

Relationship between Screen Based Activity and Computer Vision Syndrome Complaints among Vocational High School Students

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Received: 17 October 2020, Revised: 25 May 2021, Accepted: 17 June 2021

Abstract

The development of the industrial revolution 4.0 era resulted in unlimited information technology media that are accessible to all people, especially teenagers who are currently studying. Activities that are using screen-based information technology media or Screen Based Activity (SBA), especially those that are not well controlled, can lead to physical disorders such as Computer Vision Syndrome (CVS). This study aims to determine the relationship between SBA and CVS complaints among Vocational High School Students. This research is a descriptive correlative study with a cross-sectional design. The sample consisted of 255 students majoring in information technology. The sample was selected using simple random sampling technique. SBA data collection was measured using the adolescent sedentary activity questionnaire, and the CVS complaints were measured using the CVS questionnaire. The results of the bivariate analysis test for the relationship between SBA and CVS complaints using the Spearman Rank test obtained a significant value of 0.000 ($p \leq 0.05$) where there was a significant relationship between SBA and CVS complaints in students with a moderate correlation value of 0.416 and a positive correlation direction. This means that with the increasing duration of the SBA, the CVS complaints will increase in students at Vocational High School 1 Denpasar and vice versa. The writer recommends that educational institutions should pay attention to SBA in students by providing knowledge about controlled SBA to prevent CVS complaints.

Keywords: Computer Vision Syndrome (CVS), Musculoskeletal disorders, Screen-Based Activity (SBA), Students, Vision disorders

Introduction

The progress of the world's information technology development has now entered the era of the community-based industrial revolution 4.0. Based on the infographics of technology, information and communication indicators in 2016, 84 % of total population owned cell phones, 87.7 % owned televisions, 31.4 % owned computers, and 20.8 % owned laptops [1]. The use of electronic media such as cell phones, computers, television or other screen-based technology for daily activities is called Screen Based Activity (SBA) [2].

SBA is an activity that does not require a lot of energy. SBA is usually done in a passive body position that tends to be still, or by doing repetitive activities for a long time [3]. Excessive SBA that is not balanced with physical activity can certainly cause health problems, namely visual disturbances and musculoskeletal disorders [2].

Visual disturbances occur due to the eye focusing on objects that are too close for a long time, so that it can reduce the frequency of blinking and decrease the accommodation capacity of the eye [4,5]. This eye problem occurs due to blue light or high energy visible light produced by electronic devices that can impact the retina. Blue light penetrates into the macular pigments in the eye and causes damage to the eye's protection so that the eye becomes susceptible to blue light [6].

Student is one of the individuals who often do SBA. The use of information technology by students aged 16 - 25 years has the highest percentage, namely 41.3 % in 2017 [7]. Students have a greater opportunity to do SBA because students need gadgets in doing school work, or to play online games, watch television, and they also use gadgets to communicate daily through social media [8]. One group of the students who has longer time in front of the screen is a student group in the field of information technology. This is because during the learning process at school, vocational students in the field of information technology practice directly using computers, laptops or gadgets. Students who practice in

the field of information technology for a long time can certainly experience health problems. One of the health problems that can occur is Computer Vision Syndrome (CVS).

CVS is a complaint of physical disorders and eye problems that occurs due to the use of screen-based technology [9]. This CVS complaint occurs worldwide in 64 - 90 % of users of computer monitors, gadgets, laptops, and so on. The use of a computer or laptop with duration of more than 2 h is the most important factor for CVS [10]. CVS complaints consist of headaches, dry eyes, blurred vision, neck and shoulder pain. The use of screen-based information technology does not only cause CVS complaints. This of course needs to be a concern for students who use screen-based information technology in their daily lives, especially vocational students.

Based on data from the Ministry of Education and Culture in 2019, the Vocational High School that has a department in the field of information technology in Denpasar is Vocational High School 1 Denpasar. Vocational High School 1 Denpasar has 3 departments in the field of information technology. Based on the results of interviews, students can spend 2 - 10 h per day in front of a computer screen or laptop to practice using a laptop or computer at school or at home.

Vocational high school students in the field of information technology, who spend longer time on SBA in their daily life, have a higher risk of experiencing CVS complaints. This is in line with Sousa and Silva's research [12] in 2017 which explained that students spent longer time doing SBA. SBA behavior such as watching television, using a computer or laptop, and playing games for more than 3 h has a relationship with health complaints [3]. CVS is a health complaint that results from screen-based activities that are not ergonomic and can cause musculoskeletal pain and eye disorders which need to be avoided so as not to cause other health problems [10]. Based on this, the researcher is interested in researching "Relationship between Screen Based Activity and complaints of Computer Vision Syndrome among Vocational High School Students".

Materials and methods

Research design and sample

This research is a descriptive correlative study with a cross-sectional design. The research sample was 255 students majoring in information technology at Vocational High School 1 Denpasar (Bali-Indonesia), who were selected using simple random sampling technique. The inclusion criteria for this research sample were willingness to be research respondents and filling out informed consent, as well as Vocational school students majoring in information engineering aged 15 - 21 years. The exclusion criteria for this study sample were students who had eye problems, wearing glasses and wearing contact lenses. All participants gave written informed consent. After obtaining written informed consent about the study, an anonymous questionnaire was distributed to individual subjects. This research data collection has obtained a certificate of ethical eligibility number 411/UN14.2.2.VII.1/LP/2020 by Universitas Udayana's Ethical Clearance Committee.

Questionnaires

The self-reported questionnaire comprised a demographic data, adolescent sedentary activity questionnaire, and CVS questionnaire.

Assessment of SBA duration

SBA duration data collection outside school hours in the study was measured using the adolescent sedentary activity questionnaire. Data collection was carried out for 1 week to measure the average duration of SBA every day. This questionnaire consisted of 5 questions regarding the duration of the SBA. The 5 questions include the duration of watching television, watching VCD/DVD, using a computer/laptop, playing video games, and using a cell phone or smartphone for 1 day. This questionnaire was modified from Hardy's study by adding an explanation of the questionnaire filling to make it easier for respondents to fill out the questionnaire correctly [17].

Assessment of CVS complaints

The CVS complaints assessed using a CVS questionnaire after measuring the average SBA among students at Vocational High School 1 Denpasar. The CVS questionnaire consists of 20 statements which are classified into 4 indicators of symptoms of CVS complaints [19]. These are namely asthenopia, ocular surface problems, visual problems, and extraocular problems. The questions on the questionnaire use a Likert scale with a score of 1 to 4 which is selected by giving a checkmark on the most suitable alternative answers.

Statistical analysis

SPSS statistic 23 software package was used for all statistical analyses. The data analysis of this study used the Spearman-rank test because the data were not normally distributed. The data analysis of this study used a computer application program with a confidence level of 95 % ($p \leq 0.05$).

Results and discussion

Results

The results of this study state that the characteristics of respondents based on gender are as follows: 205 (80.4 %) male respondents and 50 (19.6 %) female respondents as students at Vocational High School 1 Denpasar. The results of the analysis of the characteristic of the respondents are shown in **Table 1**.

Table 1 Characteristic of respondents.

Characteristic of respondents	Frequency (f)	Percentage
Gender		
Male	205	80.4 %
Female	50	19.6 %

The results of data analysis regarding the description of SBA in students at Vocational High School 1 Denpasar showed that the SBA duration data is not normally distributed. The median value of the SBA duration data for respondents was 7.30 with an average duration of SBA that was 7.85. The lowest duration of SBA was 1.2 h and the highest duration was 19.3 h in a day, with data variants of 12.94. Based on the categorization of the median data, there were 47.8 % of students who were in the low duration category and 52.2 % were in the high duration category of SBA among students at Vocational High School 1 Denpasar. The results of data analysis on the SBA description of students at Vocational High School 1 Denpasar are shown in **Table 2**.

Table 2 Description of SBA for students at Vocational High School 1 Denpasar.

Variable	Median-Mean	Minimum-Maximum	Variant
SBA	7.30-7.85	1.20 - 19.30	12.94

The results of data analysis regarding the description of CVS complaints in students at Vocational High School 1 Denpasar showed that the CVS complaint data were not normally distributed. The median score of CVS complaints in this study was 32 with the mean score of CVS complaints was 32.98. The lowest score for CVS complaints was 20 and the highest score for CVS was 58 with a data variant value of 45.421. Based on categorization of data using median data, 45.9 % of students experienced mild CVS complaints while 54.1 % of students experienced severe CVS complaints at Vocational High School 1 Denpasar. The results of the CVS description data analysis in students at Vocational High School 1 Denpasar are shown in **Table 3**.

Table 3 Description of CVS complaints in students at Vocational High School 1 Denpasar.

Variable	Median-Mean	Minimum-Maximum	Variant
CVS	32-32.98	20 - 58	45.421

Results of research on the relationship between SBA and CVS complaints in students at Vocational High School 1 Denpasar, after analysis using the Spearman Rank test with a 95 % confidence level was done, show that the p -value is 0.000. This means that there is a significant relationship between SBA and

CVS complaints in students at Vocational High School 1 Denpasar. The correlation coefficient value in this study is 0.416, which states that the strength of the relationship between SBA and CVS complaints is moderate in the direction of a positive relationship. The direction of the positive relationship means that the higher the duration of SBA, the higher the CVS complaints in students at Vocational High School 1 Denpasar and vice versa. The results of data analysis on the relationship between SBA and CVS complaints in students at Vocational High School 1 Denpasar are shown in **Table 4**.

Table 4 The relationship between SBA and CVS complaints in students at Vocational High School 1 Denpasar.

Variable	Median-Mean	R	p-value
Screen Based Activity	7.30 - 7.85	0.416	0.000
Computer Vision Syndrome	32.00 - 32.98		

Discussion

This study was conducted on 255 students with the characteristics of 80.4 % male and 19.6 % female. For the use of technology in SBA, 52.2 % of students have a high duration, and 47.8 % of students have a low duration of SBA outside school hours. Students at Vocational High School 1 Denpasar carry out SBA outside school hours with an average duration of 7.85 h. This is in accordance with the research of Andriani *et al.* [13] in 2019 which stated that the majority of the duration of SBA in students is more than 5 h. Research by Kumala *et al.* [14] also stated that 72.1 % of 61 students undertook SBA with a high duration or more than 2 h. The duration of doing SBA for more than 2 h is a duration that is not recommended because it can cause physical complaints for students [10].

SBA outside of school is influenced by several factors such as biological, demographic, and socio-cultural factors [15]. These factors can affect the intensity of gadget use, freedom, and access to carry out daily SBA. The daily SBA with a high duration can certainly have an impact on the psychology and physicality of students. Desiningrum *et al.* research in 2017 stated that uncontrolled SBA can affect individual skills and reduce concern for the surrounding environment [16]. Uncontrolled SBA results in a student not having enough time to do physical activity [14]. The passive position of students when doing SBA can also have an impact on musculoskeletal complaints and visual problems such as CVS complaints [3].

This study states that there is a significant relationship between SBA and CVS complaints in students at Vocational High School 1 Denpasar. Students experienced severe CVS complaints were 54.1 % while those who experienced mild CVS complaints were 45.9 %. Based on the results of this research, almost all students have experienced CVS complaints. The average score of perceived CVS complaints is also high for students at Vocational High School 1 Denpasar. This research is in line with Febrianti and Bahri's research [18] in 2018 which stated that 80 % of students who use screen-based information technology media experience CVS complaints. Research by Jonge *et al.* [5] also stated that 71.7 % of students experienced mild CVS complaints and as many as 28.3 % of students experienced severe CVS complaints when using computers. CVS complaints that can be experienced by students are asthenopia, ocular surface, visual, and extraocular [18].

Complaints experienced by students at Vocational High School 1 Denpasar can be influenced by several factors, namely individual factors, environmental factors, and electronic media factors [15]. These factors can affect the severity of CVS complaints felt by students at Vocational High School 1 Denpasar while a range of scores for students was 20 - 58, and the average duration score of SBA for students was 32.98. The CVS complaints experienced by these students are in accordance with the American Optometric Association in 2017 which states that individuals who use screen-based electronic media for more than 2 h can experience CVS complaints [10].

The results of the analysis of the relationship between SBA and CVS complaints in students at Vocational High School 1 Denpasar shows that there is a positive and moderate correlation with regard to the relationship between SBA and CVS complaints. The direction of a positive correlation means that the higher the duration of SBA, the higher the CVS complaints felt by students and vice versa. Based on the data analysis in this study, 38.8 % of students had a negative correlation towards the relationship between SBA and CVS complaints which was caused by factors that could affect SBA with CVS complaints. These factors lead to a negative correlation result in the form of 20.4 % of students who had a low duration of SBA who experienced severe CVS complaints. Meanwhile, 18.4 % of students who had a high duration of SBA experienced mild CVS complaints. The factors that can influence the relationship

between SBA and CVS complaints, and the high activity of SBA with CVS complaints, need to be considered in students at Vocational High School 1 Denpasar.

Conclusions

This study demonstrated that CVS complaints was found higher in Vocational High School 1 Denpasar. There was a moderate and positive correlation between SBA and CVS complaints. The high duration of SBA is one of the individual factors that can cause CVS complaints among students. Hence, it is necessary to raise awareness and knowledge regarding health effect related to prolonged SBA and optimize the exposure time along with preventive measures in order to reduce CVS complaints among vocational high school students.

Acknowledgements

The authors would like to acknowledge to Universitas Udayana, Indonesia for the scholarship awarded for my education.

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