CHAPTER I
INTRODUCTION

1.1 Background

Color Vision Deficiency (CVD) is the inability of the human eye to see certain color differences under normal lighting conditions. This condition can be caused by abnormalities or congenital or excessive use of drugs (Bingham, Dietrich, & Goelman, 2019; Swara, 2019). Color vision is influenced by three types of cone cells, namely red, green, and blue with different wavelengths. If one of these three cells does not function properly or lacks one of the photopigments, it can cause visual disturbances called color blindness (Fareed, Anwar, & Afzal, 2015; Karolina, Pharmawati, & Setyawati, 2019). Fareed also mentions in his journal that the gene that makes the blue pigment is located on chromosome number 7, while the red and green genes are located on the long arm of the X chromosome (Xq28). A mother who is a carrier of the abnormal gene has a 50% chance that their son will be color blind. A colorblind father will only pass on the X chromosome to their daughter, this means the daughter of a colorblind father will be a carrier while the son will have normal eye conditions. In general, color blindness can be categorized into three, namely monochromacy (total color blindness), dichromacy (partial color blindness) and anomalyous trichromacy (impaired sensitivity in cone cells) (Zhu et al., 2022). According to Putra, Fiolana, & Kusumastutie (2021) in a journal entitled "Penerapan Koreksi Warna Pada Citra Bagi Penyandang Buta Warna Parsial" explained that 0.7% of the total 255 million population in Indonesia has a genetic disorder where the sufferer has difficulty distinguishing levels of color gradations. In a survey conducted by Keene (2014), it is known that color blindness is more common in men with a percentage of 8% and women with a percentage of 0.4%, where the most cases of color blindness that occur are partial color blindness.

Technology is known to develop very quickly, it can be seen from how big the impact of technology on human life is. Nowadays, mobile technology and websites are starting to appear those support aspects of human life, whether it is transportation, industry, economy, or even education. Especially in the educational aspect, technology is widely used as an information system that can support the

smooth operation of academics, for example, the e-learning system. The use of e-learning has begun to be adopted by various levels of education, one of which is university level. Universitas Pendidikan Ganesha (Undiksha) is one of the universities that has implemented the use of e-learning in existing operational activities. As one of the largest universities located in northern Bali, Undiksha has developed various kinds of information systems that support their operational activities. E-learning can be defined as a medium in the delivery of educational materials and methods by utilizing information technology in meeting the needs of learning and teaching or acquiring knowledge without being limited by place and time (Deny & Andry, 2018; Maudiarti, 2018). E-learning developed at Undiksha uses Moodle which is one of the most popular Learning Management Systems (Utami, Arthana, & Darmawiguna, 2020), where the development of Undiksha e-learning is an innovative website-based information system to support teaching and learning activities between students and lecturers which is very useful for use during the current pandemic because it requires teaching and learning activities to be carried out online. E-learning also functions as a learning tool that contains material, method limitations, and evaluation solutions that are designed systematically and attractively to achieve the expected competencies (Universitas Pendidikan Ganesha, 2019). The e-learning website is still being used and accessed by lecturers and students at Undiksha, including students who are color blind, especially partial color blindness.

Students with partial color blindness are in the minority, but their convenience when using Undiksha's e-learning is essential. This is necessary to realize equal rights and opportunities for all Indonesian citizens, including persons with disabilities, as explained in the Law of the Republic of Indonesia Number 8 of 2016 concerning Persons with Disabilities (Undang-Undang RI, 2016). According to Lynch & Horton (2016), the clarity and legibility of the content displayed on a website page can increase if the right color selection is made. The factor that affects the readability of the content is the contrast between the text (foreground) and the background of the website, where low contrast can cause readers to have difficulty distinguishing between text and background, causing difficulties to distinguish the shape of the letters. Therefore, of course, e-learning must have a friendly user

interface for students with partial color blindness to provide comfort in using e-learning and improve the readability of the content displayed. This is directly proportional to the statement of Geasela, Ranting, & Andry (2018) in their journal that a good interface or user interface is one of the important factors that can increase the usability of e-learning websites. User interfaces that have good contrast will certainly be able to improve the learning quality of students with partial color blindness in consuming learning content provided in e-learning.

Based on the results of interviews conducted with Mr. I Gede Partha Sindu, S.Pd., M.Pd as the head of the content management division at UPT TIK explained that the Undiksha e-learning website uses a template from the Moodle Learning Management System and until now there has never been researched aimed at to measure the quality of the user interface or evaluate the condition of Undiksha's e-learning whether it is friendly for people with partial color blindness or not, when in fact there are guidelines that can be used to evaluate this or become a standard. Several guidelines or standards that aim to make all information, both digital and printed, accessible to persons with disabilities include the Web Content Accessibility Guidelines, Section 508 Standards, American with Disabilities Act, and User Agent Accessibility Guidelines (Steinebach, 2020). From the various existing guidelines, Web Content Accessibility Guidlines is the most widely used guideline because the standards in it cover many types of disabilities, including being able to be used as a reference in evaluating the contrast ratio on the website user interface. Web Content Accessibility Guidelines (WCAG) is an internationally agreed website accessibility standard guideline. This guide is published and recommended by the Web Accessibility Initiative of the World Wide Web Consortium (W3C) which has collaborated with individuals and organizations around the world intending to guide website builders or developers so that the website development can be seen, understood, and used by all users (W3C, 2005). The intended website users are not only people who are categorized as normal, but also users who are categorized as having disabilities. Since it first appeared, WCAG has made several updates and has three versions, namely WCAG 1.0 which was published in 1999, then updated to WCAG 2.0 in 2008, and WCAG 2.1 in 2018 which is an update from the previous version which has 17 additional criteria

(Henry et al., 2020). In WCAG 2.1, the addition of criteria led to an increase in several things, one of which was an increase in the contrast ratio, i.e. there were success criteria for people with low vision impairment (Martínez, Turró, & Saltiveri, 2021).

Previous research was conducted by Deastu, Marthasari, & SN in 2020 with the title "Analisis Aksesibilitas Website Pemerintah Provinsi di Indonesia Menggunakan Pedoman Web Content Accessible Guidelines 2.0". In this research, an evaluation of the accessibility of 34 provincial government websites in Indonesia was carried out using the Web Content Accessibility Guidelines 2.0 and utilizing the TAW and aXe accessibility evaluation automation tools. The results of this research prove that the Web Content Accessibility Guidelines 2.0 and TAW and aXe evaluation automation tools are very effective in finding accessibility problems on provincial government websites in Indonesia. In the use of the TAW evaluation tool, the problems found in the Perceivable section are 6490. Government websites that have the most accessibility problems using the TAW evaluation tool are East Nusa Tenggara and Riau. In using the aXe evaluation tool, the provincial government websites that have a lot of accessibility are Yogyakarta and West Kalimantan provinces (Deastu, Marthasari, & SN, 2020).

Based on the characteristics of the problems that have been described, it is necessary to evaluate the contrast ratio to measure how friendly the user interface of the Undiksha e-learning website is for students with partial color blindness. Therefore, a research was designed with the title "Evaluation of Contrast Ratio on Universitas Pendidikan Ganesha E-Learning Website for Partial Color Blindness People Using Web Content Accessibility Guidelines (WCAG) 2.1". The Web Content Accessibility Guidelines (WCAG) 2.1 is the latest version of the website accessibility standard guidelines which have 4 main principles and are translated into 78 criteria. The four main principles are perceivable, operable, understandable, and robust (Henry et al., 2020). The criterion used in measuring the contrast ratio is Color Contrast (minimum) which is included in the perceivable principle where this criterion can provide sufficient contrast between the text and the background so that it can be easily read by users who have low vision problems or partial color blindness. The success criteria for measuring the level of compliance of a website

based on the WCAG 2.1 guidelines consist of three levels, namely: A level (minimum accessibility level), AA level (medium accessibility level), and AAA level (maximum accessibility level) (Kirkpatrick, Campbell, Connor, & Cooper, 2018).

In measuring the contrast ratio between the foreground and background colors of a website page, many automation tools have been developed. Contrast measurement automation tools have a specific purpose to help test the contrast of two colors that are combined whether they meet the criteria for success or not (Hansen, Krivan, & Sandnes, 2019). This research use the WCAG Color Contrast Checker browser extension as an automation tool to help detect and test color contrast on the Undiksha e-learning website according to the color contrast standard of WCAG 2.1. Previously, research was carried out by Almeida & Duarte (2020) compared three automation tools to detect and test the contrast ratio of web pages according to the standards of the WCAG guidelines, including the Color Contrast Accessibility Validator, WAVE, and the WCAG Color Contrast Checker. From various tests carried out using these three automation tools, it is evident that WCAG Color Contrast Checker can detect the contrast ratio of the tested websites well compared to other automation tools. Furthermore, to assist in the design of improvement recommendations, this research will use the Polypane automation tool which is a website color contrast checker that can provide recommendations for accurate contrast ratio improvements following WCAG standards. Polypane will be used to help get color contrast recommendations that are friendly for color-blind people based on the results of the evaluation of the color contrast of the current Undiksha e-learning website (as is).

1.2 Research Questions

Based on the background described above, some of the problems in this research are formulated as follows:

1. What are the results of the evaluation of the contrast ratio on Universitas Pendidikan Ganesha e-learning website (as is) for partial color blindness people using the Web Content Accessibility Guidelines (WCAG) 2.1?

2. What are the results of the recommendation for the contrast ratio of Universitas Pendidikan Ganesha website e-learning (to be) using the Web Content Accessibility Guidelines (WCAG) 2.1?

1.3 Purposes of the Research

The objectives that are expected to be achieved from this research are as follows:

1. To find out the results of the contrast ratio evaluation on Universitas Pendidikan Ganesha e-learning website (as is) for partial color blindness people by using the Web Content Accessibility Guidelines (WCAG) 2.1
2. To find out the results of the recommendation for the contrast ratio of Universitas Pendidikan Ganesha e-learning website (to be) using the Web Content Accessibility Guidelines (WCAG) 2.1

1.4 Benefit of the Research

The benefits that can be obtained from this research are as follows:

1. For Researchers
    Researchers can gain new knowledge and experience through the methods used during the research process as well as practice speaking skills when conducting interviews with the parties concerned.
2. For Universitas Pendidikan Ganesha
    a. The recommended results from the research conducted can be used as a support and reference in improving the contrast ratio of the Undiksha e-learning website interface.
    b. The research results can be used as a reference in increasing the contrast ratio of all existing systems at Undiksha that are already running or as a reference in designing the user interface design of the new system at Undiksha.
3. For Readers
    Gain an understanding of the importance of contrast ratio on a website for all users and know how to evaluate color contrast using standard accessibility guidelines.

1.5 Research Scope

Based on the description that has been described in the background, the scope of this research is as follows:

1. The research was conducted using two evaluation automation tools, namely WCAG Color Contrast Checker and Polypane to evaluate the contrast ratio of the Undiksha e-learning website when accessed via a desktop device.

2. This research uses one criterion in WCAG, namely Color Contrast (Minimum) as the standard of color contrast ratio in evaluation.

3. The research was conducted by evaluating the contrast ratio focusing on the type of partial color blindness or dichromacy.

4. The research was carried out to the stage of providing recommendations for the contrast ratio of the Undiksha e-learning website that is friendly to people with partial color blindness according to the WCAG standard based on the results of the evaluation of the current contrast ratio (as is) into recommendations (to be) and did not reach the stage of system improvement.

5. The research was conducted by evaluating the user interfaces of the Undiksha e-learning websites in general, namely the user interface of the features displayed on the navigation and the interface of one course that uses the default template.