQ measurement and development profile that is quantitative. The profile data consists of the following aspects: creativity, social, motor, cognitive, language, imagination, and emotion. Learners' science literacy data is obtained by using early science literacy instruments. This developmental study is divided into 6 Grades. This study was conducted in the Grade 1 (see Table 1).

Table 1: Stages of Research

| Phase | Grade | Measurement Component |
|---|---|---|
| Early stage | 1 | • Intelligence Quotient (IQ) <br> • Progress Profile <br> • Perception of Parents |
| 1st Intermediate stage | 2 | • IQ <br> • Progress Profile <br> • Early Science Literacy |
| 2nd Intermediate stage | 3-5 | • IQ <br> • Progress Profile <br> • Early Social Sceince Literacy, Media, ect |
| Last stage | 6 | • IQ <br> • Progress Profile <br> • Perception of Parents |

The participants of this study were 48 students Grade 1 of elementary school in Bandung, Indonesia. To measure IQ and Profile of the students' self-improvement was done by psychological measurement agencies from a number of state universities. The profile of development consists of aspects of creativity, social, motor, cognitive, language, imagination, and emotion.

### 2.1 Research Instruments

The research instrument consists of 2 stages. First stage IQ measuring instrument and Progress profile. This first stage aims to know the number of IQ. Profile of progress to know the scores of creativity, social, motor, cognitive, language, imagination and emotional aspects. While the second stage measured component is the ability of early science literacy on learners by using the concept of science through coloring activities, and answering the question on science as much as 6 activities. Instrument consists of 2 (two) types of package questions, which are about pet and flower. Each learner only gets 1 (one) type of question.

### 2.2 Data Collection and Analysis

The data collected included the results of IQ measurements, the developmental profiles and early science literacy. A student's IQ score ranges from less than 90 to over 130. The progression profile score ranges from less than 34 to over 65. Early science literacy skills were measured using rubric with a score range of $0 - 4$, so that the probability of scores obtained is from 0 to 24. IQ score qualification uses Table 2 below.

Table 2: Qualification of IQ

| Intelligent Quotient (IQ) | Qualification |
|---|---|
| 130-139 | Very superior/ gifted |
| 120 -129 | Superior |
| 110 - 119 | Above average |
| 90 - 109 | Average |
| 80 - 90 | Below average |

Meanwhile, to qualify the score of the progression profile, rubric in Table 3 is used.

Table 3: Qualification of Developmental profile

| Score | Qualification |
|---|---|
| VH $\geq 65$ | very high (VH) |
| 55 – 64 | High |
| 45 – 54 | Fair |
| 35 - 44 | Low |
| 34 $\geq$ VL | very low (VL) |

To determine the score of literacy ability of early science learners, Table 4 is used. The scoring system is 0 for "No answer," 1 for "Wrong Answer," 2 for "fair answer," 3 for "good answer," and 4 for "excellent answer."

Table 4: Qualification of Early Science Literacy

| Score | Qualification |
|---|---|
| < 17 | below average |
| 17 – 19 | average |
| > 19 | above average |

The entire data, whether obtained from the measurement or questionnaire is presented in tabular form. Then, it is processed by calculating the average score, and then interpreted based on qualification table. The overall data is presented based on qualifications presented in Table 2, 3 and 4. Meanwhile, the profile picture of the three variables is presented in graphics. Each graph is interpreted based on existing data variations. In addition, in order to explore the meaning of the graph, discussion regarding the relationship between IQ variables and Developmental Profile with the ability of early science literacy is conducted. Some proficiency profiles of early science literacy from learners as a sample of 48 students is also eleboarated.

## 3 RESULTS AND DISCUSSION

### 3.1 The IQ Profile, Development Profile and Early Science Literacy

Based on IQ data analysis, Developmental Profile and Early Science Literacy of 48 students, it is shown that ach student has an IQ score, Developmental Profile

and Early Science Literacy as shown in Table 5 and Figure 1.

Table 5: Profile of IQ, Developmental Profile, and Early Science Literacy

| No | Qualification ($N_{Tot}$=48) | | |
|---|---|---|---|
| | Intelligent Quotient (N) | Developmental Profile (N) | Early Science Literacy (N) |
| 1 | Below Average (0) | Very Low (12) | Below Average (5) |
| 2 | Average (15) | Low (18) | Average (29) |
| 3 | Above Average (9) | Fair (9) | Above Average (14) |
| 4 | Superior (17) | High (8) | |
| 5 | Very Superior (7) | Very High (1) | |

Table 5 shows that, out of 48 learners, no one has an IQ in the category Below Average (range 80-90 consists of 0 person). Most students belonged to Superior qualifications which is in the range 130 - 139 (17 people). For Developmental Profile, there is only one person who had Very High ($\geq$ 65) qualification and there are 18 people who fall in the range 35-44 score. Regarding the ability of Early Science Literacy, there are 29 people who reached the Average qualification (17 - 19), and 5 people who fall into the category of Below Average qualification (<17). This shows the existence of IQ variations even in a group of learners who are at the same level.

Regarding Developmental Profile and Early Science Literacy skills, several studies indicated that child IQ always shows variation even though they are in the same age range (Goodman, 1995). Similarly Heineman (2017) mentioned that the different qualifications of IQ will be related to the profile of a person's motor skills. Similarly, Eberbach & Crowley (2017) stated that there are variations or differences in understanding science or literacy science in a group of children aged 6 -9 years due to differences in the ability to observe the environment.

### 3.2 Profile of Early Science Literacy based on IQ Qualification

Based on the results of data analysis, the average learners' ability in the profile of early science literacy based on the qualification of IQ is shown in the following figures:
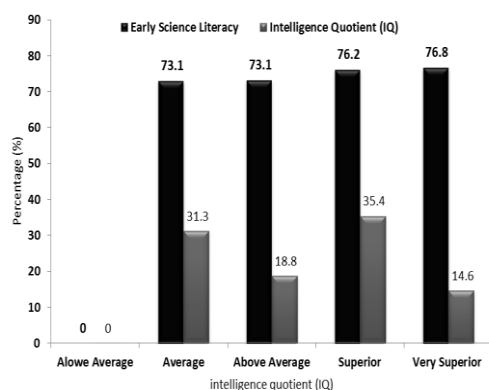
Figure 1: Profile of Early Science Literacy Based on Intelligent Quotient

Figure 1 shows that children IQ group at Very Superior level has the highest percentage of Early Science Literacy (ESL) ability of 76.8%. Meanwhile the lowest ESL score is owned by the group of learners on Average and Above Average. Based on the measurement results, no students are classified as children with IQ Allow Average. The ESL capability in this study consists of six learner activities: colouring flowers or animals, naming, flowering or favourite foods, identifying places or ways of breeding, traits, and expressing experiences related to flowers or animals. The ability to identify an object or feature relates to an IQ level. Objects in the form of drawings created by learners in the first year of school support them in expressing their literacy skills (Hopperstad, 2010). Based on analysis of the relationship between IQ and ESL, it is obtained the correlation coefficient of 0.23 or low category.

This implies that IQ qualitatively in this case is related to the ability of children science literacy. For most children, the higher the IQ, the higher the ESL. The child's IQ will determine some aspects of child ESL such as creativity, cognitive, identification, language, and imagination (Karwowski et al., 2016; Salavera et al., 2017; Zafari and Biria, 2014). The child's IQ will be optimized in the learning process. Learning programs can enhance creativity, cognition, language and imagination. Just as McCann (2005) states that the relationship between IQ and child creativity has implications for learning materials. In line with that Dadvar et al., (2012) concluded that the creativity and behaviour of children associated with emotional intelligence.

## 3.3 Profile of Early Science Literacy based on Developmental Profile

Based on the result of data analysis, the average ability skill of early science literacy of learners based on the qualification of Developmental Profile as the following graph.
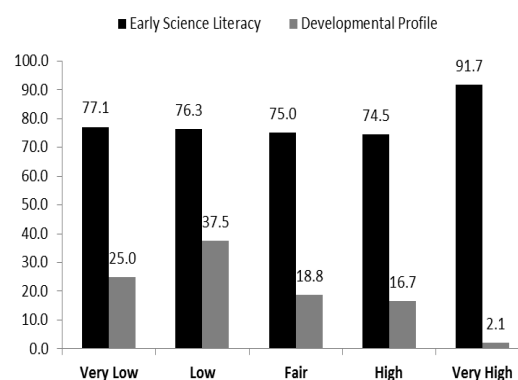


Figure 2: Profile of Early Science Literacy Based on Developmental Profile

Figure 2 shows that the children's group at the Very High (2.1%) Developmental Profile (DP) levels has the highest percentage of Early Science Literacy (ESL) ability of 91.7%. While the lowest ESL 74.5% is owned by the High learner group that is as much as 16.7% of all learners. Based on the measurement results, no students are classified as children with Low category of IQ Average. The ESL capability in this study consisted of six activities: coloring flowers or animals, naming, flowering or favorite foods, identifying places or ways of breeding, traits, and expressing experiences related to flowers or animals. The six activities are dominated by linguistic cognitive abilities. Based on the analysis of the relationship between ESL total score of cognitive aspect of Developmental Profile. It was obtained coefficient of 0.21 (low category)

Based on the above analysis, linguistic factors are more dominant in influencing ESL than cognitive factors. To have a good ESL, learners get support from their ability on concrete aspects (Poehner and Infante, 2017). Similar to colouring flowers or animals, it is an expression of the real experiences of learners in their life. Learners who have experience, either directly or indirectly about plants or animals, reveal various physical characteristics more easily (Sharifian, 2017). Thus, the physical characteristics of an object or living creature are more easily remembered or understood by the learner (Akmajian

et al., 2017). This implies the need for a learning process that is real or experienced directly.

## 3.4 Two Activities of Early Science Literacy

The results of ESL data retrieval instrument are obtained from two kinds of stuffs produced by the students.



Figure 3 Sheet 1 Early Science Literacy: 1st Flowers



Figure 4. Sheet 1 Early Science Literacy: 2nd Flowers

Figure 3 and 4 shows 2 results of the instrument field on ESL in the group interest. Both learners had different imaginations or creativity in colouring flowers. The colour of the main part of the flower that is often seen in laying is one type of colon. However, there are learners that have different imagination. This shows the colouring ability of the learner for the same object with different colours. Through images of flowers or chickens, then learners can understand the concept of science more easily. It is in line with what Chang (2012b) stated that images can be used to help children acquire the concept of science. Images can also support children in interpreting visual modes and using to convey meaning  (Hopperstad, 2008).



Figure 5 Sheet 1 Early Science Literacy: 1st Chicken



Figure 6. Sheet 1 Early Science Literacy: 2nd Chicken

Figure 5 and 6 shows 2 results of the chicken image used to reveal the ESL of the learners. In the chicken picture (see Figure 5), a learner provided different colours. The way the student coloured the image looked neater compared to Figure 6. In Figure 6, learners only used one colour and he did it less neatly.

Figure 5 is an example of the work of the first learner who managed to give a varied color on parts of the chicken image. Compared to Figure 6, the learner's colouring result (See Figure 5) indicated their various understanding of the characteristics of the object. The use of various colours on the object give an idea of the participants ability to reveal a better experience (Sorge et al., 2017).

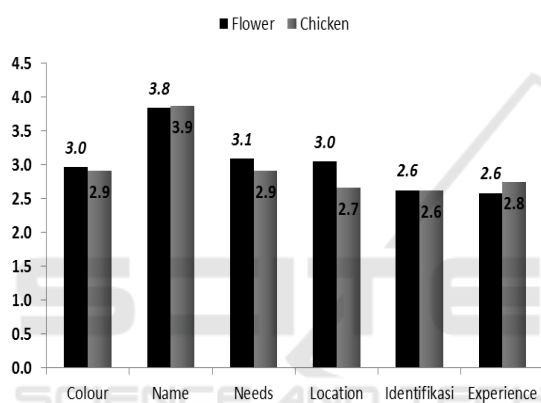Based on ESL data analysis, information is obtained as the following graph.



Figure 7: Sheet of Early Science Literacy

Figure 7 shows the ESL learners' ability the higher interest scores of the average score on some aspects (colour, needs and location) compared to the chicken image. However, learners that fill the worksheet chicken shows higher ability in 2 aspects (name and experience). While the ability of learners in identifying flower or chicken characteristics have the same average score: that is 2.6. Based on the above analysis, the skills to identify an object of the environment is still quite difficult for learners. Both groups of learners have different imaginations or creativity. As stated by Guay et.al (2010) that the child is able to convey his own various types of observations. This ability can indicate their literacy differentiation even in one study group. In addition, gender factors can affect the differentiation (Theriault et al., 2017).

# 4 CONCLUSIONS

Based on the results of research and discussion, it can be concluded that students in the first year in elementary school is able to obtain the concept of science through pictures and language activities. The image of science becomes a means of increasing the literacy of science. Intelligent quetions and developmental profile levels are related to the ability of science literacy at the initial level. So the results of this study have implications for the importance of schools or teachers to provide activities that integrate between the activities of language and other science.

# ACKNOWLEDGEMENTS

# REFERENCES

Akmajian, A., Demers, R.A., Farmer, A.K., Hamish, R.M., Bicmore, L., 2017. An Introduction to Language and Communication, 6th edition. ed. MIT Press.

Brumberg, H.L., Shah, S.I., 2015. Born early and born poor: An eco-bio-developmental model for poverty and preterm birth. J. Neonatal-Perinat. Med. 8, 179–187. https://doi.org/10.3233/NPM-15814098

Chang, N., 2012a. The Role of Drawing in Young Children's Construction of Science Concepts. Early Child. Educ. J. 40. https://doi.org/10.1007/s10643-012-0511-3

Chang, N., 2012b. What are the roles that children's drawings play in inquiry of science concepts? Early Child Dev. Care 182, 621–637. https://doi.org/10.1080/03004430.2011.569542

Dadvar, R., Mohamadrezaii, M., Fathabadi, M.H., 2012. The Relationship between Emotional Intelligence and Creativity of Female High School Students in Baft City 10.

Eberbach, C., Crowley, K., 2017. From Seeing to Observing: How Parents and Children Learn to See Science in a Botanical Garden. J. Learn. Sci. 26, 608–642. https://doi.org/10.1080/10508406.2017.1308867

Goodman, R., 1995. The relationship between normal variation in IQ and common childhood psychopathology: A clinical study. Eur. Child Adolesc. Psychiatry 4, 187–196. https://doi.org/10.1007/BF01980457

Guay, F., Chanal, J., Ratelle, C.F., Marsh, H.W., Larose, S., Boivin, M., 2010. Intrinsic, identified, and controlled types of motivation for school subjects in young elementary school children. Br. J. Educ. Psychol. 80, 711–735. https://doi.org/10.1348/000709910X499084

Heineman, K.R., Schendelaar, P., Heuvel, E.R. van den, Hadders-Algra, M., 2017. Investigate associations between motor development measured with the Infant Motor Profile (IMP) in infancy and IQ at the age of 4 years. Eur. J. Paediatr. Neurol. 21, e156. https://doi.org/10.1016/j.ejpn.2017.04.1150

Hopperstad, M.H., 2010. Studying meaning in children's drawings. J. Early Child. Lit. 10, 430–452. https://doi.org/10.1177/1468798410383251

Hopperstad, M.H., 2008. How children make meaning through drawing and play , How children make meaning through drawing and play. Vis. Commun. 7, 77–96. https://doi.org/10.1177/1470357207084866

Karwowski, M., Dul, J., Gralewski, J., Jauk, E., Jankowska, D., Gajda, A., H. Chruszczewski, M., Benedek, M., 2016. Is creativity without intelligence possible? A Necessary Condition Analysis. Intelligence 57. https://doi.org/10.1016/j.intell.2016.04.006

Lean, R.E., Paul, R.., Smyser, C.., Rogers, C.., 2018. Maternal intelligence quotient (IQ) predicts IQ and language in very preterm children at age 5 years. Journal of Child Psychology and Psychiatry 59, 150–159.

McCann, M., 2005. International perspectives on giftedness: Experimental and cultural observations of IQ and creativity with implications for curriculum and policy design 6, 125-135.

Nelson, K.E., Welsh, J.A., Trup, E.M.V., Greenberg, M.T., 2011. Language delays of impoverished preschool children in relation to early academic and emotion recognition skills. First Lang. 31, 164–194. https://doi.org/10.1177/0142723710391887

Poehner, M.E., Infante, P., 2017. Mediated Development: A Vygotskian Approach to Transforming Second Language Learner Abilities. TESOL Q. 51, 332–357. https://doi.org/10.1002/tesq.308

Salavera, C., Usán, P., Chaverri, I., Gracia, N., Aure, P., Delpueyo, M., 2017. Emotional Intelligence and Creativity in First- and Second-year Primary School Children. Procedia - Soc. Behav. Sci., Education, Health and ICT for a Transcultural World 237, 1179–1183. https://doi.org/10.1016/j.sbspro.2017.02.176

Sharifian, F., 2017. Cultural Linguistics and linguistic relativity. Lang. Sci. 59, 83–92. https://doi.org/10.1016/j.langsci.2016.06.002

Sorge, G.B., Toplak, M.E., Bialystok, E., 2017. Interactions between levels of attention ability and levels of bilingualism in children's executive functioning. Dev. Sci. 20. https://doi.org/10.1111/desc.12408

Theriault, V., Smale, M., Haider, H., 2017. How Does Gender Affect Sustainable Intensification of Cereal Production in the West African Sahel? Evidence from Burkina Faso. World Dev. 92, 177–191. https://doi.org/10.1016/j.worlddev.2016.12.003

Zafari, M., Biria, R., 2014. The Relationship between Emotional Intelligence and Language Learning Strategy Use. Procedia - Soc. Behav. Sci., Proceedings of the International Conference on Current Trends in ELT 98, 1966–1974. https://doi.org/10.1016/j.sbspro.2014.03.630

Zakia, D.L., Sunardi, S., Yamtinah, S., 2017. THE STUDY OF VISUAL MEDIA USE ON DEAF CHILDREN IN SCIENCE LEARNING. Eur. J. Spec. Educ. Res. 0.