Correlation of Visual Acuity To Average Report Card Scores with High Index Scale Assessment of Grade 2 Students of Muhammadiyah 01 Medan Senior High School

Muhammad Fathan Arsya[1*], Zaldi Z[2]

[1,2]Muhammadiyah University of North Sumatra, Indonesia
[*] Corresponding author:
E-mail: fathanarsya90@gmail.com

Abstract.
Introduction: The eyes are important human senses for carrying out daily activities. Vision impairment is common and can be at risk of causing blindness. Globally, about 2.2 billion people have vision impairments, and more than 1 billion of them are preventable. Children aged 5-15 years are also affected, with 19 million of them experiencing visual impairments. Impaired visual acuity in children can affect their academic performance, as poor vision interferes with learning ability. The sharp decline in vision during the COVID-19 pandemic was exacerbated by excessive use of gadgets, leading to worsening visual impairment. If not treated appropriately, this disorder can hinder a child's development. Vision examination is essential to detect this problem early, and examination with the Snellen Chart is one of the effective methods in detecting such abnormalities. Objective: This study aims to see the relationship between the level of visual acuity and the average score of report cards in grade 2 students of SMA Muhammadiyah 01 Medan. Methods: The study used an analytical descriptive design with a cross-sectional approach. The research sample consisted of 71 2nd grade students of Muhammadiyyah Private High School 01 for the 2024/2025 school year. The sharpness of the vision was checked using the Snellen Chart, while the average score of the report card was taken from the student's academic data. Data analysis was carried out using the Chi-square test. Results: The majority of the research subjects based on the classification of the average score of the report card for normal vision were very good with the number of 17 samples (65.38%) and for the abnormal vision was good with the number of 15 samples (60%). The results of the Chi-square test obtained a p value of 0.042. Conclusion: There is a significant relationship between the level of visual acuity and the average score of the report card of students of SMA Muhammadiyah 01 Medan.
Keywords: *impaired visual acuity, eyes, average score of report cards, snelle and chart*

I. INTRODUCTION

The eyes are a vital human sensory organ for carrying out daily activities. However, vision problems are common, ranging from mild visual impairments such as visual acuity abnormalities to more serious problems that can lead to blindness [1].

Uncorrected visual acuity disorders, which are often the cause of vision problems, are essentially preventable. Evidence of this is that refractive errors are a priority in the World Health Organization (WHO) Report of the 2030 targets on effective coverage of eye care, which includes a target of reducing the prevalence of uncorrected refractive errors globally by 40% with the most affordable health care available [2]. The number of people suffering from visual acuity disorders worldwide is quite large. Globally, at least 2.2 billion people experience near or distance vision impairment. In at least 1 billion of these people, the vision impairment is preventable or has not been treated. Among these 1 billion people, there are 123.7 million uncorrected refractive errors that cause distance vision impairment or blindness. Of the many people who experience these disorders, approximately 19 million are children aged 5-15 years [3].

Visual impairment is a common eye health problem, especially among school-aged children. School-aged children have a high prevalence of this disorder. Visual impairment can cause several problems, such as decreased visual ability, impaired eye endurance during learning, and even personal life, which can hinder children's learning process. A study on visual acuity and the academic achievement of children at SDN 07 Jakarta showed that children with visual impairments had lower grades compared to children with normal vision [4]. A common visual acuity problem experienced by school-aged children is uncorrected refractive errors. Especially during the spread of COVID-19, the teaching and learning system in Indonesia has

changed from face-to-face to online. This has led children to use gadgets more frequently to interact and study at home, which has resulted in many children experiencing decreased visual acuity [5].

Visual acuity is the ability of the eye to translate and see an object located at a certain distance. When a child's visual acuity decreases, the child's ability to learn can be disrupted, which will cause the child to be unable to understand the material given well, resulting in their grades not being optimal, especially in high school students where the average report card grade is very important. In general, children experience complaints in the form of blurred vision when looking at writing on the board, decreased visual response speed, dry eyes after studying with gadgets, and children often experience dizziness. At the same time, if the disorder is not treated early, it will worsen the disorder in children over time, so it is important in the school environment to carry out routine checks to avoid these problems [6].

One of the main indicators in routine screening of children is a visual acuity test. This test has many methods, such as the Snellen Chart, LogMAR Chart, Pinhole test, and similar methods, which can be tailored to age and needs. Given this situation, we conducted a manual examination as an effort to address this problem by examining the Snellen Chart [7].

II. METHODOLOGY

This study used a descriptive analytical research design with a cross-sectional design. The study was conducted from May 2024 to January 2025 at Muhammadiyyah 01 Private Senior High School, Medan. The sample of this study was determined according to the inclusion criteria, namely all active students of grade 2 of Muhammadiyyah 01 Private Senior High School in the 2024/2025 academic year who were willing to undergo a Snellen Chart examination and provide their average report card grades in the last semester, as well as students who did not use or used glasses. Meanwhile, the exclusion criteria were students who were unwilling to be part of the research sample, students who were blind, and students who were absent for more than 15% of school days during 1 semester. Sampling in this study used the Slovin formula with a total of 71 samples. The steps in collecting this data are as follows: (1) Obtaining informed consent from all students with inclusion criteria who are willing to be research samples, (2) Conducting visual acuity examinations, (3) Recording the average report card grades in the last semester and (4) Data processing. The data was analyzed using univariate and bivariate analysis methods with the Chi-Square test.

III. RESULTS AND DISCUSSIONS

Table 1 Frequency Distribution of Subjects by Gender

Gender	Frequency (n)	Percentage (%)
Woman	34	47.9
Man	37	52.1
Total	**71**	**100**

From Table 1, there were 34 female students with a percentage of 47.9% of the total sample and 37 male students with a percentage of 52.1%.

Table 2 Frequency Distribution of Subjects Based on Glasses Use

Use of Glasses	Frequency (n)	Percentage (%)
Use	19	26.8
Do not use	52	73.2
Total	**71**	**100**

From Table 2, it was found that 19 students used glasses with a percentage of 26.8% and 52 students did not use glasses with a percentage of 73.2%.

Table 3 Correlation of Visual Acuity Level to Average Report Card Score

Use of Glasses	Frequency (n)			*P Value*
	Very good n (%)	Good n (%)	Enough n (%)	
Abnormal	17 (65.38)	10 (40)	6 (30)	0.042

Normal	9 (34.62)	15 (60)	14 (70)	
Total	**26 (100)**	**25 (100)**	**20 (100)**	

After being analyzed using a 2x3 table, the Chi Square test obtained a p-value of 0.042, so it can be concluded that there is a statistically significant relationship between the level of visual acuity and the average grade of the report card in class 2 students of Muhammadiyah 01 Medan. This can be seen from the reading of the results of this study using Pearson Chi Square where H0 (>0.05) is not related and Ha (<0.05) is related. In this study, the value obtained is 0.043 where Ha is accepted and H0 is rejected..

Discussion

The following is the same narrative with citations converted into IEEE format according to the bibliography order you provided, without changing the content, sentences, or paragraph structure.

Vision is an integral part of interpersonal and social interactions in face-to-face communication, where information is conveyed through non-verbal cues such as gestures and facial expressions. Visual acuity is a measure of central vision, indicating how clearly a patient can see an object. Acuity testing should be performed carefully because loss of acuity is a serious sign. Visual acuity can range from normal to no light perception [8].

In this study, it was found that the total number of research samples was 71 2nd grade high school students, dominated by male gender (table 4.1), namely 37 student samples (52.1%) compared to female gender which amounted to 34 student samples (47.9%).

This result is the first study to distribute visual acuity levels based on gender at SMA Muhammadiyah 01 Medan, located in Medan City. The results of this study are in contrast to previous research in a different location where the number of females was greater, namely 50 samples (67.6%) and males only 24 samples (32.4%) [9].

However, based on the results of research conducted by Dian Eka Yulianti, Damayanti Tinduh, Yulia Trisnawati in Surabaya in assessing the relationship between age and gender and visual acuity, no significant relationship was found [10].

In this study, the age of the research sample was adolescents aged around 16-17 years because the sample came from the same class, namely the class of 2022/2023. Based on research conducted by Stikes Surya Global Yogyakarta, during adolescence, visual acuity is usually stable. However, conditions such as myopia (nearsightedness) can develop or worsen during this period [10].

There are several activities in adolescents that can cause visual acuity which is basically stable to be disturbed such as the use of digital devices. When using digital devices such as gadgets, laptops and the like, adolescents often cannot control themselves so that they are excessive in the duration of use of these digital devices which can cause decreased visual acuity [12]. In addition, the use of digital devices that are too close, namely less than 30 cm from the eyes and the position of use such as lying down can also cause eye strain and cause disturbances in visual acuity [13]. In addition, the habit of adolescents who do not pay attention to adequate lighting when reading or studying makes the eyes work harder, which ultimately can decrease visual acuity [14].

It can be seen from the results of the study that in samples with normal visual acuity, namely from 33 samples of students with normal vision, the distribution of the average report card score is very good, there are 17 samples with a percentage of 65.38% who get very good results, then there are 10 samples with a percentage of 40% get good results and there are 6 samples with a percentage of 30% who get sufficient results. Meanwhile, from samples with abnormal visual acuity, there are 38 student samples with a distribution of the average report card score is very good, there are 9 samples with a percentage of 34.62%, then there are samples that get good results totaling 15 samples with a percentage of 60% and there are also samples with sufficient results totaling 14 samples with a percentage of 70%. From the results of the research that has been done, none of the samples get less results. It was also obtained from this study that the majority of samples with abnormal visual acuity have very good values, while the majority of samples with abnormal visual acuity have good and sufficient results. However, the results of this study are not in line with the

results obtained by research conducted by Pangestu and Masduki in order to see the correlation of abnormal visual acuity with learning achievement in Medical students at Muhammadiyah University of Yogyakarta. From their research, they differentiated myopic and non-myopic students with good and poor achievements. The results obtained from 81 samples with good achievements, there were 48 samples experiencing abnormal visual acuity (Myopia) and 33 samples with normal visual acuity. Then in the samples with poor achievement results, there were 109 samples consisting of 47 samples with abnormal visual acuity and 62 samples with normal visual acuity. From the data above, we can see that the majority of samples in the previous study conducted in Jogja with good achievements were samples with abnormal visual acuity and the majority of samples with poor achievements were samples with normal visual acuity [15].

Differences in visual acuity levels are influenced by several things, according to Ecia, the clarity or cloudiness of refractive media such as the cornea, lens, aqueous humor and vitreous corpus will affect the quality of light focusing in the eye, causing incoming light to become refracted and making vision blurry, such as in conditions such as cataracts, keratitis, vitreous opacity and infection [16].

According to Fedawati, decreased visual acuity can be caused by an abnormal refractive optical system condition such as the size of the eyeball axis being too long or too short, corneal curvature to lens convexity which causes refractive disorders such as nearsightedness (myopia) when the lens is more convex than normal, farsightedness (hypermyopia) when the lens is thinner than normal and also astigmatism (cylindrical eyes) when the surface of the cornea or lens is uneven, causing distorted vision [17].

According to Jyoti, decreased visual acuity can also be caused by the optic nerve, which functions as the main transmitter of visual signals from the retina to the brain for processing. This damage can be caused by optic neuropathy due to inflammation or ischemia (such as in optic neuritis or glaucoma), pressure from tumors or papilloedema, trauma, and nutritional deficiencies or poisoning that damage the nerve. Lesions in the visual pathway, such as tumors or gliomas, can also inhibit the transmission of visual signals. As a result, the brain does not receive or process visual information properly, which can cause symptoms such as visual field loss, decreased contrast sensitivity, impaired color vision, and decreased vision that can be temporary or permanent [18].

However, according to Liasari, from the results of his research, the condition that most often occurs in adolescents, especially those who are academically active, which can cause a decrease in visual acuity is uncorrected refractive disorders [19].

For academically active adolescents, the average grade on their report cards is a benchmark for assessing their academic abilities at school. However, according to Agung and Tasya, there are two main factors that influence students' academic performance: internal and external factors. Internal factors are aspects that originate from within the student, including health, interests, talents, and motivation. Good health enables students to learn optimally, while health problems can lead to fatigue and a lack of enthusiasm. Interest in an activity or subject matter increases learning motivation, enabling students to learn better. Talent, as an innate ability that develops through learning and practice, enables students to achieve more optimal learning outcomes if the material being studied matches their talents. Motivation, which is closely related to goals, is an important driving force in students' efforts to achieve learning success [20].

External factors encompass various aspects of a student's external environment, such as family, school, and community. Families influence learning outcomes through their educational practices, relationships between family members, home atmosphere, and economic conditions. Schools also play a crucial role by providing teaching methods, relevant curricula, good relationships between teachers and students, adequate facilities, and a conducive learning environment. The community also exerts influence, particularly through student activities, peer interactions, and the social life around them. These two factors interact with each other and significantly influence the overall success of student learning outcomes [20].

Based on the Chi Square test calculation, the p-value was obtained as 0.042 ($p<0.05$), therefore it can be concluded that there is a significant correlation between the level of visual acuity and the average report card score with a high index scale assessment in class 2 students of Muhammadiyah 01 Medan Senior High School.

These results are consistent with previous research by Pangestu and Masduki in 2016 in Yogyakarta, Indonesia, on 195 student samples consisting of 95 people with normal vision (50%) and 95 people with myopia or abnormal vision (50%). There is a significant relationship between myopia (abnormal visual acuity) and academic achievement of adolescents (p = 0.028). Pangestu et al. said that people with myopia have higher academic achievement and intellectual ability due to the habit factor of those with myopia who are diligent in reading or studying longer until their eyes are tired [15].

The discussion above has demonstrated a significant relationship between visual acuity and average grades on report cards or academic achievement. However, the results of this study differ from previous research. This study found that adolescents with normal visual acuity had better academic achievement. The previous study found that adolescents with abnormal vision had better academic achievement.

IV. CONCLUSION

Based on the research results and discussions that have been developed above, the following conclusions can be drawn:

1. The research subjects based on gender were 34 female students with a percentage of 47.9% of the total sample and 37 male students with a percentage of 52.1%.
2. The research subjects based on the level of use of glasses with lenses in class 2 students of SMA Muhammadiyah 01 Medan were only 19 out of 38 students who had vision.
3. The majority of research subjects based on the classification of the average report card value for normal vision was very good with a total of 17 samples (65.38%) and for abnormal vision it was good with a total of 15 samples (60%).
4. There is a significant relationship between the level of visual acuity and the average report card grades of students at SMA Muhammadiyah 01 Medan.

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