Design and Trial of Computer Vision Syndrome Level Instruments

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Abstract: Computer use increases continuously over time. The average working time used for working with a computer was 5.8 hours or 69% of the total 8 working hours. Computers that are now widely used as a tool turned out to cause illness due to work or health problems. One of them was eye irritation due to the use of continuous eye to stare at a computer monitor or *visual display terminal* (VDT). This study aimed at designing and testing try the instrument *computer vision syndrome* on the user's computer. This research was a case study research. Done in Grandmed Lubuk Pakam Hospital with a population that was all employees working in part the claims BPJS, the registration section, parts of office and medical records of Grandmed Lubuk Pakam Hospital and samplewas many as 30 people. Collecting data using primary and secondarydata. Primary data collection was done through direct interviews with employees in the BPJS claims section using a questionnaire containing 30 questions and using a Likert scale. While collection of secondary data obtained from human resources of Grandmed Hospital Lubuk Pakam. Data processing used validity and reliability tests. The results showed that the instrument used to measure the level of *computer vision syndrome* in computer users showed a correlation coefficient ranging from 0.542 to 0.973 and a reliability value of 0.986. It was recommended to further research to use this *computer vision syndrome level* instrument when conducting research on the duration of exposure to the occurrence of *computer vision syndrome*.

1 INTRODUCTION

The invention of the computer became a rapid development in all fields of professions, architects, art and design workers, journalists, flight controllers, even today it was very necessary to have a computer to work. This in addition to providing convenience for the production process, of course, will cause side effects that we can not avoid. The development of information technology that must require humans to have a direct relationship with computers both in offices and parts of one's life.

The role of computers today was very broad, generally 80% of office work can be completed using a computer. The use of the internet which was now also increasingly popular causes workers to spend time in front of the computer at least 3 hours per day. The benefits gained from the use of computers were very numerous but not everyone was aware of the problems caused when using a computer, especially if working at the computer for too long and continuously.

The rapid development of technology makes computers as a tool that facilitates work quickly and efficiently. Almost all fields of work today use computers as a tool to facilitate their work, there were around 100 million people use computers in their daily work (Izquierdo, 2016). From the results of research conducted by the *National Institute of Occupational Safety and Health* (NIOSH) that the use of computers for too long can cause higher stress than other workers. NIOSH also shows that almost 88% of all computer users experience *Computer Vision Syndrome* (CVS), a condition that occurs because they focus too long on the computer screen for more than four 4 hours a day. The longer duration of daily computer exposure wass directly proportional to the number of symptoms experienced by computer user respondents (Akinbinu and Mashalla, 2017). Various

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symptoms that arise in computer workers who work for a long time in addition to being caused by light entering the eyeball, also due to the eyes of a worker when staring at the computer, the blink of the eye was reduced by 2/3 times less than normal. And other complaints in the form of red eyes, burning sensation in the eyes, and watery eyes .

The use of computers also has an effect on health, one of which was eye disorders due to the continuous use of eyes to stare at a computer monitor or *Visual Display Terminal* (VDT). This will occur after using the computer for more than 3 hours. Complaints will appear 3 times more often on computer users who have refractive abnormalities (Jonge, 2018).

Computer Vision Syndrome was also a term used to describe various symptoms such as eye strain, eye discomfort, headaches, dry eyes, blurred vision at close range, and double vision in computer users. Users who complain of pain in the neck and back are also included in the symptoms of CVS.

Various symptoms that arise in computer workers who work for a long time in addition to being caused by light entering the eyeball, also due to the eyes of a worker when staring at the computer, the blink of the eye was reduced by 2/3 times less than normal. And other complaints in the form of red eyes, heartburn, and watery eyes (Valentina, 2018).

With the existence of research instruments, we will know the source of the data we will examine and the type of data, data collection techniques, data collection instruments, the steps of the preparation of the research instruments as well as knowing the validity, reliability, difficulty level, distinguishing power, and deception / distractor of a data in research. The instrument has a very important role. Because with the presence of instruments, the quality of a study can be known. If the instrument was made, has good criteria, then the quality of the research was also good, and vice versa.

Observations made at the BPJS Health Office Lubuk Pakam, amounting to 36 employees, were found that office employees work using computers as a tool to complete their work. The time spent by employees in working on computers averages 4-5 hours a day. The results of the employee's response said that experiencing symptoms such as dry eyes strained dry eyes and often complained of pain in the neck. Based on the data and survey result, so the authors are interested in conducting research on "Design and Testing of *Computer Vision Syndrome Level* Instruments".

2 RESEARCH METHOD

Grandmed Hospital was used as the location of this study. This type of research used in this research was quantitative research by *case studies design.* This study aims to design and test instrument level *computer vision syndrome*. Involved 30 office employees who were placed in the BPJS claims section, in-patient and outpatient registration, office and medical records at Grandmed Lubuk Pakam Hospital. The research sample was taken using total sampling technique.

Data collection using primary data and secondary data. Primary data were obtained by conducting direct interviews with respondents with the guideline questionnaire that has been prepared in the form of questions. The number of questions is 30 questions, using a likert scale with a choice of answers always, sometimes and never. Validity of the instrument was done by using validity and reliability tests. The instrument validity test was conducted on 30 people. Indicators of each instrument are said to be valid when the correlation value was calculated > correlation table (0.3) and was said to be reliable when the *Cronbach alpha* value > 0.6. Collecting secondary data obtained from Human Resources at Grandmed Hospital Lubuk Pakam. In carrying out the development of research instruments, it can follow the *Research and Development* or R&D procedures and the instruments produced become products that result from conducting *R&D* research. In the context of this paper scientific research instruments are tools used to assess the *level of computer vision syndrome*. Data were analyzed using validity and reliability tests to explain the suitability of the measuring instrument.

The research process starts from identifying problems at the research site, conducting literature studies, formulating problems and research objectives, determining research methods to be used, identifying samples to be studied, preparing research questionnaires, testing questionnaires and distributing questionnaires, processing data, determine the characteristics of the sample, describe the results and discussion and make conclusions and suggestions on the research obtained.

The flow of research activities was described in the following of Figure 1:

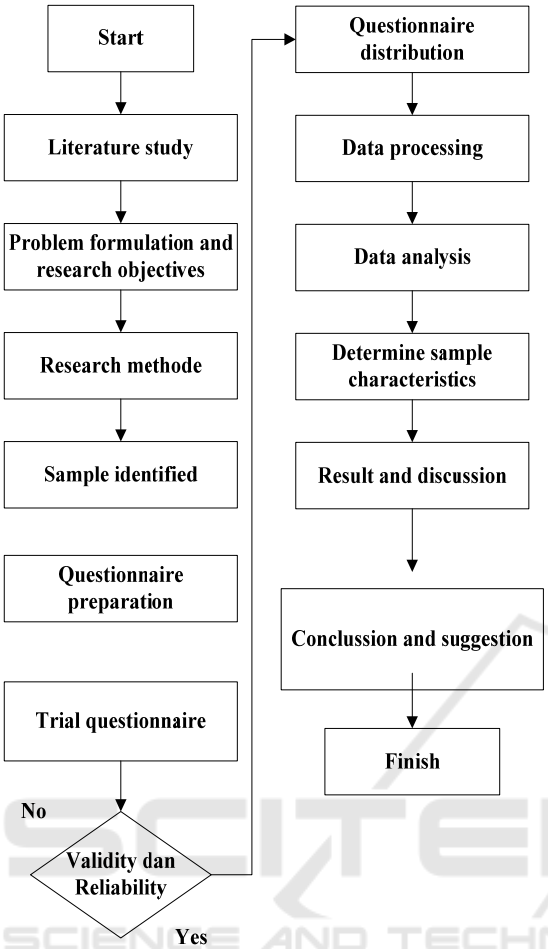

Figure 1: Research Activity Flow.

Computer vision syndrome or often also referred to as visual fatigue and digital eye strain, is a term for a collection of symptoms related to eye disorders due to the use of computer-based electronic devices, such as laptops, desktops, cellphones, and tablets. Symptoms that usually accompany CVS are fatigue or aching in the eyes, blurred or double vision, and red, dry, or hot eyes. Even in some cases, headaches, necks, shoulders and back can be accompanied. The longer the duration of computer use, the longer the symptoms will last, even continuing after computer use is complete. Computer vision syndrome can arise due to several reasons, namely: 1) when staring at the screen, the eyes continue to move from one point to another and focus for a long time. This activity requires hard work of the eye muscles. 2) The letters on a computer screen are generally not as sharp as in the print media, so unconsciously it will force our eyes to focus more on reading them. 3) Flickering and glare coming from the screen adds to the workload on the eyes. 4) The frequency of eyes to blink tends to decrease when staring at the screen. This causes the eyes to become drier.

The Figure 2 is the process of the occurrence of *computer vision syndrome was* explained as follows:

Figure 2: The process of the occurrence of *computer vision syndrome.*

Table 1 is an overview of the respondents' characteristics at the Grandmed Lubuk Pakam Hospital:

Table 1. Characteristics of Respondents at Grandmed Lubuk Pakam Hospital.

No	Characteristics	f	(%)
1	Length of working		
	8 hours	30	100,0
	Total	30	100,0
2	Working period		
	1-4 years	30	100,0
	5-8 years	-	-
	9-12 years	-	-
	Total	30	100,0

3 RESULT AND DISCUSSION

3.1 Instrument Development

The preparation of the research instrument follows the stages of development research. According to Soenarto in Basic Concepts and Development

Eligibility Methods in the field of education, research development aims to produce products that can be used to improve and improve quality. The concept of developing a computer vision syndrome level instrument was explained in Figure 3:

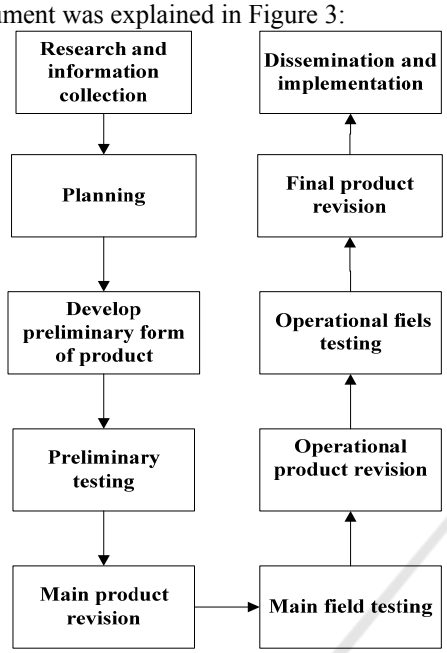

Figure 3: Instrument development.

The steps in developing a research instrument were explained as follows:

a. *Research and information collecting* , was carried out through preliminary studies by gathering information on contextual conditions where research will be conducted, reviewing literature, research field observations , classes or laboratories.
b. *Planning,* determining goals, identifying skills, determining performance to be assessed.
c. *Develop preliminary form of product* , develop initial instruments, prepare instrument lines, data collection methods , and assessments.
d. *Preliminary testing*, validating the initial instruments (products) produced in step 3.
e. *Main product revision* , product revision based on input from the initial test. Conduct interviews, observations and questionnaires on research subjects.
f. *Main field testing*, *field testing* of 30 or more respondents as product user respondents. Me accumulate quantitative data.
g. *Operational product revision* , revising the product based on input in field trials.
h. *Operational testing testing*, field trials involved 30 respondents of product users, collecting quantitative data.
i. *Final product revision*, revising the instrument based on input from operational field trials to produce the final product.
j. *Dissemination and implementation,* making a final product report and presented through a seminar on research results**.**

Table 2 explains the content of the developed questionnaire. The total questionnaire developed was 30 questions using a likert scale with a choice of answers always, sometimes and never. The questionnaire contains questions related to complaints when using the computer in the eye area such as eye pain, dry eyes, watery eyes, sandy eyes, sore eyes, sore eyes, moving eyes when reading, blurred vision, double vision, difficulty in vision, eyes dazzled. The contents of the questionnaire also explained the complaints felt by respondents in the head, shoulders and neck. The following describes the content of the developed questionnaire. The developed questionnaire will be distributed to 30 respondents. Each respondent will be given 1 questionnaire and are required to fill in every question contained in the questionnaire.

Table 2: Research Instruments.

No	Questions
1.	Do you have vision complaints such as tired eyes?
2.	Do you used eydrops when use a computer ?
3.	Do you have complaints about using your computer, such as aching eyes ?
4.	Doyou chave visual complaints such as pain when used computer in the eye area?
5.	Do you have vision complaints when used computer like dry eyes?
6.	Do you feel like watery eyes when used computer?
7.	Do you feel have sand when used computer?
8.	Do you have a headache when used your computer?
9.	Do you feel that your eyes feel sore when you used computer?
10.	Do the words in the text move when you read on the computer for a long time?
11.	Do you feel blurred when you used computer?
12.	Do you feel that you have double vision when used computer ?
13.	Do you have difficulty in focusing your eyes on used computer?
14.	Do you feel glare when used computer?

15.	Do you feel that in using your computer it is not clear to see objects at close range or at far distances?
16.	Do you feel pain around the shoulder when used computer?
17.	Do you feel pain around the neck when used computer?
18.	When used computer do you feel changes in vision or perception of color?
19.	Do your vision go dark after used the computer for a long time?
20.	Do you really like holding your eyes (rubbing) when used a computer?
21.	Do you feel your eyelids twitching when used a computer?
22.	Do you easily feel sleepy when used a computer?
23.	Do you feel difficult to concentrate when worked with a computer?
24.	When used computer you narrowedyour eye?
25.	Did you got a lot of errors in worked with a computer?
26.	Do you feel headaches when used the computer for a long time?
27.	Do you feel shoulder stiffness after a long used computer?
28.	Do you feel unbalanced whenyou stand up after used an old computer?
29.	Do you feel your thinking power has decreased after used an old computer?
30.	Do you wear anti-radiation glasses?

3.2 Test Research Instruments

This research used primary data. Data collected by questionnaire technique, namely by giving written questions to respondents. Furthermore the respondent gave a response to the question given. Considering that the data collection was carried out using a questionnaire, the seriousness of the respondents in answering the questions was very important in the study. The questionnaire administered was designed using a three -point Likert scale. The validity or validity of the results of social research was largely determined by the measuring instrument used. To overcome this, two types of tests were needed, namely the test of validity (test of validity or validity) and the test of reliability (reliability test).

3.3 Test Validity of Research Instruments

Validity test was used to measure the validity or validity of a questionnaire. A questionnaire was said to be valid if the questions on the questionnaire were able to reveal something that will be measured by the questionnaire. This study besides using content validity test was a test related to the extent to which a measurement scale / instrument represents the overall characteristics of the content being measured, also by means of AIC (Average Inter-Item Correlation) testing with a benchmark that gets an excess coefficient value of 0.30 is declared valid.

Based on Table 3 of the validity testing results , it was known that thirty questions used in the research instrument have correlation coefficients ranging from 0.542 to 0.973 . This could be interpreted that each of the questions was valid. In other words, these questions can represent or form the construct of the computer vision syndrome incident variable.

3.4 Reliability Test

Reliability test is a term used to indicate the extent to which measurement results are relatively consistent if measurements are repeated twice or more. Data reliability in this study was tested using Inter-item Consistency Reliability which saw *Cronbach's coefficient* alpha as the coefficient of reliability. *Cronbach's* alpha is a reliability coefficient that shows how the parts of a set are positively correlated with each other. An instrument is considered reliable if it has an alpha coefficient (α) of 0.6 or more.
The basis for decision making for a reliable instrument was:

1. If the alpha coefficient (α) test was greater than (≥) 0.6 then the questions in the questionnaire are worth using (reliable).
2. If the alpha coefficient (α) of the test was less than (<) 0.6 then the questions in the questionnaire are not reliable.

The cronbach's alpha coefficient for each construct is meeting the recommended reliability criteria (greater than 0.60). Thus, the respondents' answers to questions that were used to measure each of these constructs was consistent and construct trustworthy (reliable).

The results of the analysis of the computer vision syndrome instrument test on computer users were presented in the in the Table 3:

Table 3 . Results of Analysis of Test Validity and Reliability of Research Instruments.

No	The question	Validity	Reliability
1	Question 1	0, 542	0.986
2	Question 2	0, 542	0.986
3	Question 3	0, 640	0.986
4	Question 4	0, 973	0.986

5	Question 5	0, 846	0.986
6	Question 6	0, 928	0.986
7	Question 7	0, 944	0.986
8	Question 8	0, 897	0.986
9	Question 9	0, 567	0.986
10	Question 1 0	0, 936	0.986
11	Question 1 1	0, 623	0.986
12	Question 1 2	0, 872	0.986
13	Question 1 3	0, 910	0.986
14	Question 1 4	0, 892	0.986
15	Question 1 5	0, 973	0.986
16	Question 1 6	0, 846	0.986
17	Question 1 7	0, 928	0.986
18	Question 1 8	0, 944	0.986
19	Question 1 9	0, 897	0.986
20	Question 20	0, 567	0.986
21	Question 21	0, 936	0.986
22	Question 22	0, 872	0.986
23	Question 23	0, 910	0.986
24	Question 24	0, 892	0.986
25	Question 25	0, 973	0.986
26	Question 26	0, 846	0.986
27	Question 27	0, 928	0.986
28	Question 28	0, 944	0.986
29	Question 29	0, 897	0.986
30	Question 30	0, 567	0.986

3.5 Old Use of Computers

Table 4 shows that the majority of the old computer use was in the medium category of 20 people (66,6%). Increasing working hours at the computer without interspersed with other activities can reduce the ability of accommodation so that it will aggravate the symptoms of CVS on computer user workers.

The use of computers that are too long without interspersed with other activities can aggravate symptoms and increase symptoms of *Computer Vision Syndrome* (CVS) to workers. The longer duration of daily computer exposure is directly proportional to the number of symptoms experienced by respondents of computer users (Raymond, 2017).

The continuous used of computers for more than 4 hours has 26 times the risk of causing *Computer Vision Syndrome* compared to the use of less than 4 hours (Azkadina , 2015). There was a significant relationship between the length of computer use that was carried out continuously with the incidence of *Computer Vision Syndrome* (Bali, et al, 2015). In carrying out work in the BPJS office, employees work together in carrying out many activities, such as inputting data, data entry, and other work that uses computers. This is the cause of CVS when doing continuous work in front of the computer without a break or ignoring things that will result from the long use of the computer due to the work to be completed first. For the employee's own knowledge about the dangers of using the computer for too long it might be good but just ignored because it is considered not too important. A rest period of less than 10 minutes after computer use has a twenty old risk of suffering from CVS compared to rest for more than or equal to 10 minutes after computer use.

Table 4: Distribution of Respondents Based on the Length of Computer Usage at BPJS Office Employees.

Old Use of Computers	Frequency (people)	Percentage (%)
Light	5	16.7
Medium	20	66.6
Weight	5	16.7
Total	30	100.0

3.6 *Computer Vision Syndrome* Incidence

Table 5 shows that the majority of respondents experienced CVS as many as 26 people (72.2%). *The American Optometric Association* (AOA) defines *Computer Vision Syindrome* (CVS) as a collection of symptoms in the eyes and vision associated with the use of computers, tablets, and cell phones with short distances and lasts long (AOA, 2017). *Computer Vision Syndrome* was also a term used to describe various symptoms such as eye strain, eye discomfort, headache, dry eyes, blurred vision at close range, users who complain of pain in the neck and back were also included in the symptoms CVS.

As many as 88.5% of respondents experienced CVS complaints, this result was higher than the prevalence of CVS in employees of a University in Malaysia that is equal to 68.1%. The most common complaints of CVS were eye strain / asthenopia and neck / shoulder / back pain, each at 73.9%. Meanwhile, CVS complaints that were least experienced were dry / sandy eyes, which was 23.2% (Jonge, 2018).

Quoting from the *A Merican Optometrist Association* (AOA) to prevent eye fatigue, the monitor should be placed in a position of 16-30 inches, depending on how big the screen is. Generally a comfortable position for staring at a monitor was at least 20 inches or 50 cm.

The occurrence of *Computer Vision Syndromewa was* caused by prolonged use of computer signs interspersed with adequate rest which causes CVS symptoms. In addition, based on a questionnaire filled out by BPJS office staff more answers to the answers

"sometimes and always" on questions that lead to questions experienced by employees every time they use a computer, which means BPJS employees experience CVS symptoms.

Table 5: Distribution of Respondents Based on *Computer Vision Syndrome* Events.

Computer Vision Syndrome Incidence	Frequency (people)	Percentage (%)
No CVS Occurred	10	33.4
CVS happened	20	66.6
Total	36	100.0

4 CONCLUSION

The validity of the instrument *level of computer vision syndrome* tested had correlation coefficient values ranging from 0.542 to 0.973 and was declared valid. The *computer vision syndrome* instrument *level* reliability tested had a *Cronbach alpha* of 0.986 and was declared reliable. The majority of computer usage time in Grandmed Lubuk Pakam Hospital office employees was in the medium category with 20 people (66.6 %). The majority of office employees at Grandmed Lubuk Pakam Hospital experience *computer vision syndrome* , as many as 20 people (66.6 %).

5 SUGGESTION

Apply a *computer vision syndrome level* instrument to determine the occurrence of *computer vision syndrome* in office employees. For leader of the company should issue a Standard Operating Procedure health work for the computer and prepare policies in accordance with Standard Operating Procedures and It was expected to conduct further research by adding other variables related to room lighting when used a computer that can cause Computer Vision Syndrome events in computer users.

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