INTRODUCTION

Intelligence is a fundamental factor which can predict academic achievement in schools, and has an important role in students’ future success (Kuncel et al., 2004; Chamorro-Premuzic & Furnham, 2005). Intelligence plays a role on students’ ability to absorb new information or new knowledge and to make it as the bases to process and solve a problem. Intelligence has a strong correlation with individuals’ cognitive ability such as, thinking, remembering, reading, learning, problem solving, and language usage (Binet, 1905; Zeidner, 1995; Zenderland, 1998). Intelligence can be measured using psychometric tools known as the test of intelligence quotient (IQ) test.

Intelligence quotient (IQ) is a common term used to explain the attributes of thoughts encompassing a number of abilities, such as, reasoning, planning, problem solving, abstract thinking, concept understanding, language using, and learning. IQ is the ability of the individuals enabling them to give the appropriate response towards a stimulus received (Thorndike, 1923). Furthermore, the ability is specifically explained by Binet and Simon (1916) and Varon (1963) saying that intelligence has three different elements, those are, direction, adaptation, and criticism. Direction involves any knowledge about what to do and how to do. Adaptation refers to the ability to choose strategies, to do tasks, and then to adapt the tasks. Furthermore criticism refers to the ability to criticize our own thoughts and actions. Zeidner (1995) stated that the people who had low intelligence were more likely to feel frustrated in the process of education, aggressive, and impulsive.

An individual's abilities and capacity to learn can be partly uncovered by the use of verbal and non-verbal (henceforth performance) intelligence tests. IQ provides a standardized method for measuring intellectual abilities and is widely used within education, employment and clinical practice (Deary et al., 2000). The distinction between verbal and nonverbal IQ was not originally based on empirically driven theory; rather, Wechsler’s original IQ scales differentiated verbal from performance (nonverbal) primarily for practical reasons (McGrew and Flanagan, 1998).

The contribution of intelligence quotient (IQ) on biology academic achievement of senior high school students in Medan, Indonesia

Academic achievement can be used as an indicator of learning success, and can prepare the students to pursue higher education. It has an important role for students’ future success. One of the factors correlating to academic achievement is intelligence. This research aims to investigate the correlation between intelligence quotient (IQ) and Biology academic achievement of the students in Medan, Indonesia. The subjects of this research are 240 students. The result of this research showed that there was a correlation between intelligence quotient (IQ) and Biology academic achievement with regression equation of $Y = -11.587 + 0.882X$ ($F = 324.490, \alpha = 0.000$). The result of the R square analysis shows that IQ gives 57.7% contribution on Biology academic achievement. Based on the research result, it is suggested that the Biology teachers pay attention on the IQ factor to suit the teaching lesson plan in order to get the best Biology academic achievement.

Key words: Intelligence quotient, Biology achievement, senior high school students, natural science.

Pratama Anggi Tias, Syamsuri Istamar, Adi Atmoko and *Aloysius Duran Corebima

Biology Department, Faculty of Mathematics and Science, State University of Malang, Indonesia.

*Corresponding Author: Email durancorebima@yahoo.com

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The score of IQ test is used as a good predictor of students’ academic achievement in schools, work performance, work achievement, income, and any other aspects affecting the success in life (Gottfredson, 2004; Herrnstein and Murray, 1994). The correlation between IQ score and academic achievement (Neisser et al., 1996) varies depending on the policy used. Students who have high academic achievement also have high IQ score, and vice versa (Detterman and Daniel, 1989). Students having high IQ score are likely to perform better in schools than those whose IQ scores are low (Coyle and Pillow, 2008). The prediction of academic achievement has become an important topic discussed in current researches (Lazano et al., 2013).

There has been a long debate on the factors affecting academic achievement and intelligence (Miele, 2002). Shapiro (1998) found that nowadays parents were trying hard to make their children more intelligent and at least had higher IQ score. Parents believe that people having high IQ will be more successful in both academic career and life, so that they try to provide their children the best facilities in order to become more intelligent and to have excellent cognitive ability (Phillipson, 2012). Intelligence also has a significant correlation and contribution to the other variables such as, curriculum, study program, teachers, school characters, and any other aspects of school (Naglieri and Bornstein, 2003) and has reciprocal relationship. Therefore, schools, families, and the students themselves need to pay attention to the academic achievement of individuals.

The academic achievement related to biology learning senior of high school students refers to the students’ achievement in mastering the material in Biology. Academic achievement is formulated in the form of numbers which can reflect the students’ ability after following the classroom instruction (Sudjana, 2005; Mansur, 2012). Students’ success in mastering the learning material can be measured by the result of a test in the form of score, and can be used to evaluate teaching learning process in a certain period of time.

Students are required to be able to develop their intelligence and knowledge independently and actively. Students need to have thinking skills that can help in making decisions that are reliable and in acquiring new knowledge quickly (Lau, 2011). It means that there is an ability to understand oneself and the efforts to gain stable image, to encourage students’ positive behaviors and to prevent negative behaviors. Occasionally, students experience difficulties in conditioning their attitudes, thoughts, and themselves positively.

Surveys on state senior high school teachers in Medan indicate that there is still a problem in the teaching learning process of Biology. The students’ academic achievement is still very low, indicated by 50% students who do not pass the test. Teachers assume that IQ is the main factor affecting the low academic achievement of the students. Besides, the result of the IQ test is used as the reference to help students decide their majors in school.

Based on the explanation above, it is necessary to conduct a correlation research investigating the correlation between IQ and academic achievement of Biology. This research aims to investigate how significant the correlation between IQ and Biology academic achievement of senior high school students in Medan, Indonesia, among those students of the tenth grade. The process and product of this research is expected to give contribution to natural science, especially biology education.

METHOD

Participant

The population of this research was all of the senior high school students in Medan, Indonesia. The samples of this research were taken by random sampling from the state senior high school as much as 240 students.

MATERIAL AND PROCEDURE

This research has been carried out by survey method in correlation quantitative approach or ex post facto from March until November 2015. The instruments used in this research were a standardized test to measure the students’ IQ called Culture Fair Scale Intelligence (CFIT) test (Cartel, 1940) as well as a multiple choice test and an essay test related to Biology achievement.

The instruments used in this research (CFIT - 3a & b) have 3 scales of evaluation to measure the students’ IQ. Besides this instrument, there were another instruments, such as a multiple choice test and an essay test to measure students’ Biology achievement. This test contained four subsections such as a) Series, b) Classification, c) Matrices, d) Typology. Raw scores on each subtest are summed together to form a composite score, which may also be converted into a standardized IQ. The instrument for Biology achievement test was validated.

Data were analysed by descriptive and inferential statistics (Pearson correlation analysis as well as linear regression analysis). The inferential analysis began with the prerequisite testing to know if the data distribution was normal. The Pearson Correlation Analysis was used to uncover the correlation between students’ IQ and Biology academic achievement. The linear regression analysis was used in order to uncover the significance of the correlation, as well as the linear regression equation. The data analysis were carried out by SPSS 17 for windows.

RESULT

Table 1 shows the summary of the descriptive statistics of IQ and Biology achievement of the students. This result shows that mean of student’s IQ is 99.88 and mean of
Biology achievement is 76.49.

The R value of this correlation is 0.760 and the R² value is 0.577 (57.7%). Based on the R² value, the academic achievement (Y) of the students in Biology can be explained by the IQ as much as 57.7%, and this achievement is affected too by other variables as much as 42.3%.

Table 2 and 3 shows the summary of the statistical test of simple regression analysis between IQ and Biology achievement of the senior high school students. The linear regression graph of the correlation between IQ and Biology achievement shows that regression line directs to the right upward. The Graph showing the linear regression between IQ and Biology academic achievement is shown in Figure 1.

Based on the data analysis presented at the Table 2, the value of $a = -11.587$; $b = 0.882$, thus the regression equation $Y = -11.587 + 0.882X$

Based on the data analysis presented at the Table 3, the value of $F= 324.490$. Thus the correlation between IQ and Biology achievement of the students is very significant.

### DISCUSSION

The result of research shows that there is a linear correlation between IQ and Biology achievement. Students having the higher IQ are relatively more easily to understand the learning material and more actively undergo the learning process, so that they have more potential to succeed in learning and their academic achievements are more optimal. In the same condition, students having higher intelligence are more success than those having lower intelligence. According to this statement, it can be concluded that higher IQ can give better learning process and assist the students to gain better achievement.

The finding of this research is in line with the research result reported by Deary (2007) that intelligence correlates with academic achievement with the correlation coefficient 0.81 and gives positive contributions toward 25 lessons. Furthermore, research conducted by Muammar (2001) using the gifted students as the research subjects also shows a significant correlation between intelligence and academic achievement. The correlation between students IQ and their academic achievement in schools varies depending on the level of the student development as well as of the lessons (Kytala and Lehto 2008; Strenze 2007; Taub et al., 2008).

The cognitive achievement covers: remembering, understanding, applying, analyzing, evaluating, and creating (Anderson and Krathwohl, 2001). Academic achievement is the result of the teachers’ assessment toward students’ learning result and their performance after joining the classroom instruction. The assessment is conducted in order to know how much the result of the students’ learning has met the instructional objectives, related to the content aspects as well as to the behavior aspects (Winkel, 2004; Sudjana, 2006). It can be concluded that academic achievement is the result of the teachers’ assessment, in the form of test result, toward the result of the students’ learning displaying students’ mastery of the lesson and the behaviors as a result of the classroom learning. Furthermore, cognitive ability is a strong predictor of success in life, including later educational achievement and income (Fergusson et al., 2005; Kuncel et al., 2004; Lounsbury et al., 2003; Strenze 2007).

The result of the hypothesis test showed that there is a positive correlation between IQ score and Biology achievement, in which the higher the students’ IQ score is, the higher their Biology achievement is. Conversely, the lower the students’ IQ score is, the lower their Biology achievement is. This result is in line with a number of researches which consistently report the positive correlation between intelligence and memory capacity supporting student academic achievement (Ackerman et al.,

<table>
<thead>
<tr>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Sum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ</td>
<td>240</td>
<td>25</td>
<td>90</td>
<td>115</td>
<td>23972</td>
<td>99.88</td>
</tr>
<tr>
<td>Biology Achievement</td>
<td>240</td>
<td>26</td>
<td>68</td>
<td>94</td>
<td>18358</td>
<td>76.49</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>240</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>-11.587</td>
<td>4.896</td>
<td>-2.367</td>
<td>.019</td>
</tr>
<tr>
<td>IQ</td>
<td>.882</td>
<td>.049</td>
<td>.760</td>
<td>18.014</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Biology achievement
The result of this research shows that IQ has a large contribution on students' achievement as much as 57.7%. This research result is in line with Walberg (1984), and Rohde and Thomson (2007) saying that the contribution of IQ to students' achievement was ranging from moderate to high, typically was about 50% to 75%. Furthermore Gagne and St. Pere said too that IQ score were the indicators cognitive ability. Based on the size of the contribution, the intelligence quotient (IQ) affects students' achievement significantly, in which students having high level of intelligence are likely to get higher academic achievement. Conversely, students who have low level of intelligence will presumably have low academic achievement. These findings are in line with Lanawati (1999), Setiadi (2001), 2005; Colom et al., 2008; Conway et al., 2003; Oberauer et al., 2008; Shelton et al., 2009).

![Figure 1: The Linear Regression Graph of The Correlation between IQ and Biology achievement of the Students.](image)

![Table 3. The Summary of ANOVA Test of Correlation Regression between IQ and Biology Achievement of The Students](table)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>4638.119</td>
<td>1</td>
<td>4638.119</td>
<td>324.490</td>
<td>.000&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Residual</td>
<td>3401.864</td>
<td>238</td>
<td>14.294</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8039.983</td>
<td>239</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), IQ
b. Dependent Variable: Biology achievement
Sulaeman (2008) and Hendriani (2008) who stating that IQ has a correlation and contribution on academic achievement.

Based on the finding of this research, it can be used as the basis to conclude that intelligence can predict students’ academic achievement. This is in line with Laidra, et al. (2007) stating that IQ can predict students’ academic achievement. Moreover, Vellutino et al. (2003) and Fuschs and Young (2006) stated that a good cognitive processing of IQ could predict students’ success. This research gives practical significance to schools related to the education holders, teachers, and parents in understanding or predicting students’ academic achievement. However, it is not impossible that students with low level of intelligence will have high academic achievement, or vice versa (Winkel, 1997).

The intelligence quotient is proven to be sufficiently effective to generate certain ideas relying on the work of memory (Nusbaum and Silvia, 2011). Intelligence does not only mean as an intellectual ability, as well as the thoughts relating to the Biology achievement of students in schools. There are some other factors correlating to the Biology achievement of students in schools. Based on the result of this research, other factors correlating and contributing to biology achievement not revealed are as much as 42.3%. Those factors include school attendance and engagement, students personality traits, motivation and effort, the extent of parental support, and the provision of appropriate learning experiences, teaching quality, school ethos, health, and emotional state (Petrides et al., 2005; Strand, 2003; Kane and Brand, 2006; Perry et al., 2006; Schunk et al., 2008). Previous study showed that socio-economic status factor (Akhtar, 2012) and learning methods (Wyk, 2012 and Yapici, 2012) have positive effect on students academic achievement.

IQ cannot function properly without the participation of emotion towards to lessons taught in schools. According to Goleman (1995), the contribution of IQ toward someone’s success is 20%, and the remaining 80% is due to emotion. Education in schools does not only develop intelligence quotient (IQ) but also emotional quotient.

Based on students’ academic achievement, teachers can classify the students in the classroom into high achiever, mid-achiever, or low achiever. Academic achievement is usually stated in the form of number, letters, or sentences, and can be achieved within specific periods. Academic achievement can give satisfaction for the persons involved, especially for students. Therefore, it is important to pay careful attention on the factors affecting the academic achievement, one of which is intelligence quotient which is also the fundamental or internal factors of individuals.

CONCLUSION

It can be concluded that the intelligence quotient variable (IQ) has a strong correlation on Biology achievement of senior high school students in Medan and has the contribution as much as 57.7% (F = 324.490, p = 0.000). The academic achievement can be predicted based on the intellectual quotient, but there are other factors yet affecting the Biology achievement of the students as much as 42.3% which has not been revealed in this research. Those other factors among others are students’ emotional quotient, students’ creativity, students personality characters, motivation and effort, the extent of parental support, and the provision of appropriate learning experiences, teaching quality, school ethos, health, and other possible factors.

Suggestions

Based on the result of the research, it is suggested that the school head master and Biology teachers pay attention on the IQ factor to suit the teaching lesson plan in order to get the best Biology achievement. Furthermore, students’ parents and societies are suggested to be more concerned on the development of their children, because if the children are only provided with material belongings without enough attention from their parents, it will be less beneficial for the development of the children. Those efforts are parts of character education which aims at creating students who are intelligent, creative, independent, responsible, and courteous.

There are still the other factors which can affect student achievement, which will be further studied such as students’ emotional quotient and students’ creativity, students personality characters, motivation and effort, and other possible factors.

Conflict of interests

The authors declare that they have no conflict interests.

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