COLOR-BLINDNESS IN TRANSITION:

A FOUCAULDIAN GENEALOGICAL DISCOURSE ANALYSIS

OF

SCHOOL COLOR VISION TESTING IN JAPAN

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ABSTRACT

This study explores the way in which the notion of color-blindness was discursively constructed and transformed through various changes of school color vision testing in Japan. The study employs a Foucauldian genealogical discourse analysis as the methodology of this study. The notions of color-blindness during the mandatory and the optional school color vision testing were reconceptualized in light of disability studies. As a result, the study highlights the way in which the notion of color-blindness has been discursively in transition from failing a color test to self-advocating color vision needs.

First, the study examines the shifts of the notion of color-blindness during the mandatory school color vision testing. The notion of students' health as disease free was constituted before the school color vision testing was incorporated in school health examination in 1920. The Ishihara color test was primarily used to screen out students with lacking or defective color vision in order to improve their health. In this sense, the study addressed the medical model of color-blindness during the mandatory school color vision testing.

Second, the study discusses the way in which the notion of color-blindness was shifted from lacking or defective color vision towards failing the Ishihara color test, during the mandatory school color vision testing abolition movement. The notion of

color-blindness as failing the Ishihara color test was advocated by the people concerned with color vision defects and their families. They claimed elimination of the color vision discrimination, which eventually concentrated on the mandatory school color vision testing abolition movement. The study addresses the social model of color-blindness during this transition period.

Third, the study investigates how the notion of color-blindness as self-advocacy of color vision needs was discursively reconstructed under the optional school color vision testing after 2003. The study examines life stories of the younger generation of people with defective color vision. They strategically disclosed their color vision needs based on different situations. As a result, the study addresses the discursive formations of strategic model of color-blindness that was discursively constituted by self-awareness, self-examination, and self-disclosure of color-blindness.

In conclusion, the study concludes by pointing out that the strategic model of color-blindness provides an insight into the way in which mild disabilities are constructed in society. The findings of the study contribute to the theoretical development of disability studies. The findings of the study will also improve accessibility to education for learners with diverse needs. It is hoped that the study sheds light on the shifting of notions of color-blindness in school color vision testing.

要　旨

本研究は、日本において色盲観がどのように構築され変遷してきたか、学校色覚検査の変遷を分析することで明らかにすることを目的としている。本研究では、フーコーの系譜学的言説分析法を採用し、様々なテクストから色盲観の変遷を探った。また、本研究では障害学の視点を援用し、強制的色覚検査と選択的色覚検査の時代それぞれで構築された異なる色盲観についても明らかにしている。分析の結果、色盲観が色覚検査不合格者から、自らの色覚ニーズを自己主張する個人へと変遷する過程が明らかになった。

第一に、本研究では強制的学校色覚検査の時代において、色盲観が言説的に構築され変遷した過程を明らかにした。学校色覚検査が学校健康診断に始めて導入された1920年に、疾病がない状態を健康とする学生の健康観が生まれた。学生の健康を増進することを目的として、主に石原式色覚検査表を使用して色覚を欠損、或いは異常の疑いのある学生がふるい分けられた。したがって、本研究の分析結果は、強制的学校色覚検査の時代に、色盲の医学モデルが言説的に構築されたことを示唆している。

第二に、本研究では、強制的学校色覚検査撤廃運動の時代、色盲観はそれまでの医学的な意味での色覚の欠損、或いは異常の疑いを色盲とする医学モデルから、石原式色覚検査表で不合格となる者を色盲とする色盲観へと変遷する過程を明らかにした。このような石原表誤読者を色盲とする色盲観は、色覚異常当事者とその家族の声により構築されていた。彼らは、色覚差別の根絶を主張していく活動の中で、強制的（この運動側の視点で

は、制度的と呼ばれる）学校色覚検査の撤廃にも注力していった。したがって、本研究の分析結果は、このような学校色覚検査制度の移行時期において、色盲の社会モデルが言説的に構築されたことを示唆する。

第三に、本研究では、2003年以降の選択的学校色覚検査により、自らの色覚ニーズを自己主張する色盲観が言説的に再構築された過程を明らかにした。具体的には、若い世代の色覚異常当事者のライフストーリーを収集し、詳細に分析した。分析の結果、彼らは状況に合わせて、自らの色覚ニーズを戦略的に自己開示していることが明らかになった。したがって、本研究の分析結果は、色盲の自己認識、自己診断、自己開示というプロセスを経て言説的に構築される戦略的色盲モデルというこれまでにない新たな視点を提起する。

結論として、本研究は、学校色覚検査において変遷する色盲観を明らかにした。本研究が明らかにした戦略としての色盲モデルは、軽度障害が社会的に構築される過程についての新たな視角を提起する。その意味で、本研究の学術的意義として、本研究が明らかにした視点は、障害学の理論的発展に貢献しうるものである。また、本研究の社会的意義として、本研究の成果は、多様なニーズを抱える学習者の教育機会向上にも貢献しうるものである。

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GLOSSARY

Term	Definition or English Translation
Shikimou	*Shikimou* is color-blindness in English which usually reflects a stereotype towards people, who are labeled with color-blindness, as being unable to percept colors.
Color vision defects	Color vision defects address the medical condition of lacking or having defective color perception.
People concerned with defective color vision	The people concerned are stakeholders in the issue of defective color vision, which include those who identify themselves as defective color vision without medical diagnoses.
Gakkohokenho	*Gakkohokenho* is known as School Health Act in English.
Monbukagakusho	*Monbukagakusho* is known as Ministry of Education, Culture, Sports, Science and Technology Japan (MEXT) in English.
Gakkohoken Anzenho	*Gakkohoken Anzenho* is known as School Health and Safety Act in English, which replaced *Gakkohokenho* in 2009.
Katsuryoku Kensa	*Katsuryoku Kensa* is known as vitality exam in English.
Gakusei Seito Shintaikensa Kitei	*Gakusei Seito Shintaikensa Kitei* is known as regulations of physical examination for students in English.
Gakusei Jidou Seito Shintaikensa Kitei	*Gakusei Jidou Seito Shintaikensa Kitei* is known as regulations of physical examination for children and students in English.
Gakkohoken Shikoukisoku	*Gakkohoken Shikoukisoku* is known as enforcement regulations for the school health law in English.
Shikikakuijou	*Shikikakuijou* is known as color vision defect in English.
Gakko shikikaku kensa	*Gakko Shikikaku Kensa* is known as school color vision testing.
Ishihara Shikikaku Kensahyou	*Ishihara Shikikaku Kensahyou* is known as Ishihara's Tests for Colour Deficiency or the Ishihara color blindness test.
Color special vision	Color special vision is Takayanagi's own translation of her term *shikikaku tokusei* in Japanese, which refers to the symptoms of color vision defects.
Yogo teacher	*A yogo* teacher is a special licensed teacher who usually practices basic medical care at a school infirmary.
Nihon Shikikakusabetsu Teppai no Kai	*Nihon Shikikakusabetsu Teppai no Kai* is an advocacy group which mainly sought mandatory school color vision testing abolition.

CHAPTER ONE

INTRODUCTION TO THE STUDY

This study seeks to investigate the phenomenon of how color vision testing as part of annual school health examination revived in 2014 after more than 10 years since mandatory school color vision testing was abolished in 2003. The amendment entails the increased debates regarding school color vision testing whether it should be mandatory or not. The purpose of this study is to explore the ways in which the notion of color-blindness in school color vision testing has been discursively constructed and transformed in Japan towards the amendment of 2014. The study seeks to better understand how the debates in 2014 regarding school color vision testing are formed and located around the discursive formation of notion of color-blindness. It is anticipated that this inquiry would provide new insights to the study of notion of color-blindness and so enhance school health practice in Japan.

The study thoroughly examines discourses of school color vision requirements and life stories of people with color vision defects in light of a social model of disability. Although the social model of disability primarily composes the theoretical framework of disability studies in education, it has been criticized for the lack of

incorporating the lived experience of the disabled people in the theory. In order to counteract the criticism, this study employs Foucault's notion of power to highlight the shifts in the reasoning for school color vision testing in Japan. Foucault's notion of power allows the study to pursue various power relations behind the discursive formation of notion of color-blindness. Through lens of the social model of disability, the study aims at better understanding how abolishing mandatory school color vision testing in 2003 discursively reshaped the notion of color-blindness.

This chapter commences with an overview of the background and context that addresses the problem that this study seeks to explore. The review of the background of the study is followed by problem statement, statement of purpose, and research questions. Accordingly, research approach, hypotheses, researcher's perspective, and rationale and significance of the study are also presented in this chapter. The chapter comes to an end with an overview of the following chapters.

1.1. Background and Context

Although the testing standard and method affect the percentage of occurrence, there seems to be at least one student with congenital color vision defects in an average class of twenty men and twenty women in Japan (Kanata, 2013). Statistically, one in twenty

of men and one in five hundred of women have congenital color vision defects. In addition, the number of people with acquired color vision defects is increasing as the population of Japan is aging rapidly (Ichikawa, 2015). In total, there are more than three million of people with either congenital or acquired color vision defects in Japan (Color Universal Design Organization, 2009).

Color-blindness, commonly known as *shikimou* in Japanese, generally refers to the overall symptoms caused by the particular medical condition of color vision defects. The term *shikimou* might have been always misleading to the notion of color-blindness as being unable to see colors (Rosenthal & Phillips, 1997). Hence, Takayanagi (1996a, 2014b) states that color-blindness usually reflects a stereotype towards people, who are labeled with color-blindness, as being unable to percept colors. The notion of being colorblind is the discursive formation of notion of color-blindness that this study refers to as the traditional notion of color-blindness in Japan.

Yasuyo Takayanagi, who is a clinical ophthalmologist and school physician, argued that the traditional notion of color-blindness was constructed through the mandatory school color vision testing (Takayanagi, 1996a). Takayanagi's view of color-blindness influenced various deregulations and abolition of color vision requirements. The removal of color vision testing from annual school health examination in 2003 was

one example. Takayanagi's argument divided politics of school color vision testing into the following two groups. One was the supporters and the other was the opponents regarding the mandatory school color vision testing.

The amendment of *Gakkohokenho*, in English known as School Health Act, in 2003 removed the requirement of color vision testing from school health examination and made the testing optional. However, the situation was shifted in 2014 when *Monbukagakusho*, in English known as Ministry of Education, Culture, Sports, Science and Technology Japan in English (hereafter MEXT), issued an official notice regarding *Gakkohoken Anzenho*, in English known as School Health and Safety Act, in 2014. The notice 2014 of *Gakkohoken Anzenho*, which replaced *Gakkohokenho* in 2009, officially encouraged all the public schools to consider incorporating a color vision requirement in annual health examination (MEXT, 2014a). The notice of 2014 was followed by an official memorandum, which even clarified with useful sources, insisting that school color vision testing should proactively be suggested to students and their parents (MEXT, 2014b). As a result, the set of notice and memorandum has been commonly regarded by both the supporters and opponents of mandatory school color vision testing as the revival of school color vision testing. The following table is a history of school color vision testing in Japan (see Table 1).

Table 1

A History of School Color Vision Testing in Japan

1874	The first field day, called *Kyoutou Yuugikai* in Japanese, was held.
1878	Vitality exam started at a school of gymnastics.
1898	Vitality exam was incorporated with school curriculum.
1900	Regulations of physical examination for students was enacted.
1916	Shinobu Ishihara published Ishihara's Tests for Colour Deficiency.
1920	Regulations of school health checkup for children and students was enacted. The first school color vision testing started. Students were required to take it once in six years of elementary school.
1921	Sinobu Ishihara published Ishihara's Tests for Color Deficiency for School Use.
1937	Students who were older than eight years old were required to annually take the school color vision testing.
1944	Students were required to take school color vision testing once in six years of elementary school under the World War II.
1949	Students who were older than eight years were required to annually take the school color vision testing.
1958	School Health Act was enacted. Students were required to take the pre-school color vision testing and annually take the school color vision testing as part of the annual school health echeckup.
1972	Pre-employment color vision testing became a requirement.
1973	School color vision testing eliminated the pre-school testing and reduced the number of testing to only four times until post-secondary education.
1995	Only students who were nine years old were required to take the school color vision testing.
2001	Pre-employment color vision testing was abolished.
2003	School color vision testing became an option of the annual school health checkup.

Note. The above information derived from Shikikakuijou kenshin no rekishi, *Ophthalmology*, 58(12), 1473-1483, by K. Yano & K. Nakamura, 2016; History of colour vision test (1), *Journal of the Color Science Association of Japan*, 29 (1), 54-63, by Y. Ohta, 2005; Nihon gakko hoken shi, *Nihon Ishigaku Zassi*, 21 (3), 263-299, by M. Sugiura, 1975.

An intention survey to have parents' confirmation of conducting color vision testing became mandatory in the school health checkup (Amagasa, 2015; Yano, & Nakamura, 2016; Ichikawa, 2015; Japanese Ophthalmological Society, 2015; Takayanagi, 2014b; Tokugawa, 2016). The number of schools which not only started to take consent with students but also to revive school color vision testing has increased significantly from almost 0% to 50% of all the public schools in Japan after *Gakkohoken Anzenho* 2014 (Hara, 2018 Dec.). The percentage gap highlights the division between supporters and opponents of mandatory school color vision testing. The shift of school color vision testing in *Gakkohoken Anzenho* 2014, therefore, entails the relapse of debates in 2003 regarding school color vision testing whether the testing should be mandatory or abolished.

Majority of earlier studies regarding school color vision testing were located in the domain of school health studies. They have mainly discussed the cause, occurrence, risk, and disadvantage of students with color vision defects in schools (e.g., Ichikawa, 2015, 2016; Miyaura, Utsumi, Kashii, Yamagishi, & Takano, 2012a, 2012b; Muraki, 2014, 2016; Miyaura, 2014; Kashii, 2016a, 2016b). On the other hand, there is only a limited number of researches from sociological perspectives including Takayanagi (e.g., 1998; 2014b) and *Nihon Shikikaku Sabetsu Teppai no Kai* (1996). These studies have

discussed the notion of color-blindness from the perspective of the people concerned and examined their life stories. Takayanagi (2014b) argued that mandatory school color vision testing constructed the notion of color-blindness as failure of the Ishihara color blindness test through school color vision testing. Therefore, she asserted that difficulties the people concerned encounter must be assessed for their better learning and schooling experience. Although Takayanagi successfully raised awareness of color-blindness as a social construct, she has not fully described the way in which the notion of color-blindness was constructed through mandatory school color vision testing. The missing piece of earlier studies raises the following question:

> How was the traditional notion of color-blindness constructed through mandatory school color vision testing?

The domain of disability studies in education has a collection of studies discussing impairment as construct (e.g., Evans, Broido, Brown, & Wilke, 2017; Gabel, 2009; Gallagher, Conno, & Ferri, 2014; Iannacci, 2018). Therefore, the disability studies perspective may provide a meaningful insight to understanding notion of color-blindness. However, no earlier studies have discussed color-blindness yet in the tradition. The lack of attention therefore raises another question:

How can the social model of disability be theoretically developed so as to incorporate color-blindness and school color vision testing as a possible theme of disability studies in education?

This study aims to provide a new insight to the study of color-blindness and school color vision testing in the domains of school health studies and disability studies in education. Therefore, the study seeks to address problems regarding *Gakkohoken Anzenho* 2014 and the increased debates of school color vision testing in Japan.

1.2. Problem Statement

The revival of school color vision testing in 2014 entails the relapse of debates regarding mandatory school color vision testing in Japan. *Gakkohoken Anzenho* 2014 officially supports the revival of school color vision testing. Consequently, school color vision testing may become mandatory again for many students. In this sense, it is important to better understand the way in which the optional school color vision testing influenced students with defective color vision after 2003.

However, there are the following four problems in the earlier literature. First, the existing literature does not provide in-depth and comprehensive understanding of the way in which students with color vision defects has become subject to school health

examination. An only limited number of studies are available yet to disclose the way in which the notion of color-blindness has been discursively constructed through school color vision testing. Another problem is that the increased debates regarding mandatory school color vision testing are not thoroughly addressed and fully examined yet in the previous studies. The way in which the revival of school color vision testing in 2014 may theoretically different from and similar to the abolition of it in 2003 has not been explored yet. Third, there is lack of studies regarding school color vision testing from a socio-cultural perspective after 2003 when school color vision testing became optional. In other words, the previous studies are short of addressing the way in which the younger generation without the mandatory school color vision testing experience has grown up and lived under optionalized school color vision testing. Lastly, the domain of disability studies in education has a missing piece of study regarding people with color vision defects so that a social model of disability has not incorporated color-blindness in its theory yet.

1.3. Purpose and Research Questions

The purpose of this study is to explore the ways in which the notion of color-blindness in school color vision testing has been discursively constructed in Japan. It is

anticipated that this inquiry would enhance better understanding of how the revival of school color vision testing occurred in 2014. The inquiry may also help us better understand how the social debates regarding testing has been theoretically framed. The study addresses the following research questions regarding the problems.

The first question is how the notion of color-blindness in school color vision testing has been discursively constructed and transformed in Japan. The second question is how the debate in 2003 regarding abolishing mandatory school color vision testing was theoretically framed and different from the increased debate in 2014. The third question is how the experience of school color vision testing has been changed from the mandatory testing through the optional testing. Finally, the fourth question is how the social model of disability can be theoretically developed so as to incorporate color-blindness and school color vision testing as a possible theme of disability studies in education.

1.4. Research Approach

The researcher examines discourses of school color vision testing, including the following texts and narratives. Primary texts include vitality exam which is called *Katsuryoku Kensa* in Japanese, regulations of physical examination for students which

are called *Gakusei Seito Shintaikensa Kitei* in Japanese, regulations of physical examination for children and students which are called *Gakusei Jidou Seito Shintaikensa Kitei* in Japanese, *Gakkohokenho*, *Gakkohoken Anzenho*, and enforcement regulations for the school health law which are called *Gakkohokenho Shikoukisoku* in Japanese, as well as written and unwritten life stories of people with congenital color vision defects as primary narratives. Life story interview (Sakurai, 2002; Sakurai, 2005; Sakurai & Kobayashi, 2005; Sakurai, 2012; Okubo, 2011; Ishikawa & Nishikura, 2015) was employed as the primary method of collecting written and unwritten narratives. Through emplying the life story interview, the researcher collected written narratives of people with color vision defects. Especially collecting unwritten narratives after 2003, the researcher interviewed those who did not experience mandatory school color vision testing. The nature of life story interview prevents the study from interviewing a large number of research participants. However, in-depth interviews with a comprehensive review of literature and written life stories allow the study to support findings emanating from the interviews.

The study draws on disability studies in education and employs a social model of disability which allows the study to address color-blindness as a socially and historically constructed notion of disability. In light of a social model of disability, the

study employed a social constructionist discourse analysis (Burr, 2015; Suzuki, Ohashi, & Nouchi, 2015; Kendall & Wickham, 1999). The social constructionist discourse analysis allows the study to examine the discursive formations of notion of color-blindness in school color vision testing. Particularly, this study employs a Foucauldian genealogical discourse analysis. It also departs from the same tradition but mainly considers Foucault's notion of genealogy as the preferred tool to investigate power relations through analyzing discourses (Burr, 2015; Carabine, 2014). Foucault's notion of power is unique in the way which power does not belong to anybody but can be exercised so as to discursively form particular notion of what is regarded as norm and what is not (Foucault, 1972, 1988, 1990a, 1991, 1994, 1995, 2013, 2014). The researcher seeks to investigate power relations regarding the construction and transformation of notion of color-blindness in which the relapse of debate regarding school color vision testing in 2014 is discursively formed.

1.5. Hypotheses

Three primary hypotheses were presented based on my experience and background as one with a color vision defect. These hypotheses were my assumptions that served to guide my exploration at the beginning of this research. The first hypothesis I presented

is that the notion of color-blindness in the birth of school color vision requirement must have been different from the notion of color-blindness in the increase of debate regarding school color vision testing in 2014. The experience of school color vision testing shapes the ways to observe students with color vision defects and treat them as abnormal. In this regard, my own experience as one of students with defective color vision is reflected in this hypothesis.

The second hypothesis I presented is that the supporters of school color vision testing would refer to medical diagnosis of color vision defects in order to address their view. On the other hand, the opponents would refer to the individual experience of people with color vision defects within daily life. The former tends to value early detection and treatment of color vision defects. On the other hand, the latter reflects the bitter experience of mandatory school color vision testing. In this sense, the hypothesis I put forward is that theoretical elements of social model of disability might be found in the discourse of the opponents' discourse.

The third hypothesis I presented is that those who grew up under the optional school color vision testing would have influence on the discursive formation of notion of color-blindness after 2003. In light of the people who have not experienced the mandatory school color vision testing, notions of color-blindness must be different from

those who have experienced the mandatory testing. In other words, the younger generation of the people concerned with defective color vision might have developed a different notion of their unique color vision. This hypothesis also reflects my own experience with school color vision testing. The following section, accordingly, will review the role that I play as one of the people with color vision defects who experienced mandatory school color vision testing in this research.

1.6. The Researcher

The researcher is one of the people with color vision defects. I, myself, also experienced mandatory school color vision testing in elementary school. Thus, the researcher's own experience provides unique insights to the inquiry as well as having in-depth understanding of the collected life stories. On the other hand, the research acknowledges that the same experience may also cause biases and misinterpretations of research findings. Therefore, the researcher addresses subjectivities of the interpretations when appropriate. The study, accordingly, intends to improve the credibility and transferability of its interpretations by employing various methods and sources of collecting data.

1.7. Rationale and Significance

The rationale for this study relies on the researcher's long for disclosing the ways in which the notion of color-blindness has been discursively constructed in Japan. It is expected that the findings of the study provide in-depth understanding of how the revitalization of school color vision testing as well as it's debate in 2014 was formed. In addition, the study may also provide new insights to understanding the ways in which the notion of color-blindness in school color vision testing has been discursively transformed in Japan. Awareness of people with color vision defects will be raised by the better understanding of the construction of notion of color-blindness. Accordingly, existing color vision requirements may be put in reconsideration. People with color vision defects can enjoy increased career options. These changes may entail shedding light on various problems regarding not only color-blindness but also other disabilities and benefit society at large.

1.8. Overview of the Following Chapters

This study investigates the ways in which the notion of color-blindness has been discursively constructed and transformed towards the revitalization of school color vision testing in 2014. The following chapters will shed light on the way in which the

notion of color-blindness was in transition from mandatory school color vision testing to optional school color vision testing. To briefly state the following chapters, the second chapter describes the research framework of the study. This chapter will review the previous studies in the various fields. highlight the theoretical framework of the study and illustrate the methodologies of the study.

Furthermore, the third chapter discloses the ways in which the notion of color-blindness had been constructed and transformed during the earlier stage of mandatory school color vision testing from 1920 through 1972. In this chapter, various texts are examined. They include vitality exam which is called *Katsuryoku Kensa* in Japanese, regulations of physical examination for students which are called *Gakusei Seito Shintaikensa Kitei* in Japanese, regulations of physical examination for children and students which are called *Gakusei Jidou Seito Shintaikensa Kitei* in Japanese, the Ishihara color test for school use, and life stories of the people with color-blindness. Thoroughly reviewing the various documents, this chapter sheds light on the discursive formations of notion of color-blindness embedded in the discourses of mandatory school color vision testing.

Moreover, the fourth chapter of this study investigates the ways in which the traditional notion of color-blindness had been transformed towards the abolition of

mandatory school color vision testing in 2003. This chapter investigates the construction of the mandatory school color vision testing abolition movement which was organized and led by Yasuyo Takayanagi. Thus, this chapter examines various texts including *Gakkohokenho, Gakkohoken Anzenho,* the literature of Yasuyo Takayanagi, *Nihon Shikikakusabetsu Teppai no Kai*, and life stories of the people with color vision defects. This chapter intends to disclose Takayanagi's notion of color-blindness embedded in the discourses of the mandatory school color vision testing abolition movement.

Accordingly, the fifth chapter investigates the ways in which the notion of color-blindness has been discursively shifted from 2003 through 2014. No earlier literatures are available yet in terms of the individual experience of optional school color vision testing. This chapter, therefore, employs a life story interview of the younger generation of the people concerned who grew up during the optional school color vision testing period. This approach allows the study to contribute a unique insight to the earlier studies of school color vision testing by filling in the missing piece of data. This chapter highlights the discursive formations of notion of color-blindness embodied in the collected narratives of the people concerned who experienced the optional school color vision testing.

Finally, following the fifth chapter is concluding discussion and implications. This chapter elucidates discussion of the study. The study addresses the difference in the way which the debate was discursively formed between 2003 and 2014 by examining the collected narratives of the people concerned who grew up under the optional school color vision testing. Furthermore, the strategic model of color-blindness that the study addresses will be further discussed in terms of research and social implications of the study. The strategic model of color-blindness reflects the notion of self-advocacy of color vision needs. The notion is underpinned by the discourse of the younger generation of the people concerned who experienced the optional school color vision testing. The discourse regarding the optional school color vision testing implies the embodiment of restriction that individuals experience to the social model of disabilities. As a result, this chapter intends to facilitate social awareness of the people with color-blindness in society. In addition, this chapter also aims at facilitating discussion regarding the following research in the domains of school health and disability studies. Consequently, this chapter will further discuss what the findings of the study implies to the fields of school health and disability studies, in addition to Japanese society.

CHAPTER TWO

LITERATURE REVIEW, THEORETICAL FRAMEWORK, METHODOLOGIES

This study explores the ways in which the notion of color-blindness has been discursively constructed in Japan. In particular, the study sheds light on how the notion of color-blindness has been discursively transformed through the optionalization of school color vision testing. In order to develop the theoretical framework of the study, this chapter begins with a critical review of the previous studies. The literature review is followed by theoretical framework and methodologies of the study.

2.1. Literature Review

This critical literature review investigates the existing literature regarding school color vision testing in the areas selected. The following two topics of studies are chosen for the purpose of literature review:

- Topic A: School color vision testing: school health studies
- Topic B: Color-blindness as a social construct: social science

School color vision testing is reviewed to highlight the context, procedure, and regulations under which students are tested. The focus is to review earlier studies in the domain of school health studies. Accordingly, a review of color-blindness as a social construct mainly draws from earlier literatures in social science including psychology, history of ideas, and sociology. This approach will provide a broader view of earlier studies regarding school color vision testing so as to highlight where in the domains of earlier studies this research is located.

Various information sources were covered for this review, including books, dissertations, internet resources, scholarly journals, periodicals, newspapers, and films. These sources were mainly accessed through CiNii, NDL-opac, Google Scholar, and selected journal websites including Japan Journal of School Health. The researcher did not apply any specific delimiting time frame for this review. Primary keywords used for this review were *shikimou* in English known as color-blindness, *shikikakuijou* in English known as color vision defect, *gakko shikikaku kensa* in English known as school color vision testing, *karaa yunibaasaru dezain* in English known as color universal design, *karaa bariafurii* in English known as color barrier free, *ishihara shikikaku kensahyou* in English known as Ishihara's Tests for Colour Deficiency or the Ishihara color blindness test, and *shougai* in English known as disability or impairment.

The researcher seeks to examine similarities, differences, emphases, omissions, and limitations in the selected topics of literature. Thoroughly reviewing the two topics, each section of the review provides implications for the theoretical framework of the study. The following two sections include a short summary providing the review of each topic.

2.1.1. Topic A: School Color Vision Testing: School Health Studies

This section explores the context, regulations, and procedures of school color vision testing. Since school color vision testing has been mainly discussed in the context of school health, this section focuses on the review of school color vision testing in the domain of school health studies. First, this section reviews the context and regulations of *Gakkohoken Anzenho* 2014. Following the review of the regulations is the description of the normalized procedure to practice school color vision testing.

First, color vision testing had been a requirement of annual school health examination until 2003 when it was optionalized by the amendment (Ichikawa, 2015; Yano & Nakamura, 2016). In 2014, *Monbukagakusho* issued an official notice about school color vision testing which required public schools to let parents know about options to take school color vision testing by letters from 2016. The following quotation

is the translation of official notice issued by MEXT for the purpose of informing schools about the change in school color vision testing:

> Especially, students should be well informed about their color vision defects in order to prevent students from experiencing disadvantage. Thus, it is necessary that color vision defect should be recorded in the health record and parents are even actively and better informed about the benefits to their children of taking school color vision testing. (MEXT, 2014a; author's translation)

As MEXT (2014a) states, the notice encourages schools to advise parents that school color vision testing is of benefit to their children. The notice of 2014 was followed by an official memorandum, which emphasized the revitalization of school color vision testing, "school color vision testing must properly be conducted" (MEXT, 2014b; author's translation). Thus, Ichikawa (2015) understands the set of official notice and memorandum as the revitalization of school color vision testing even though *Gakkohoken Anzenho* was not actually amended:

> [People with color vision defects] must have hard time to adjust their color recognition with what is regarded as normal color vision because school color vision testing was abolished. As a result, they do not have chance to recognize their own unique color vision. This entails that they also have no chance to

> understand their color vision and find their own solutions. Inequality between people with and without color vision defects is even worse and more complicated than before because it is invisible. In order to solve the problem, school color vision testing in elementary school will revive in 2016. Therefore, students will be again able to know whether they have normal or abnormal color vision. (Ichikawa, 2015, p. 100; author's translation)

As Ichikawa (2015) claimed, the revival of school color vision testing was underpinned by the discourse that the students with color vision defects should become aware of their different color vision. Those who fail school color vision testing should be informed about their abnormality as early as elementary school. Otherwise, some inequality remains between the people with color vison defects and without the defects. In this sense, Ichikawa (2015) applies the value of early detection and treatment to school color vision testing.

Major literature in school health studies also applies the same value and often concludes that the objective of revitalized school color vision testing was set to solve social and educational inequality caused by differences in color vision by improving self-recognition (Ichikawa, 2016; Muraki, 2014, 2016; Nakamura, 2016; Miyaura, 2014; Kashii, 2016a, 2016b; Miyaura, Utsumi, Kashii, Yamagishi & Takano, 2012a,

2012b). For example, Nakamura (2016) argues, “the people concerned [people with color vision defects] should know that they must make small and less severe mistakes on a daily basis which they even may not realize more often than they expect. Therefore, it is necessary for them to recognize their own color vision and to take appropriate measures” (p. 51; author’s translation).

In addition, Muraki (2016) states that the purpose of testing is to choose the right career path. Muraki (2016) asserts that “it is highly recommended to take color vision testing for the purpose of career counseling although school color vision testing is currently optional” (p. 38; author’s translation). The same objective is reflected in the discourse of the official notice of school color vision testing in 2014. MEXT (2014a) addresses that “students should be well informed about their color vision defects in order to prevent students from experiencing disadvantage” (author’s translation).

To summarize, the majority of these studies have been discussed in ophthalmological and medical perspectives. They seek for the cause, occurrence, risk, and disadvantage of students with color vision defects in education. These studies, as a result, tend to support mandatory school color vision testing from medical perspectives. However, the ways in which the notion of color-blindness and school color vision testing was constructed has not been fully examined yet.

Second, what was regarded as the proper way to conduct school color vision testing at school was reintroduced by Japan Ophthalmologists Association. Japan Ophthalmologists Association recommends the Ishihara color blindness test for school color vision testing as they stated, “we recommend schools to use Ishihara’s Tests for Colour Deficiency II Concise” (Yamashita & Takano, 2015; author’s translation). Furthermore, Japan Ophthalmologists Association presented recommended criteria for medical judgment. In the criteria, they also emphasized the Ishihara color test for school color vision testing. According to the criteria that Japan Ophthalmologists Association presented, “Ishihara’s Tests for Colour Deficiency should not be used for the purpose of determining degree of severity” (Yamashita & Takano, 2015; author’s translation). Ophthalmologists Association, however, claims that “Ishihara’s Tests for Colour Deficiency should be used for screening out congenital color vision defects” (Yamashita & Takano, 2015; author’s translation). In these regards, school color vision testing using the Ishihara color blindness test was normalized through ophthalmologists’ discourse. By law, failures of the Ishihara test will be requested to submit the result of detailed color vision examination at local ophthalmologists to their schools.

Ishihara’s Tests for Colour Deficiency is one of the most well-known and trusted color blindness tests. Shinobu Ishihara made an original set of test plates in 1916

for conscription (Ohta, 2005; Suda, 1984). Then, he developed another set of test plate for the use of school color vision testing, called the Ishihara color test for school use, in 1918 (Ohta, 2005). Since then, the Ishihara color blindness test has been published with various patterns of test plates but they all, including Ishihara's Tests for Colour Deficiency II Concise, use the same test plates which were originally made in 1916. Each test plate is designed with color coordinate dots which illustrates shapes of different numbers. For example, the shape of 3 should appear in the illustration that the author drew (see Figure 1).

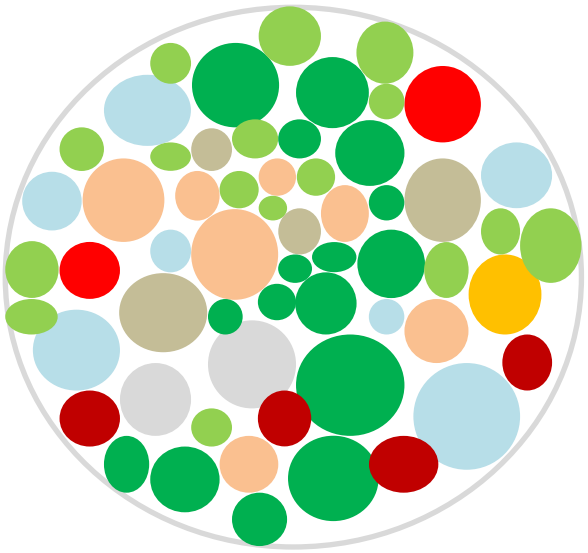

Figure 1. An example of the Ishihara test's plates. If you focus on green dots, you can recognize the shape of 3 in this illustration. I drew this illustration. Therefore, colors are not well coordinated. Adapted from *Ishihara shiki nihon shikimou kensahyou*, by S. Ishihara, 1920, Tokyo: Handaya.

Each plate has different patterns of color coordinate dots which are designed to screen out those who cannot recognize numbers in the pictures. On the other hand, the Ishihara test plates include a plate which every examinee can recognize numbers and the one which only the people with defective color vision can recognize numbers.

Because the Ishihara color blindness test is made of pseudo-isochromatic plates, screening with the Ishihara test detects medical symptoms of color vision defects. Color vision defects can be classified into the following two different major kinds: congenital and acquired defects. The former, congenital defects are hereditary and divided into the following three different types; protan known as red color vision defect, deutan known as green color vision defect, and tritan known as blue color vision defect (The Japanese Association of Medical Science, 2007). Those different types of congenital defects appear differently depending on sex and race except for tritan. Protan and deutan are known as sex linked recessive inheritance (McIntyre, 2002). Men suffer from defective color vision genes much more frequently than women do because recessive genes can only be carried on X chromosome which only females can carry two sets, instead of Y chromosome which only males can carry.

As a result, men's retina can be easily affected by a single defect gene while women's one needs two sets. Therefore, men generally have much higher percentages

of occurrence of color vision defects (McIntyre, 2002). In Japan, 5% percent of men and 0.2% of women statistically suffer from some form of congenital color vision defects (Color Universal Design Organization, 2009, p. 83). In Japan, color vision defects consist of 1.5% protan, 3.5% deutan, and 0.001% tritan (Color Universal Design Organization, 2009, p. 86). In addition, the distribution of defects varies with ethnic groups. In general, it is known that people from Europe tend to have higher percentages than those who are from Asia and Africa. For example, it is statistically estimated that the following percentages of people have congenital color vision defects: 8% of North America, between 7% and 9% of France, 10% of Northern Europe, between 2% and 4% of Africa (The percentages were obtained from McIntyre, 2002, p. 68; Color Universal Design Organization, 2009, p. 83).

Furthermore, there are also acquired color vision defects. McIntyre (2002) estimates that "at least 5% of the population have an acquired defect as severe as the 8% with a congenital defect" (p. 55). There are six major causes of acquired color vision defects including "Glaucoma, Diabetes, Injury, Age, Chemicals and drugs, and Heavy tobacco smoking" (McIntyre, 2002, p. 56). Particularly, lens of human eyes become yellowish as people age. Therefore, aged lens percept colors in different ways, which eventually ends up having a condition of defective color vision similar to congenital

color vision defects (Wright, 1947). In short, clinical color tests such as Ishihara's Tests for Colour Deficiency detects color vision defects. The defects are considered as the influence of congenital or acquired defective genes on the retina.

On the other hand, a limited number of previous studies regarding school color vision testing employed sociological perspectives in the domain of school health studies. They include Takayanagi (1996; 1998; 2014b) and *Nihon Shikikaku Sabetsu Teppai no Kai* (1996). These studies have discussed the notion of color-blindness from the perspective of the people concerned. They analyzed collected narratives of their individual experiences with school color vision testing.

It was Yasuyo Takayanagi who first argued that the notion of *shikimou* was constructed through school color vision testing in *Tsukurareta Shougai "Shikimou"* (Takayanagi, 1996a). In this ground-breaking book, Takayanagi criticized the traditional use of the Ishihara color blindness test for school color vision testing. She argued that the Ishihara test created misunderstanding of *shikimou* as impairment to see no color. In order to address her argument, Takayanagi conducted various researches. One of the researches that Takayanagi conducted was the analysis of annual detailed examination in Nagoya. In the study, she investigated color vision of students who were screened out at school color vision testing (see Table 2).

Table 2

Takayanagi's Study of Students' Color Vision in Nagoya

Participants	about 25, 000 of first year of elementary and junior high school students in Nagoya city who were screened out at school color vision testing with the Ishihara color test for school use
Procedure	Tests for Colour Blindness [an overseas edition of Ishihara's Tests for Colour Deficiency], Panel D-15 test, Anomaloscope test, and Lantern test
Result	4-10% of men and 47.8% of women who were screened out as color vision defects by the Ishihara color blindness test were not diagnosed as color vision defects by other tests

Note. Takayanagi was appointed to the school physician in Nagoya city. Therefore, she could have a large sample of students. Adapted from *Tsukurareta shougai "shikimou"* (pp. 27-28), by Y. Takayanagi, 2016a, Tokyo: Asahi Shimbun. (author's translation)

According to Takayanagi (1996a), almost half of women who were screened out at school color vision testing was misdiagnosed as color vision defects. Takayanagi interpreted the result as, "color vision testing at school is not only unnecessary, especially for women, but also it causes disadvantage to the students" (1996a, p. 30; author's translation).

In addition, Takayanagi reexamined other existing requirements in Japan (see Table 3). The test results allowed Takayanagi to argue, "the Japanese school color vision testing discriminated students who failed the Ishihara color blindness test from those who did not. As a result, the Ishihara test failures were labeled as 'color vision impairment'" (Takayanagi, Matoba, Miyao, and Yoshida, 2001, p. 171; author's

translation). Takayanagi's studies eventually underpinned the abolition of mandatory school color vision testing in 2003.

Table 3

Takayanagi's Study of Color Vision Requirements

Test	Color Vision Normal(Pass)	P= Protanope (Pass) PA=Protanomaly(Pass)	D=Deuteranope (Pass) DA=Deuteranomaly(Pass)
Resistance element identification test	85%	14%	13%
Display color identification test	80%	P = 24% PA = 43%	D = 38% DA = 72%
Red/Green pepper test	N/A	99%	99%
Traffic signal test	94.4%	P = 97% PA = 81%	D = 92 % DA = 94.7 %
Vessel anti-collision lights test	N/A	100%	100%

Note. The distinction between deuteranope and deuteranomaly is degree of severity. For example, deuteranope is severer than deuteranomaly. The same distinction is applied to the difference between protanope and protanomaly. Adapted from *Tsukurareta shougai "shikimou"* (pp. 113-118), by Y. Takayanagi, 2016a, Tokyo: Asahi Shimbun. (author's translation)

After eighteen years, Takayanagi reprinted *Tsukurareta Shougai "Shikimou" [Rev. ed.]* (Takayanagi, 2014b) in response to the revitalizing mood of school color vision testing in 2014. In the revised edition, Takayanagi expressed her concern about the mood among ophthalmologists and school physicians as follows:

> I do not understand why this [the revitalizing mood of school color vision testing] can happen. I believe it happens because ophthalmologists do not understand the concept of human rights. Furthermore, not only ophthalmologists but also Japanese society does not understand what human rights actually mean. At the conference, I had to stand up explaining how I spent last 30 years for correcting the mistakes that Japanese society made regarding color vision and the circumstances of people with color vision defects. I could not stand for the revitalizing mood of school color vision testing mood. (Takayanagi, 2014b, p. 221; author's translation)

At the conference, Takayanagi presented her concern about lacking awareness of history among ophthalmologists that school color vision testing became optional in 2003. Regarding the revitalization of school color vision testing in 2014, Takayanagi continues to address the same criticism as she used for abolishing mandatory school color vision testing in 2003. In other words, she intended to build the same argument as she did for Amendment 2003 by reminding ophthalmologists and physicians of her thirty years abolishing school color vision testing. However, Takayanagi does not update on her research findings in the 2014's edition yet. Therefore, it should be noted that Takayanagi (2014b) is missing data from 2003 to the present in order to reconstruct

her arguments towards the revitalization of 2014. This argument will be fully elaborated on in the fourth chapter.

Accordingly, Takayanagi's studies disclosed social aspects of issues of people with color vision defects. However, her studies did not succeed to redefine color vision defects with a social perspective. In other words, Takayanagi could redefine the notion of color-blindness as a social phenomenon but the research that she conducted was based on the medical diagnosis of color vision defects. Therefore, Takayanagi's perspective entails a tautology, which her criticism relies on the concept that she is criticizing. This study attempts to overcome the limitation of Takayanagi's perspective by applying a social model of disability and to develop a social model of color-blindness in order to better understand the discursive formations of notion of color-blindness and the way in which the revitalization of school color vision testing occurred.

Takayanagi (1996a) discussed the traditional notion of color-blindness as the failure of the Ishihara test. She argued that mandatory school color vision testing constructed the notion of color-blindness as the failure of the Ishihara test through school color vision testing. Difficulties the people concerned face must have been assessed for improving their learning and schooling environments. In this sense, color-

blindness is a social construct. Although Takayanagi successfully raised awareness of color-blindness as a social construct, she has not fully described the way in which the traditional notion of color-blindness was constructed through mandatory school color vision testing. In addition, her traditional notion of color-blindness as failure of the Ishihara test has never been examined yet in the domain of school health studies.

As a result, there has been lack of theoretical investigation of notion of color-blindness as a social construct. This missing piece of earlier studies raises the following research question:

> How was the traditional notion of color-blindness constructed through mandatory school color vision testing?

The study, therefore, seeks to highlight and reconceptualize Takayanagi's model of traditional notion of color-blindness through investigating the way in which the traditional notion of color-blindness was discursively formed and transformed through school color vision testing and relating alterations of school health acts.

In summary of this section, since 2016, it became mandatory for schools to inform parents about the benefit of taking school color vision testing for their children. Most of earlier literatures have been seeking for the cause, occurrence, risk, and disadvantage of students with color vision defects in education. The existing literature

in school health studies therefore understands the emphasis of letting parents know about school color vision testing option as the revitalization of school color vision testing. The purpose of revitalized school color vision testing was to help students make a better career choice by making them aware of their unique color vision. This rationale behind the revitalization reflects the value of early detection and treatment.

Accordingly, school color vision testing is supposed to be conducted with the Ishihara color blindness test. The testing procedure aims at detecting medical symptoms of color vision defects. Finally, the existing literature in school health studies has emphasized on describing the cause of color vision defects as medical symptoms. However, even though screening test and following detailed examination can detect types of color vision defect and degree of severity, most of severe color vision defects are congenital and no medical solution is found for them yet. Therefore, treatment for students with color vision defects has to be career counseling. Thoroughly reviewing the existing literature in the domain of school health studies allows the study to address the following four limitations.

The first limitation the study addresses is lacking social perspectives in the areas of research. The approach of school health and school color vision testing studies lies on the medical definition of color vision defects. However, if solution cannot be

found in the medical theory, the use of medical definition of color vision defect may require in-depth discussion. However, the existing literature in this field constructs their arguments based on the premise of medical definition.

The second limitation the study addresses is lacking earlier study of the way in which students with color vision defects become aware of their defects. Arguments made by the existing literature require further discussion regarding how self-awareness of people with color vision defects cannot be developed without mandatory school color vision testing. However, the existing literature does not provide in-depth explanation. In other words, the supports of school color vision testing claim the benefit of early detection of color vision defects for students.

The third limitation the study addresses is lacking qualitative study in the areas of research. The first and second limitations require qualitative data to analyze the experience or influence of optional school color vision testing. However, there is only a limited number of qualitative data available in the domain of school health studies. The lack of attention corresponds with disregarding the construction of notion of defects.

The fourth limitation the study addresses is the limits of Takayanagi's model of color-blindness. Takayanagi's study broke a ground into discussing color vision defects as a social phenomenon in the domain of school health studies. However, the study did

not succeed to develop a new definition of color vision defects without being trapped in color vision defects as a medical symptom. Takayanagi's study did not examine qualitative data after 2003. Therefore, Takayanagi's model of color-blindness as the failure of the Ishihara test cannot fully explain why the notice of school color vision testing in 2014 relapsed in the debate regarding school color vision testing.

2.1.2. Topic B: Color-blindness as a Social Construct: Social Science

This section reviews what previous studies in the field of social science including psychology, history of ideas, and sociology, have discussed about color-blindness as well as the revitalization of school color vision testing in 2014. The study argues that not only the number of the existing literature is limited but also there is lack of studies about the revitalized school color vision testing in 2014. There have been a limited number of studies regarding color-blindness and school color vision testing in the domain of social science including psychology (Suzuki, 2015a; 2015b; 2015c), history of ideas in philosophy (Baba, 2012; 2013a; 2013b; 2013c; 2018, Nov.), and interactionist study in sociology (Tokugawa, 2016).

Suzuki (2015a; 2015b; 2015c) analyzed the individual experience of mandatory school color vision testing by a discourse analysis with interests in psychological

analysis. Suzuki (2015a, 2015b) investigated the way in which people with color vision defects became aware of their color vision defects by applying a discursive psychological analysis. In this theoretical framework, Suzuki (2015c) investigated subjectivity and personal experience. Personal experience may make people concerned aware of their defects. Through reviewing biographies, autobiographies and novels written by people concerned, Suzuki (2015a; 2015b) disclosed that there might be five kinds of experience that make people concerned aware of their defects through school color vision testing.

First, there is the feeling of conducting crime. This feeling occurs when people concerned find out that their failing on color vision testing gives their families, especially mothers, shock (Suzuki, 2015a). Following this is the feeling of being defeated or hopeless when people concerned find out their defects are incurable (Suzuki, 2015a). The feeling of being defeated and hopeless is followed by being sentenced to color vision defects by others, and the feeling of separation from what is regarded as normal color vision, and the feeling of inequality (Suzuki, 2015a). Suzuki concluded that mandatory school color vision testing made the people concerned aware of their defects by forcing them to go through the five experiences (Suzuki, 2015a, 2015b).

In addition, Suzuki implied that school color vision might not be a pleasant experience for people with color vision defects. It is important to note that Suzuki (2015a, 2015b) only analyzed biographies and autobiographies of people who actually experienced mandatory school color vision testing in these studies. Therefore, the study will examine biographies and autobiographies collected from people who grew up after school color vision testing became optional in 2003. The approach allows the study to further understanding the way in which the revitalization happened in 2014. In addition, it should also be noted that Suzuki's study did not answer the question, why did the mothers of people concerned have to feel shock on their children's failing results of color vision tests? This study, therefore, addresses why people consider color vision defects as problem and to investigate the way in which the notion of color vision defects as something negative has been constructed in Japan.

Accordingly, Baba (2012; 2013a; 2013b; 2013c) investigated the discursive formations of notion of color-blindness through examining the Ishihara color blindness test and transformations of philosophical ideas. Particularly, Baba disclosed the way in which people with color vision defects became disciplined through the Ishihara color blindness test. Although Baba shed light on the cognitive procedure of the Ishihara test on Foucault's account of power, he did not incorporate space or examination sites where

school color vision testing was conducted in his analysis. Therefore, this study reexamines school color vision testing from Foucault's notion of power perspective so as to highlight how the notion of color-blindness has been discursively constructed and transformed through school color vision testing.

Tokugawa (2016), on the other hand, discussed the transformation of notion of people with color-blindness, which he called color vision minorities, in Japan from an interactionist approach. He criticized that after 2003, school color vision testing became a taboo. In other words, negative images of people with defective color vision became reinforced. Tokugawa (2016) addressed twenty-two labels on the people concerned who had defective color vision by examining various texts (see Table 4). The discourse analysis of labels on defective color vision addressed the notion of people with defective color vision as a social phenomenon.

Tokugawa (2016) asserts that the younger generation became indifferent and less critical about color vision requirements. The increased indifference and decreased criticality of people concerned may cause feeling of uncertainty about the future, which may relapse into the revitalization of school color vision testing. Tokugawa (2016) addresses his concern about the revitalization as follows, "in 2014, school color vision testing was altered and became positively recommended by schools. I am very

concerned about the alteration of law as the relapse into school color vision testing" (p. 16; author's translation).

Tokugawa (2016), accordingly, claims the benefit of school color vision testing as follows, "it is for the benefit of people/ students with color vision defects that they take color vision testing as young as possible if there are color vision requirements in society" (p. 16; author's translation). Tokugawa (2016) shows an ambivalent feeling towards school color vision testing. He disagrees with the revitalization but supports the early diagnosis of defective color vision. This ambivalence reflects the way in which the debate between the opponents of the revitalization of mandatory school color vision testing and the supporters of it is complicated and intertwined.

Tokugawa (2016) took initiative to point out that the younger people concerned became indifferent and uncritical about color vision defects and color vision requirements after 2003. However, the data collected for his analysis was limited to data collected before 2003. In addition, the transformation of notion of people with color vision defects is not investigated in-depth even though the collected texts were ranged from Meiji period until 2003. In this sense, Tokugawa (2016) did not fully discuss the way in which the notion of color-blindness was discursively transformed under the optional school color vision testing.

Table 4
List of Labels of the People Concerned

Labels
Unawareness of one's own color vision defect
Not cooperative
Being coward and making themselves socially disadvantaged
Uncritical
Double blunder
Concealing and lying defects
Others in terms of experience of impairment
Paradoxical about themselves with impairment
Uncritical
Making mistakes
Concealing and lying defects
Others in terms of experience of disability
Paradoxical about themselves with disability
Hero of tragedy
Naïve
Abnormal people who need examination and differentiation
Inferiority which needs to be extinct
Others to be disabled in society
Self-contradiction
Self-centered
Perverse
Pseudo-science
Lack of flexibility
Complainer
Putting society at risk
Identity crisis
Being discriminated among abnormal people

Note. Adapted from *Shikikakusabetsu to katarizurasa no shakaigaku* (p. 266), by N. Tokugawa, 2016, Tokyo: Seikatsushoin. (author's translation)

This limitation implies that there is lack of information between 2003 and the present which is necessary to further analyze the revitalization of school color vision

testing in 2014. The fulfillment of the unknown years between 2003 and 2014 may explain in-depth the way in which the notion of color-blindness has been discursively transformed towards the revitalization of school color vision testing in 2014. Although there is the limitation, it is important to note that Tokugawa (2016) addressed relations between discourses about notion of color vision defects and establishment of school color vision testing. This perspective is the underpinning for the study to further examine the way in which the notion of color-blindness has been discursively transformed through the changes of *Gakkohokenho* and *Gokkoahoken Anzenho* in Japan.

The earlier studies in the field of social science have successfully addressed the social construction of school color vision testing, color-blindness, and the Ishihara color blindness test. However, they did not fully elaborate on the way in which the traditional notion of color-blindness was discursively formed through shifting of school color vision testing and school health acts. Thoroughly reviewing the existing literature in the different areas of social science, the following three major limitations of the studies are addressed. The first limitation the study addresses is the limits of Suzuki's study. Suzuki (2015a, 2015b) intended to discuss school color vision testing experience as the source of psychological phenomenon through examining biographies as discourses. This unique discursive psychology approach succeeded to disclose the way in which

mandatory school color vision testing made people concerned aware of their defects. However, the study could not in-depth explain why mothers of people concerned were shocked by their children's color vision testing. In addition, Suzuki's finding did not examine data collected after 2003 so that the finding is not eligible to explain what has been happening since school color vision testing became optional through the revitalization of school color vision testing in 2014.

The second limitation the study addresses is lacking insights into school color vision testing in Baba's study. Baba (2012; 2013a; 2013b; 2013c) did not consider influence of testing site or space in which the notion of color-blindness was discursively constructed through school color vision testing. He successfully disclosed how the notion of color-blindness was discursively constructed through the Ishihara color blindness test. However, his approach cannot fully be transferable to the analysis of school color vision testing that the study intends to conduct.

The third limitation the study addresses is lacking data after 2003 in Tokugawa's study. Tokugawa's interactionist approach could explain the way in which the notion of color-blindness has been discursively constructed. However, Tokugawa's study did not examine data collected after 2003. Therefore, his findings cannot be extended to further discussing the revitalization of school color vision testing in 2014.

2.1.3. A Summary of the Literature Review

This part highlights key findings discussed in this section through reviewing the existing literature in two major areas of studies: school health studies and social science. The former, school health studies, has emphasized the causal relationships between defects on retina and symptoms that can be detected through color vision tests. Accordingly, previous studies in school health studies applied the medical analysis to the debate of school color vision testing. As a result, the existing literature in the domain of school health studies fails in-depth explaining why color vision testing is necessary when no medical treatment is found. Previous studies in school health studies also does not examine the way in which people concerned become aware of their defects. In other words, the existing literature seems to only believe that school color vision testing must be the only way to make people concerned aware of their defects.

In addition, the studies conducted by Takayanagi and *Nihon Shikikakusabetsu Teppai no Kai* are the only existing literature which attempted to redefine color vision defects as a social construct in the domain of school health studies. However, Takayanagi's notion of color-blindness as failure of the Ishihara test needs to be further examined in order to address what has happened after school color vision testing

became optional in 2003. In this sense, this critical literature review addressed that Takayanagi's notion of color-blindness can be theoretically developed through further discussing the data collected from people who grew up under the optional school color vision testing.

Accordingly, there is only a limited number of qualitative researches available in the domain of social science. The earlier studies in social science concentrate on addressing why school color vision testing is necessary. By applying a discursive psychology, Suzuki found particular experiences which were formed through experiencing school color vision testing. Baba, through lens of history of ideas, disclosed the way in which notion of color-blindness was discursively formed by the Ishihara color blindness test although he did not discuss school color vision testing. Tokugawa's study, in light of an interactionist sociology perspective, addressed labels on people with color vision defects which discursively constructed the notion of them as inferior to whom was regarded as normal color vision. Although these earlier studies shed light on color-blindness as a social construct, these studies did not examine the way in which the notion of color-blindness was discursively constructed and transformed through school color vision testing. They also lacked the data collected after 2003 when the school color vision testing became optional.

2.2. Theoretical Framework

No earlier studies have been found regarding color-blindness and school color vision testing in other domains of social science including disability studies in education. This may be partly because the social model of disability, which is often regarded as the commonality of studies in disability studies, theoretically excludes mild disabilities. This theoretical limitation will be further discussed in the following section. The study addresses that the limitation is underpinned by the tautology that impairment is presupposed in the social model of disability. People who have milder impairments which tend to appear less problematic than the difficulties or barriers they experience, consequently, are less likely discussed in the theoretical model.

For example, Akikaze (2013) analyzed the collected self-narratives of people with various mild disabilities. Akikaze (2013) argued that people with mild disabilities chose disability status or identity as their strategy. Although Akikaze's finding was informative about mild disabilities in general, she did not either address or discuss about the difficulties that people with color vision defects face in society. Therefore, her findings cannot simply be applied to the case of color-blindness. In addition, she did not

discuss about the way in which disability and education are intertwined. This lack of attention in the domain of disability studies raises another question:

> How the social model of disability can be theoretically developed so as to incorporate color-blindness and school color vision testing as a possible theme of disability studies in education?

Disability studies in education, however, has a collection of studies discussing impairment as a construct (e.g., Evans, Broido, Brown & Wilke, 2017; Gabel, 2009; 2012; Gallagher, Connor & Ferri, 2014; Iannacci, 2018). The collection of studies implies that disability studies in education may provide a meaningful insight into understanding color-blindness and school color vision testing. The study, therefore, attempts to reconceptualize color-blindness as a social construct from a disability studies perspective in order to reexamine Takayanagi's model of traditional notion of color-blindness. Consequently, the study contributes a better understanding of color-blindness as a social construct and developing the social model of disability.

No existing literature has ever investigated the way in which the traditional notion of color-blindness was discursively constructed and transformed through the issue and alterations of mandatory school color vision testing and school health acts. To fulfill the gap in the existing literature, this study seeks to investigate the way in which

the notion of color-blindness was discursively constructed and transformed through alterations in school health acts and enforcement of mandatory school color vision testing in education of Japan. In particular, the study investigates the way in which notions of color-blindness have been discursively constructed and transformed towards the revitalization of school color vision testing in 2014. The study aims to provide new insights to the study of color-blindness and school color vision testing in the domains of school health studies and disability studies in education, and to develop understanding of the lived experience of people with color-blindness through raising awareness of their issues. Thus, this study examines various discourses about school color vision testing in the texts of biographies, autobiographies, novels, articles, various school health acts, and life stories. The following sections will highlight a theoretical framework of the study, which composing interpretations of a social model of disability, Foucault's notion of technology, governmentality, power, and genealogy.

2.2.1. A Social Model of Disability

The study draws from scholars of disability studies in education. In this tradition, disability is theoretically separated as a social construct from impairment. The

following definitions of disability and impairment refer to a social model of disability that Oliver, Sapey, and Thomas (2012) addressed:

> Disability is the disadvantage or restriction of activity caused by the political, economic and cultural norms of a society which takes little or no account of people who have impairments and thus excludes them from mainstream activity. Impairment is a characteristic of the mind, body or senses within an individual which is long term and may, or may not, be the result of disease, genetics or injury. (p. 16)

In the social model of disability, disability refers to any disadvantage that people with impairments experience and that is caused by inaccessibility to society. In contrast, the medical model of disability defines disability as "a medical problem that resides in the individual...a defect in or failure of a bodily system and as such is inherently abnormal and pathological" (Olkin, 1999, p. 26). The medical model views the cause of difficulty and restrictions of individuals with impairments as "lacking part of or all of a limb, or having a defective limb, organ or mechanism of the body" (UPIAS, 1976, pp. 3-4). The medical model prioritizes cure of malfunctioning bodily mechanisms so as to solve the problem (Hoshika, 2018; Tateiwa, 2018). Hence, Haegele and Hodge (2016) define medical model of disability discourse as "an individual or medical phenomenon that

results from impairments in body functions or structures; a deficiency or abnormality" (p. 194).

The study employs a social model of disability so as to discuss color-blindness as a social construct. This approach allows me to become skeptical about what is regarded as norm about school color vision testing. Consequently, the study investigates the way in which the notion of color-blindness was discursively transformed in different social contexts and times. Morris (1993) claims that a social model disability, which theoretically criticizes the medical model of disability, confirms the idea that "it is not the inability to walk which disables someone but the steps into the building" (p. 10). A medical model of disability is "disabled people are reduced to the medical condition which accounts for their physical and/or intellectual characteristics and there is little or no account taken of the social and economic context in which people experience such medical conditions" (Morris, 1993, pp. 9-10). It is this dichotomy that the social model of disability broke ground for reconsideration of disadvantages, which people with disabilities personally experience, as social problems (Kawaguchi, 2014; Goodley, 2010; Hori, 2012; Sugino, 2007; Oliver & Barnes, 2012; Oliver, Sapey & Thomas, 2012; Hoshika, 2010, 2013). The social model of disability, consequently, has commonly been adopted by disability activists and scholars as a theoretical framework

for advocating accessibility and disability rights in Japan (Hori, 2012; Sugino, 2007; Hoshika, 2010; Ishikawa & Kuramoto, 2002; Ishikawa & Kuramoto, 2009).

In light of a feminist perspective, on the other hand, Morris (1993) criticized the social model of disability for disregarding the individual experience of bodily and mental restrictions as follows:

> However, there is a tendency within the social model of disability to deny the experience of our own bodies, insisting that our physical differences and restrictions are entirely socially created. … to suggest that this [environmental barriers and social attitudes] is all there is to it [the social model of disability] is to deny the personal experience of physical or intellectual restrictions, of illness, of the fear of dying. (p. 10)

As Morris (1993) claims, the social model of disability tends to separate disability from impairment in a way that impairment is regarded as a social construct. This criticism presented by Morris shed light on the tautology that Oliver's social model of disability connotes in its theory. As Oliver's social model includes impairment in its definition of disability, the concept of disability cannot be completely separated from impairment unless the concept of impairment is premised as real or natural existence. Therefore, the

social model of disability is facing a challenge to theoretically incorporate the personal experience that individuals with impairments have in its model.

One of the strategies to counteract the criticism is that studies, which employ a social model of disability, ask for both disablism and ableism inquiries (Hoshika, 2013). Hoshika (2013) argues that the criticism presented by the feminism perspective does not depress the value of the social model as follows:

> The focus of criticism [presented from a feminism perspective] should be understood that both the concept of disability and impairment disregarded the personal and private experience. Therefore, it is the issue of separating what is personal from what is public that should be addressed. In light of this, the criticism presented by a feminism perspective is not a limitation that the social model of disability connotes and thus inevitably limits its usefulness. (p. 30; author's translation)

As Hoshika (2013) addresses, a theoretical limitation the social model of disability entails is lacking respect to the lived experience of people with impairments. Hoshika's argument implies that the concept of disability and impairment are correlated, but Oliver's social model underestimated the correlation. It is this problem on which the social model of disability needs to be further developed. Hoshika (2013) asserts that the

significance of the social model relies on disclosing the social construction of what is commonly and unconsciously regarded as natural and necessary. According to Hoshika (2013), there are two ways to disclose the social construction of disability. The first approach that Hoshika (2013) suggested is:

> To disclose the existence of disabling society in which people with impairments are forced to become inaccessible to social resources. In this approach, the ways in which disabled people are excluded and coherent solutions should be explored. (p. 36; author's translation)

As Hoshika (2013) addresses, the first approach is to reveal inaccessibility for people with various impairments in society. This approach allows the people concerned to relativize their impairment. It also encourages society to seek countermeasures to improve accessibility. Disablism on account of Hoshika (2013), therefore, is what troubles people with impaired bodies and what prevents them from participating in society. Disability studies scholars and disabled activists have a long history of fighting for social, cultural, and political recognition of people with disabilities (Goodley, 2014). Hospitals, inaccessible education systems, inaccessible buildings, deaf and hard of hearing cultures, and disability insurance are typical examples of disablism which are considered as putting physical and mental barriers in the way of social participation of

people with impairments in disability studies. In this dissertation, I use the term disablism in a way to reflect the notion of disablism in disability studies.

The second approach that Hoshika (2013) addressed is:

> To disclose the existence of ableistic society in which people with impairments are forced to suffer from experiencing difficulties and barriers daily basis. In this approach, the suffering can be alleviated by relativizing or criticizing existing norms to value ability or capability. (pp. 36-37; author's translation)

The second approach aims at relativizing what is norm in society. One example is the ableistic notion in which people believe that being able is better than being unable to do things. The ableistic notion puts priority on capability through which disabled bodies are inevitably inferior to able bodies. In this sense, people with disabled bodies are likely to hesitate to disclose disabling environments in society. Therefore, disclosing ableistic society is important for disabling society to be deconstructed.

Hoshika's account of ableism is what troubles and prevents people with impaired bodies from social participation by prioritizing capability in society (Hoshika, 2013). Goodley (2014) asserts that ableism is a principle to value able body:

> Ableism's psychological, social, economic, cultural character normatively privileges able-bodiedness; promotes smooth forms of personhood and smooth

> health; creates space fit for normative citizens; encourages an institutional bias towards autonomous, independent bodies; and lends support to economic and material dependence on neoliberal and hyper-capitalist forms of production. (p. 21)

The notion of ableism in disability studies emphasizes exclusion of disabled body from social participation by normalizing able body. Ableism in a common sense is often a positive concept which addresses that people with disabled bodies become capable of doing things. However, in the disability studies perspective, ableism is a claim for better social participation of people with disabled bodies and a claim for deconstructing what privileges able bodies.

As a result, the notions of disablism and ableism entail both pros and cons of disabling environments and able bodies in light of disability studies. In this sense, disablism and ableism are intertwined. In addition, in each concept, both pros and cons of disabled bodies co-exist. What Hoshika's approach implies, therefore, is that both approaches: disclosing disability and ableistic society, are intertwined, rather they are considered as two different approaches.

Goto, on account of Morris's criticism against the social model, provided another insight into the premise of impairment as something inevitably natural. Goto

(2007) problematized the conceptual dichotomy between the normal and the disabled as follows:

> I propose that 'emancipatory' sociology which aims at emancipating the oppressed needs to illustrate positive images of the disabled, rather problematize the existence of contrastive categorization between the normal and the disabled, and thus critically intervene in the process of categorization. (p. 80; author's translation)

Goto (2007) asserts that the contrastive categorization between what is normal and disabled must be deconstructed. In this sense, Goto adopted Foucault's notion of bio-power: a form of power which centers on human health in order to investigate the ways in which the notion of what is regarded as the normal body is constructed.

Another strategy is suggested by Sakakibara, who is a Japanese disability studies theorist, to deconstruct the premise of impairment in the social model of disability. Sakakibara (2016) criticized Oliver's definition of disability in which notion of impairment is reinforced and stereotyped. Instead, Sakakibara (2016) employed Foucault's notion of power in order to redefine impairment as the target for disability. Disability, on Sakakibara's account, is regarded as "one of social exclusions which observers attribute to the causal relations between" (p. 138; author's translation)

impairment and social treatment. In Sakakibara's view of impairment, impairment and disability are intertwined to construct a particular notion of disability rather than separated.

Sakakibara (2016) elaborated on the social model of disability by redefining the disabled body as "fragmentary information" (Sakakibara, 2016, p. 142; author's translation): specific focus on bodily functions and systems. On Sakakibara's account, it is the specific focus on bodily functions and systems that the concept of impairment and disability can be distinctively separated. Sakakibara's insight into the disabled body was also derived from Foucault's notion of the discipline: a form of power which centers on details of bodily functions. Through lens of Foucault's account of power, thus, Sakakibara identified both disability and impairment as social phenomena. Sakakibara argues that "disability can be understood as the product of modernization through defining impairment as the specific focus on bodily functions and systems" (2016, p. 145; author's translation). In addition, Sakakibara (2016) adds claims that "disability does not need to be limited to inaccessibility as long as disability is defined by state of being reduced to bodily functions and systems" (p. 145; author's translation).

Those people who experience disability but have less severe or mild impairments, therefore, can be theoretically incorporated into Sakakibara's notion of

disability. For example, people with disfigured faces who can function without serious problems within daily life but tend to experience disadvantage in society (Mizuno, 2017). In this sense, Sakakibara (2016) asserts that "disability is one of social exclusions which observers attribute to the causal relations between body and treatment" (p. 138; author's translation). Sakakibara identifies body of the disabled as fragmentary information. In light of Sakakibara's notion of body, disability evolves on the reasoning or explanations which observers make for making their decisions about the ways in which some disabled people should be treated.

The following collection of definitions consists of an autopoietic definition of disability that Sakakibara (2016) addressed. First, Sakakibara (2016) defines disability as "one of social exclusions which observers attribute to the causal relations between fragmentary body information and social treatment" (p. 146; author's translation). Second, the social exclusion that Sakakibara (2016) addresses is "temporal or permanent limitations of participation or distribution in single or multiple social systems" (p. 146; author's translation). Third, fragmentary body information is another unique concept presented by Sakakibara (2016). Sakakibara's account of fragmentary body information refers to "statements which are highly reduced to specific bodily functions or systems of the excluded" (p. 156; author's translation). In other words,

fragmentary body information can be regarded as attention to particular bodily functions including seeing, walking, and speaking. Fourth, Sakakibara's notion of information is "events or happenings which not only identify condition of systems but also the systems attribute to the environment" (Sakakibara, 2016, p. 146; author's translation). In this regard, fragmentary bodily function on Sakakibara's account can be understood as events which occur relating to particular bodily functions. Following this notion of information is the social treatment, which refers to "actions towards the specific person" (Sakakibara, 2016, p. 146; author's translation). Lastly, Sakakibara's account of attribution is "what is identified by observers in the selected condition of system" (Sakakibara, 2016, p. 146; author's translation). In consequence, Sakakibara considers disability as the result of social treatment which is exercised on the particular bodily function of individuals.

The autopoietic definition of disability that Sakakibara (2016) addressed theoretically redefines disability as a problem regarding the difference of treatment. Sakakibara (2016) draws a quadrant diagram of treatment (see Figure 2). In the diagram, Sakakibara breaks down the difference of treatment into the following four types: Inclusive/ Same treatment, Exclusive/ Same treatment, Exclusive/ Different treatment, and Inclusive/ Different treatment. In reference to the quadrant diagram of

treatment (see Figure 2), the vertical axis of the diagram shows the intention of treatment. The parallel axis, on the other hand, shows the way of treatment. According to Sakakibara (2016), the status quo of Japanese society locates in the fourth quadrant, where the same treatment was provided under the exclusive circumstances.

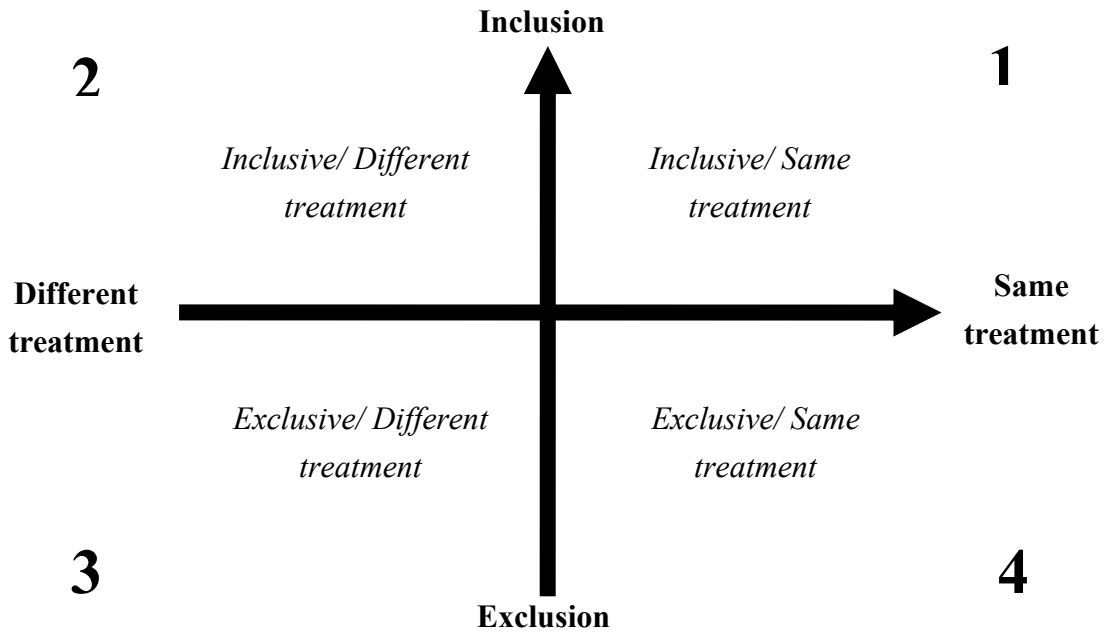

Figure 2. Quadrant diagram of treatment. Exclusive treatment refers to the treatment which becomes social barriers to the disabled person. Inclusive treatment refers to the treatment which is intended to include the disabled person. Same treatment refers to the treatment which is given to the disabled person under the equal condition with the others. Different treatment refers to the treatment which is given to the disabled person under the unequal condition with the others. I made this diagram based on the diagram drawn by Sakakibara (2016, p. 167). Adapted from *Shakaitekihousetsu to shintai* (p. 167), by K. Sakakibara, 2016, Tokyo: Seikatsushoin. (author's translation)

Sakakibara (2016) claims that disability should be defined in the second quadrant between inclusive and different treatment under the disability law. *Shougai wo*

Riyuu tosuru Sabetsu no Kaishou no Suishin nikansuru Houritsu, in English known as Act for Eliminating Discrimination against Persons with Disabilities, was enacted in 2016. It was for this act that Sakakibara redefined the concept of disability so that it can benefit not only the disabled with impairments but also the others with experiencing exclusion. Sakakibara (2016) successfully deconstructed impairment as a construct in the social model of disability by applying Foucault's notion of power. However, Sakakibara never incorporated neither color-blindness nor school color vision testing in his analysis. Sakakibara (2016) intended to examine the definition of impairment in Act for Eliminating Discrimination against Persons with Disabilities. However, the act does not currently incorporate and affect color-blindness. Employing Sakakibara's insight allows this study to investigate people with color-blindness who occasionally experience difficulties and restrictions with color recognition but do not fail detailed color vision testing. By extension, it is theoretically possible for this study to address that the purpose of school color vision testing can be ambivalent between screening out those who fail color vision testing and seeking for the ways to improve learning experience of learners with various color visions.

Through lens of the social model of disability, the study explores the ways in which notion of color-blindness has been discursively constructed and transformed

through Japanese school color vision testing. This study does not only attempt disclosing an example of disabling society but also addressing an example of ableistic society regarding color vision in Japanese education. Therefore, the study employs Foucault's notion of genealogy in order to problematize the current notion of color-blindness. Accordingly, the study examines Sakakibara's notion of disability in which disability and impairment are intertwined so as to address color vision problems as issues of social exclusion. Employing Foucault's notion of genealogy allows the study to investigate ambivalent discourses in school color vision testing, which reflect the coexistence of ophthalmological testing procedure and the existence of educational purpose.

2.2.2. Foucault's Interpretations of Technology, Governmentality, Power, and Genealogy

Following Goto and Sakakibara, the study employs Foucault's notions of technology, governmentality, power, and genealogy. This approach allows me not only to become skeptical about what is regarded as normal in school color vision testing but also incorporate the personal experience that people with impairments have in the social model of disability. The study aims to contribute a theoretical insight to disability

studies in education. The following part discusses Foucault's notions of technology, governmentality, power, and genealogy.

It was Michel Foucault who pursued the ways in which what is regarded as norm in society not only includes but also excludes someone at the same time. That is, what Foucault called as technology, which implies construction or production, "the etymology of 'technology', from the Greek techne, implies an art or skill, particularly a constructive skill, so 'technology' in its Foucaultian sense is precisely such a 'construction' or production" (Kendall and Wickham, 1999, p. 53). On Foucault's account, accordingly, technology can be divided into the following four kinds:

- A technologies of production, which permit us to produce, transform, or manipulate things;
- B technologies of sign systems, which permit us to use signs, meanings, symbols, or signification;
- C technologies of power, which determine the conduct of individuals and submit them to certain ends or domination, an objectivizing of the subject
- D technologies of the self, which permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform

> themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality. (Foucault, 1988, p. 18)

Within these four kinds of technologies, it was the last two: technologies of power and the self through which Foucault developed another concept, governmentality through exploring "how a type of management inside and outside of asylums was made possible by this strange discourse [madness]" (Foucault, 1988, pp. 18-19). In Foucault's view, thus, governmentality is "this contact between the technologies of domination of others and those of the self" (Foucault, 1983, p. 19). In light of Foucault's notion of technology, therefore, governmentality is considered as the product of interaction between technologies of power and technologies of the self. Individuals are not only governed but also self-govern themselves in society. In this sense, as Qi (2004) asserted, "governmentality is the economy of normalizing people in society" (p. 131). Through the practice of Foucault's notion of governmentality, individuals are normalized.

Following the notion of governmentality is Foucault's notion of power. Power on Foucault's account is particularly unique in the following three features. First, Foucault's notion of power refers to "the name of complicated strategic condition in society" (Fujita, 2000, p. 134; author's translation). Foucault's notion of power, therefore, does not belong to any particular individual or group. Second, Foucault's

notion of power is viewed to exist in relations. Accordingly, Kendall and Wickham (1999) claimed that Foucault's notion of power is "a strategy that maintains a relation between the sayable and the visible" (p. 49). Therefore, Foucault's notion of power is invisible but appears in the gap between what one says and what one observes. Third, Foucault's notion of power is "not essentially repressive; it is not possessed but is practised. Power is not the prerogative of 'masters', but passes through every force. We should think of power not as an attribute (and ask 'What is it?'), but as an exercise (and ask 'How does it work?')" (Kendall & Wickham, 1999, p. 50). Qi (2006) also confirms that "power only exists when it is exercised and circulates" (p. 155). In other words, as Qi (2004) asserted, "power cannot be possessed but is something that exists only in action" (p. 130). Therefore, power exists in everywhere it is exercised by the practice of Foucault's notion of governmentality. Foucault's notion of power, therefore, is a collection of various exercises which directs one's decisions or path but not essentially controlling.

Foucault further elaborated on his notion of power by introducing the concept of bio-power. Bio-power is defined by Foucault as power over life which is exercised by a pair of technologies: anatomo-politics of body which exercises disciplinary power and bio-politics of the population which exercises "coordinate power" (Osawa, 2013, p.

28; author's translation). In *the History of Sexuality* (1990a), Foucault explained in-depth how bio-power appears in the two particular forms: an anatomo-politics of the human body and a bio-politics of the population. The former, an anatomo-politics of the human body, works mainly on the human body as Foucault (1990a) discusses:

> One of these poles [two basic forms in which power over life evolved]-the first to be formed, it seems- centered on the body as a machine: its disciplining, the optimization of its capabilities, the extortion of its forces, the parallel increase of its usefulness and its docility, its integration into systems of efficient and economic controls…. (p. 139)

As Foucault (1990a) addresses, the anatomo-politics of the human body is Foucault's notion of technology in which human bodies are discursively disciplined. The anatomo-politics of the human body was also introduced as the disciplines in his book, *Discipline and Punish* (1995). The anatomo-politics of the human body works on the human body in positive ways as Foucault (1995) claims:

> They [disciplines] were expected to neutralize dangers, to fix useless or disturbed populations, to avoid the inconveniences of over-large assemblies; now they [disciplines] were being asked to play a positive role, for they were becoming able to do so, to increase the possible utility of individuals. (p. 210)

It is this notion of disciplines, the same as the anatomo-politics of the human body, in which bio-power is exercised and thus works on the human body. According to Azuma and Osawa (2003), the anatomo-politics of the human body is the power intervening directly in and forming individual values by enforcing internalization of certain standard, which is what Foucault called "normation" (Fujita, 2016, p. 160). Disciplinary power in *Discipline and Punish* (Foucault, 1995) was later renamed as the anatomo-politics of the human body to describe disciplinary power working in the concept of bio-power in *the History of Sexuality* (Foucault, 1990a).

Foucault's notion of disciplinary power can be exercised at a health examination through a particular technology, called normalizing gaze. Foucault's notion of normalizing gaze consists of two technologies, hierarchical observation and normalizing judgment. According to Fujita (2000), hierarchical observation is a technology of tableaux that allows individuals to be visible through distribution of space. Whereas, normalizing judgment consists of two technologies including Fujita's notions of exercises and maneuver. The former, Fujita's notion of technology of exercises, entails time coordination of individuals so as to examine their achievement levels through examinations (Fujita, 2000). The latter, Fujita's notion of technology of maneuver, highlights controls/regulations of individual body movement/activity (Fujita,

2000). According to Fujita (2000), these three technologies are incorporated into/by (double condition) another technology of tactics (see Figure 3).

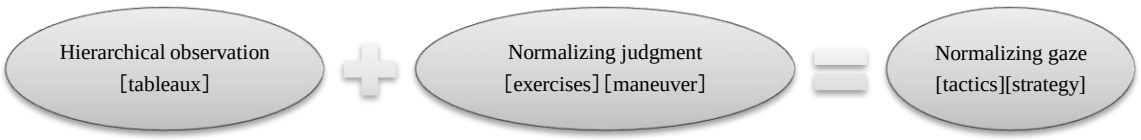

Figure 3. Constitution of normalizing gaze. I made this figure based on the discussions had by Foucault (1995, p. 184) and Fujita (2000, p. 132).

Tactics on Foucault's account is not only stable/fixed so as to reproduce various power relations through putting all the technologies together but also entails activation of strategies which are potentially unstable/flexible so as to effectively influence objects (Fujita, 2003). Tactics consists of tableaux, exercises, maneuver technologies so as to generate "an entire system of power" (Fujita, 2003, p. 155; author's translation). School color vision testing is one example of discourses where tactics is exercised to discursively constitute and transform the notion of color-blindness. Therefore, tactics can be understood as a complicated system of power relations in the observation of panopticon (Foucault, 1995).

Foucault's notion of strategy, on the other hand, is "a decision to choose a particular solution from various ones" (Fujita, 2000, p. 134; author's translation) in

competition. Fujita (2003) notes that Foucault's account of "strategy has some superiority to tactics" (p. 161; author's translation). Without a strategy, tactics cannot be commenced. In addition, Fujita (2003) asserts that Foucault's notion of tactics is only a collection of technologies. In contrast, Foucault's notion of strategy is the key to activate his notion of tactics and to discursively exercise his notion of power. In this sense, the school color vision testing is an example of discourses where Foucault's notion of tactics requires Foucault's notion of strategy in order to exercise bio-power on life of people with defective color vision.

According to Fujita (2003), Foucault's notion of strategy entails both the "strategy of power" (p. 159; author's translation) and the "strategy of confrontation" (p. 159; author's translation). The former, the strategy of power, plays a role to maintain the way in which Foucault's notion of power is discursively exercised. The latter, the strategy of confrontation, on the other hand, deconstructs the way in which Foucault's notion of power is discursively exercised. It reflects resistance in Foucault's notion of power. In this regard, Foucault's notion of power entails a double condition in which Fujita's notion of strategy of power and Fujita's notion of strategy of confrontation are intertwined. Shinkai (2019) asserts that power and resistance are coexistent:

> Resistance does not exist outside power. Of course, Foucault does not claim that we cannot fight against power at all because we are already kept in captivity. Instead, he notes that power is where resistance is. Resistance allows power relations to be exercised. (pp. 143-144; author's translation)

Fujita (2003) argues that Foucault's notion of strategy also requires support to maintain its efficiency from what is the source of intention and decision in the human mind. Foucault (1990b) called it "arts of existence" (p. 10). He defined it as follows:

> What I mean by the phrase [arts of existence] are those intentional and voluntary actions by which men not only set themselves rules of conduct, but also seek to transform themselves, to change themselves in their singular being, and to make their life into an oeuvre that carries certain aesthetic values and meets certain stylistic criteria. (Foucault, 1990b, pp.10-11)

Foucault's notion of arts of existence reflects the positive intention and voluntary actions to change oneself. In this regard, Foucault's notion of bio-power can be discursively exercised on life through a complex system of relations between Foucault's notions of tactics and strategy.

Accordingly, Foucault's notions of tactics and strategy are intertwined in the construction of normalizing gaze. Normalizing gaze is a surveillance in particular to

"qualify, to classify, and to punish" (Foucault, 1995, p. 184) at examination. In other words, normalizing gaze enables individuals to be visually recognized through differentiation and judgment procedures (Foucault, 1995). In this sense, power is exercised through normalizing gaze.

On Foucault's account, power mainly has the following seven characteristics. First, in Foucault's notion of power, power cannot be possessed but exercised. Second, Foucault's notion of power is named as bio-power when it centers on the body. Third, Foucault's account of the disciplines is one of the forms in which power evolves through the anatomo-politics of the body which intervenes in individual bodies. Fourth, Foucault's notion of the regulations of the population is the bio-politics of the population that is another form in which power evolves with particular focus on biological processes. Fifth, Foucault's notion of disciplinary power is exercised at health examination through normalizing gaze technology consisting of hierarchical observation: qualify and differentiate, and normalizing judgment: classify and judge, and cooperates with coordinate power which is exercised through the regulations of the population in order to exercise bio-power. Sixth, Foucault's notion of hierarchical observation entails Fujita's notion of technology of tableaux which allows individuals to be visible/observable. Seventh, Foucault's notion of normalizing judgment entails

Fujita's notion of technology of exercises which allows individuals to be examined for achievement as well as maneuver which polices movement of individual bodies.

In addition, the latter, bio-politics of the population, has more particular focus on "the biological processes: propagation, births and mortality, the level of health, life expectancy and longevity" (Foucault, 1990a, p. 139). It is this bio-politics of the population in which bio-power can also be exercised to regulate the human body. The bio-politics of the population does not intervene in individual bodies instead coordinate condition which facilitates improvement of health and life (Nagayoshi, 2011). Osawa (2013) addressed what facilitates individual health and life as "coordinate power" (p. 28; author's translation). Under the influence of coordinate power, people become obedient to what is norm in society by controlling their body movements or actions without their intention. Bio-politics of the population is a technology to control and manage "the species body, the body imbued with the mechanics of life and serving as the basis of the biological process: propagation, births and mortality, the level of health, life expectancy and longevity, with all the conditions that can cause these to vary" (Foucault, 1990a, p. 139).

Bio-politics of the population technology works at the population level in the way which the targeted people become unconsciously obedient to what is regarded as

ideal or norm. Foucault (1990a), thus, asserted that bio-power is the product of the following two technologies as follows, “the disciplines of the body and the regulations of the population constituted the two poles around which the organization of power over life was deployed” (p. 139). Bio-power, in short, is a new “power to increase population instead of killing people” (Nagayoshi, p. 96; author’s translation). Therefore, Foucault’s notion of bio-power is the power to let people live.

Finally, Foucault’s use of the term, genealogy, is reviewed in this section. As a Foucault’s notion of history, Foucault’s notions of archaeology and genealogy are sometimes compared. However, Foucault’s notion of genealogy has a unique intention of historical analysis. According to Kendall and Wickham (1999), Foucault’s notion of “archaeology is the process of investigating the archives of discourses” (p. 25). Kendall and Wickham (1999) identify Foucault’s notion of discourse as “a corpus of ‘statements’ whose organization is regular and systematic” (p. 42). Regular and systematic, on Foucault’s account, is as follows:

> The identification of rules of the production of statements, … of rules that delimit the sayable, …of rules that create the spaces in which new statements can be made, …of rules that ensure that a practice is material and discursive at the same time”. (Kendall & Wickham, 1999, p. 42)

In addition, Sugita (2000) asserts that Foucault's notion of discourse is a collection of speech acts on which episteme: a construction of ordering knowledge in some period, evolves. In these regards, Foucault's notion of discourse is the collection of written and verbal statements which generates meanings under the certain rule. Consequently, Foucault's notion of archaeology is a practice of investigating historical statements.

On the other hand, Foucault's notion of genealogy is "writing the history of the present" (Foucault, 1995, p. 31). As Qi (2004) asserted, Foucault's notion of genealogy is not rewriting the history in light of the present perspective. Genealogy, on Foucault's account, is "not so much a method as a way of putting archaeology to work, a way of linking it to our present concerns" (Kendall & Wickham, 1997, p. 31). Furthermore, Foucault's notion of genealogy is not an investigation of "overarching principles which govern the development of an epoch" (Kendall & Wickham, 1999, p. 24). In other words, Foucault's notion of genealogy is a historical analysis to seek for discontinuities in history in order to better understand constructions of what we people are today.

Qi (2004) addressed Foucault's notion of history as follows, "for Foucault, writing history is for the present. Through historicizing the notion of 'nature,' we could recognize how we have become what we are and learn how to problematize what we

have taken as natural" (Qi, 2004, p. 126). In this sense, Foucault's notion of genealogy must be separated from his notion of archaeology. Foucault's notion of genealogy aims at historically investigating the present constructions of notions in order to problematize what is norm in society. On the other hand, archaeology, in Foucault's view, seems to be not emphasized to problematize what is natural in society today.

It is important to note that Foucault's notion of genealogy is a way of "problematization" (Kendall & Wickham, 1999, p. 22) of the present. As Qi (2004) points out that "in Foucault's sense, genealogy is a method of problematizing the "nature" of what we have become and expose that which appears 'natural' as a social and historical construct. It allows us to ask different questions about the status quo" (2004, p. 125). The study, therefore, intends to explore discourses of school color vision testing in order to problematize the notion of color-blindness which is regarded as norm in the modern society. By employing Foucault's notion of genealogy, this study seeks for differences, discontinuities, transformations, and mutation in the discursive formations of notion of color-blindness.

In closing, employing Foucault's notions of technology, governmentality, power, and genealogy allows me to problematize what is regarded as norm in society. In this regard, the notion of color-blindness as well as impairment can be relativized so as

to counteract the previously mentioned theoretical limitation of social model of disability. The study may contribute a new insight to the social model of disability through examining discursive formations of notions of color-blindness. As a result, the way in which the notion of color-blindness has been discursively constructed through school color vision testing may also be further discussed and better understood.

2.3. Methodologies

This section elaborates on methodologies of the study. The in-depth understanding of discursive formations of notion of color-blindness would provide an insight to the debate about the revitalization of testing and the lived experience of people with color-blindness in Japan. In these regards, the study employed a Foucauldian genealogical discourse analysis. This section describes the following elements of methodologies of the study including Foucauldian genealogical discourse analysis, a life story research, the research sample, methods of data collection and analysis, and ethical considerations.

2.3.1. The Research Approach: Foucauldian Genealogical Discourse Analysis and a Life Story Research

This part reviews the research approach that the study employed. Through lens of the social constructionist approach, the study employed Foucauldian genealogical discourse

analysis as a methodology to analyze how the notion of color-blindness was discursively constructed and transformed through school color vision testing. In addition, the study employed a life story analysis in order to collect narrative data regarding what the earlier literature has been missing in the area of study. This part, therefore, discusses first what Foucauldian genealogical discourse analysis is, second what materials can be considered as data in this tradition, and third how a life story analysis was incorporated in the study.

The study employs a social constructionist approach in which "social problems are investigated through lens of the people concerned" (Akagawa, 2006, p. 9; author's translation). In addition, a social constructionist approach claims that "social problems are conceptualized as exercises of addressing claims" (Akagawa, 2006, p. 9; author's translation). In light of the social constructionism, people are theoretically defined as "users and manipulators of language and discourse for their own purposes" (Burr, 1997, p. 113). Discourse, in this regard, is the primary information for the study of a social constructionism to explore.

Akagawa (2006) asserts that there are the following three advantages for the social constructionism as research approach. First, Akagawa (2006) notes that "recent problems or debates can reflect the same problematization and arguments as they

previously existed" (p. 10; author's translation). The social constructionist approach allows the study to discuss continuity and discontinuity of social problems. Second, according to Akagawa (2006), "the construction of certain trends of rhetoric: the one accepted and another excluded regarding the focused social problems can be disclosed and understood in depth" (p. 11; author's translation). The social constructionist approach allows the study to shed light on the way in which the contrastive dichotomy between the one accepted and another excluded in education. Third, Akagawa (2006) claims that "the researcher can become skeptical about commonly accepted and popular statistics or theories, and thus address why they stay common and influential" (p. 12; author's translation). The researcher can relativize its own norm in mind through the social constructionist approach. Employing a social constructionism allows the researcher to reflect the same problematization and arguments regarding school color vision testing as they used to be before the mandatory testing was abolished in 2003. Thus, the researcher can become skeptical about the existing notion of color-blindness regarding school color vision testing. In light of the social constructionism, the following paragraphs intend to describe the approach and methodologies of the study.

First, the study employs a Foucauldian genealogical discourse analysis. This approach allows me not only to become skeptical about what is regarded as norm in

school color vision testing but also to position the study in-between disability studies in education and educational sociology. There is lack of earlier studies regarding school color vision testing in the domain of disability studies in education. It is probably due to the social model of disability in which mild impairments may not become major targets of the theory. In addition, the social model of disability has its own theoretical limitation, which needs to theoretically incorporate the restriction that the people concerned experience. Color vision defects, which are commonly regarded as mild impairments, may contribute a new research topic to the social model of disability and develop transferability of its theory. Employing the Foucauldian approach accordingly counteracts its theoretical limitation as well as position the study in educational sociology.

As Takahashi and Tendo (2017) assert, Foucauldian discourse research approach has been one of major parts of discourse studies in educational sociology. However, there are various references named as discourse analysis and thus it "is best understood as a field of research rather than a single practice" (Taylor, 2014, p.5). In this sense, Taylor (2014) loosely defines discourse analysis as a "close study of language in use" (p.5). Burr (2015), likewise, defines discourse analysis as "the analysis of a piece of text in order to reveal either the discourses operating within it or the

linguistic and rhetorical devices that are used in its construction" (p. 236). Burr's notion of discourse analysis allows discourse analysis to take various approaches.

Nouchi (2015), in light of a discursive psychology, asserts a social constructionism underpins discourse and discourse analysis. The social constructionism, in this regard, is a way of thinking that "the reality for people to live in is the linguistic representation, which is commonly shared in society and culture, and thus reproduced through the communication" (Nouchi, 2015, p. 12; author's translation). Linguistic representation, in this quotation, reflects what is regarded as an extremist social constructionism in which discourse is all there and nothing can independently exist outside it (Burr, 1997; Akagawa, 2006). It is important to note that this account of language and discourse is theoretically incorporated in the social constructionism.

No one can be aware of anything without discourse, which "provides a frame of reference, a way of interpreting the world and giving it meaning that allows some 'objects' to take shape" (Burr, 1997, p. 57). A social constructionist research, accordingly, assumes that "discourse is the data for discourse analysis and thus no reality or existence is accessible unless they are approached through discourse" (Akagawa, 2006, p. 28; author's translation). In other words, nothing about society really exists and thus can be perceived without or outside discourse. In this sense,

discourse analysis is not only a research method but also a research attitude which entails certain "insight, positioning, stance, and approach" (Suzuki, Ohashi & Nouchi, 2015, p. I; author's translation).

One of different approaches within discourse analysis field is Foucauldian discourse analysis. It is defined by Burr (2015) as "the analysis of texts of all kinds to reveal the discourses operating within them. This often entails an attention to implicit subject positions and power relations" (p. 236). The Foucauldian discourse analysis is a close study of discourses within various kinds of texts in order to analyze power relations. Foucauldian genealogical discourse analysis the study employs, accordingly, departs from the same perspective but mainly considers Foucault's notion of genealogy as the specific tool to analyze discourses.

Genealogy, in Foucauldian genealogical discourse analysis, is regarded as a "methodology rather than method" (Carabine, 2014, p. 276). Genealogy in Foucauldian genealogical discourse analysis, accordingly, is to apply "Foucault's concepts of discourse/power/knowledge and therefore the lens through which they [researchers] read their data" (Carabine, 2014, p. 268). In this sense, Carabine (2014) defined genealogy as "the name given to the methodological approach he [Foucault] used to study discourse to reveal power/knowledge networks" (p. 275). In addition, Foucault's

notion of genealogy is also “history of the present” (Foucault, 1995, p.31). Foucault’s notion of genealogy seeks for differences, discontinuities, transformations, and mutation in the discursive formations of notion in history (Kendall & Wickham, 1999). Foucault’s notion of genealogy is the history of the present in which Foucault’s account of archaeological study can be linked to the present concerns. In other words, Foucault’s notion of genealogy is a way to analyze historical texts in order to problematize what is regarded as norm in society.

In this sense, Foucault’s notion of genealogy represents present concerns in its exploration of discourse. Foucault’s notion of genealogy allows me to become skeptical about the dichotomy between what is regarded as a problem and what is not. The dichotomy, in the context of the study, is in which discourses are practiced and thus notion of what is regarded as color-blindness appears. In this regard, Foucault’s account of genealogy is the method of this study to investigate how the notion of color-blindness has been discursively transformed towards the revitalization of school color vision testing in 2014. This inquiry, accordingly, addresses difference in discourses about school color vision testing between mandatory and optional settings.

As a result, the study employs a Foucauldian genealogical discourse analysis as a methodology to investigate the way in which the notion of color-blindness was

discursively formed and transformed in various texts relating to school color vision testing. Accordingly, the study followed the procedure that Carabine (2014) highlighted as a guide to do Foucauldian genealogical discourse analysis as follows. The first step Carabine (2014) addressed is to "select your topic-identify possible sources of data" (p. 281). The second step is to "know your data-read and re-read. Familiarity aids analysis and interpretation" (Carabine, 2014, p. 281). As Carabine (2014) states, once topic was selected, I collected relevant data and repeatedly read it for analysis. The third step Carabine (2014) states is to "identify themes, categories and objects of the discourse" (p. 281). Following this third step, the study identified the emerging debate about school color vision testing between supports and opponents after 2014 as themes of the discourse. The fourth step is to "look for evidence of an inter-relationship between discourses" (Carabine, 2014, p. 281). Therefore, statements in school health acts, life stories, and various color vision requirements were primarily examined in the study. The fifth step of analysis is to "identify the discursive strategies and techniques that are employed" (Carabine, 2014, p. 281). The study employed Foucault's notion of anatomo-politcs of the body and the regulations of the population in order to address discursive formations of notion of color-blindness. The sixth step Carabine (2014) addressed is to "look for absences and silences" (p. 281). The study investigated the

way in which the younger generation of people with defective color vision are silenced in society. The seventh step Carabine (2014) presents, accordingly, is to "look for resistances and counter-discourses" (p. 281). The study examined discourses of mandatory school color vision testing abolition movement. The eighth step is to "identify the effects of the discourse" (Carabine, 2014, p. 281). The study investigated the way in which Takayanagi's discourse of school color vision testing influenced the mandatory school color vision testing abolition movement. The ninth and tenth steps are the following. The ninth is to "outline the background to the issue" (Carabine, 2014, p. 281). The tenth step is to "contextualize the material in the power/knowledge networks of the period" (Carabine, 2014, p. 281). Lastly, Carabine (2014) addressed the importance to "be aware of the limitations of the research, your data and sources" (Carabine, 2014, p. 281). The study, therefore, addressed limitations of the research in the sixth chapter.

In discourse analysis, data is discourses which appear in various kinds of texts. In this sense, Burr (2015) defined discourse as "a frame of reference" (p. 122). Observers can access reality only through discourse as a frame of reference. Discourse, accordingly, includes "a set of meanings, metaphors, representations, images, stories, statements and so on in some way together produce a particular version of events"

(Burr, 2015, pp. 74-74). Carabine (2014) also defined discourse as “historically variable ways of speaking, writing and talking about, as well as practices around, an issue” (p. 274). In this regard, Carabine’s notion of discourse is to “produce effects − discursively and through practice − which influences the way we understand, experience, and respond to the issue or topic” (Carabine, 2014, p. 273). In this regard, text in discourse analysis is “anything that can be ‘read’ for meaning” (Burr, 2015, p. 239). Titchosky (2007), likewise, asserted that “disability...must also be understood as a text that can be read and written about” (p. 11). The notion of disability as text allows this study to explore color-blindness, color vision requirements, school color vision testing procedure, school health acts, and the lived experiences of people with color-blindness. As a result, primary texts of this study are the following: various school health acts, color tests including the Ishihara test, and written and unwritten life stories of people with color vision defects.

Finally, the study employed a life story interview in order to collect narratives of people with color vision defects who have the personal experience with school color vision testing. This part, therefore, intends to provide an overview of what is a life story, how life story interviews are conducted for the study, and how the life story interview is beneficial to the study. First, the terms, life story and life history are similar in the

meaning but different in the way they are collected. Life story has more specific focus than life history does. Sakurai (2002) asserts that life story regards the self-told story as a happening that occurs under influence of the interview circumstance:

> Life story is a self-told story about a trajectory of one's life which is selective and only covers happenings that seem to be important to the storyteller because nobody can tell the complete trajectory of itself. … occasional monologues of one's life are part of life story. An autobiography is a life story in print. (p. 60; author's translation)

Life story reflects storytellers' own value judgment on what and how the story should be told. In light of this, life stories, even monologues, are never told and collected unless storytellers concern listeners, interviewers, or the society to whom they tell their stories. Sakurai (2002), therefore, notes that "life stories are made, interviewee's self and reality are constructed at a research interview through linguistic interactions between the interviewee and interviewer" (p. 61; author's translation). A life story in Sakurai's account is a product of communication between the interviewee and interviewer.

In contrast, life history regards the self-told story as the representation of history at large. Life history may include life stories, but collected stories require absence of

researcher's presence. In other words, in light of life history analysis, the interviewer's subjectivity must be removed from the analysis as Sakurai states (2002):

> Life history is a generic concept which includes life story and record of lives of particular persons or events in the way that biographies are collected. … Life history is an account which includes not only life story but also stories of the particular individual told by someone else, life history data (diaries, letters, and other text data), or scholarly documents. (p. 58; author's translation)

A life history reflects researcher's value judgment on which story should be included. Life histories are edited by the interviewer or researcher in the way that it makes sense to the readers (Sakurai, 2002). According to Ishikawa and Nishikawa (2015), "life history research mainly concerns what was told and thus how it can be reconstructed" (p. 2; author's translation). Life history may appear to the readers as the true history of the interviewee' life but it is merely a product of interviewer's editing. In short, Sakurai (2002) notes that interviewees actively produce their life stories at an interview and thus life stories are dialogic mixtures between interviewees and interviewers as follows:

> Storytellers are actors who produce stories at interviews and thus aware of their audience such as interviewers and the society. They are not merely an informant. In this sense, story is a dialogic mixture which is constructed through

> interactions between the interviewee and interviewer rather is merely a series of past events that the storyteller experienced before. … Interview sites, therefore, are where life stories are constructed. (pp. 30-31; author's translation)

As Sakurai (2002) asserts, life stories regard interviewers as one of agents who are involved in story making as storytellers do. In this sense, life stories are the product of communication between the storyteller and interviewer.

Considering the life story interview, interviewers try to collect not only what is told but also how the story is told at each interview if possible. The way the interviewee tells the story reflects how the interview is conducted between the interviewee and interviewer. Sakurai (2002), therefore, asserts interviewers must become aware of what their intention is, "an interviewer always has certain intention at the interview. … we must acknowledge that we all have certain intention and thus become aware of what our intention is" (p. 171; author's translation). In this sense, interviewers tend to make their appearance in the transcription of life story interview.

Full transcriptions are not particularly necessary for Foucauldian genealogical discourse analysis (Taylor, 2014). Therefore, the researcher mainly worked over the interview recordings and field notes that the researcher took in a form of life chronology sheet (see Appendix A) during the interview. The researcher made transcriptions as

necessary. It should be noted that working over the recordings is a reasonable alternative because the way that the interviewee delivered answers can be better analyzed (Taylor, 2014). The transcription often entails questions, continuation attention markers: yes, okay, or I see, how the interviewee feels about the interviewer's responses, and the intention of the interviewer (Ishikawa & Nishikura, 2015; Sakurai, 2002). This way of transcribing the interview allows the researcher to understand in-depth the construction of life stories told at the interview (Ishikawa, 2015). Ishikawa notes that transcribing questions and verbal and nonverbal responses at an interview helps the researcher to "understand how the interviewees grow up into who they are in the present" (Ishikawa, 2015, p. 223). A life story researcher aims at better understanding the life of the interviewee through investigating the construction of life stories collected at the interview. Therefore, life story researchers listen to how the life story is told by the interviewee in order to disclose interviewer's interactions with the life story.

In summary, employing the life story research method allows this study to explore the way in which people with color vision defects have or have not experienced school color vision testing in a retrospective way. The construction of life stories does not only reflect the relationships between the interviewee and interviewer at the

interview but also how the interviewee understands what is acceptable and what is not in society (Ishikawa & Nishikura, 2015). According to Sakurai (2014), the boundary between being acceptable and inacceptable reflects a master narrative, which is "the politically correct story which reflects cultural traditions and social norms and thus reflects socially acceptable ideology" (p. 103). Interviewees become uncomfortable telling their stories in the way that does not fit to what is regarded as the master narrative in their communities.

On the one hand, interviewees may feel more comfortable telling their stories in the way that fits to the master narrative. In consequence, their life stories reflect the notion of color-blindness in society. The life stories collected are the product of communication between the interviewee and the interviewer. Therefore, employing the life story interview method allows the study to disclose the notion of color-blindness in Japan through investigating life stories of people concerned who have or have not experienced school color vision testing. Through lens of the life story research, thus, the study explores the ways in which the notion of color-blindness has been discursively constructed and transformed from mandatory school color vision testing towards revitalizing school color vision testing in 2014.

2.3.2. The Research Sample

This part reviews the sampling strategy of the study. First, the study employed a purposeful sampling, which "means that the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study" (Creswell, 2013, p. 156). The purposeful sampling approach is typically used in qualitative research because qualitative researchers often elaborate on sample size, interview questions, or even conceptual frameworks while they are collecting data (Creswell, 2013; Bloomberg & Volpe, 2012; Sakurai, 2002). In this regard, the researcher reflects on sample selection procedures of the study. Creswell (2013) notes that sample for qualitative research is selected by the researcher on availability, importance, background, and willingness to participate as follows:

> The individual may be convenient to study because she or he is available, a politically important individual who attracts attention or is marginalized, or a typical, ordinary person. All of the individuals need to have stories to tell about their lived experiences. (p. 155)

The researcher on account of purposeful sampling reflects on sample size of the study. The goal of qualitative research is to provide in-depth description of the particular

phenomenon in question. Bloomberg and Volpe (2012) assert the goal of qualitative study that "the researcher's intent is to describe a particular context in depth, not to generalize another context or population" (p. 104). The study collected interview participants in order to make a "thick description" (Geertz, 2000, p. 26) of the particular notion of color-blindness. Yatsuzuka (2013) notes that "a single case can provide a valid evidence as long as the researcher can disclose regularities between the single case and the rest of the cases" (p. 352; author's translation). The study, therefore, did not intend to enlarge sample size. Instead, the study aimed at making a thick description for improving validity of the research through the purposeful sampling.

Second, the study examined two kinds of sample: textual data and narrative data. Sample of the study is discourse in light of a social constructionism. Reality of life on account of social constructionism exists in linguistic representation (Nouchi, 2015). As Nouchi (2015) asserts, "it is the perspective of discourse that one's speech act and behavior are formed in communication" (p. 13; author's translation). In light of social constructionism, discourse forms the reality that people can percept and experience. In other words, people percept and experience what is exchanged in communication through discourse, which "provides a frame of reference, a way of interpreting the world and giving it meaning that allows some 'objects' to take shape" (Burr, 1997, p.

57). In this regard, narrative data can be derived from both written and unwritten life stories of people who use discourses.

In addition, discourse may refer to anything, including text to be read for meaning, to generate events according to Burr (1997). In this sense, the study collected various textual data regarding school health acts, disability laws, color vision defects, school color vision testing, and color vision requirements. These collected documents included both biographies and autobiographies of people with color-blindness. Narrative data regarding mandatory school color vision testing, accordingly, was also collected by the life story interview. I interviewed people who experienced mandatory school color vision testing and also who grew up under the optional testing. In light of purposeful sampling approach, the interviewees were those who self-disclosed their defective color vision to me. All of them voluntarily participated in the life story interview after informed consent was carefully made.

2.3.3. Methods of Data Collection and Analysis

This part provides an overview of the way the data was collected and analyzed in the study. The study employed a procedure of "triangulation" (Bloomberg & Volpe, 2012, p. 107). The triangulation procedure of data source was not only intended to avoid

misinterpretations but also to incorporate multiple insights. Each following chapter applied different sets of triangulation methods. The third chapter intended to disclose the way in which the notion of color-blindness was discursively formed towards establishing mandatory school color vision testing in 1920. Therefore, the researcher reviewed documents of different sources regarding school color vision testing including laws and amendments, medical reviews of various color vision testing procedures, publications of Shinobu Ishihara. The documents were mainly searched through NDL-OPAC, CiNii Articles, Google Scholar, Japan Center for Asian Historical Records, university libraries, and Amazon.

The fourth chapter aimed at disclosing the ways in which the notion of color-blindness had been transformed through the mandatory school color vision testing abolition movement between 1973 and 2002. The researcher examined various documents including laws and amendments, color vision requirements, publications of Yasuyo Takayanagi, biographies and autobiographies of people with color-blindness. These documents were mainly searched through NDL-OPAC, CiNii Articles, Google Scholar, Japan Center for Asian Historical Records, university libraries, and Amazon. The fourth chapter intended to disclose continuity, discontinuity, changes, mutation, differences, and similarities between the documents.

The fifth chapter intended to disclose how the notion of color-blindness has been discursively shifted through the optional school color vision testing since 2003. The researcher conducted a life story interview with four young interviewees who grew up in the optional school color vision testing periods. The interviewees are anonymously named B, C, D, and E. In order to compare their narratives with those who experienced the annual mandatory school color vision testing, I as the interviewer also interviewed two people who experienced the annual mandatory school color vision testing. The life stories collected from the people who experienced the annual mandatory school color vision testing confirmed previous studies of color-blindness (e.g., Takayanagi, 1998, 2014b; Nihon Shikikakusabetsu Teppai no Kai, 1996). The study, therefore, only quoted one of the older interview participants' stories (Interviewee A) in the discussion. The life story of Interviewee A most clearly reflected the shared experience of those who experienced the annual mandatory testing.

The life story interviews with each participant have been simultaneously conducted since 2016. Some interviewees already had personal connections with the researcher prior to the interview. Others were introduced through an informant whom the researcher knew about. Therefore, the researcher was already aware of their color vision defects before the interviews. The researcher contacted each interviewee and

carefully made informed consent. Then, those interviewees agreed to voluntarily participate in the life story interview.

At each interview, the interviewer recorded narratives of their life stories with an IC recorder except for the interview with Interviewee A, where the interviewer could only take a field note. The interviewer took notes of their life stories on a life chronology sheet (see Appendix A) with the other interview participants at each interview. This difference of interview recording method caused that the excerpt of his life story, which appears in the fourth chapter, is only a summary of what he told me at the interview. The interviewer encouraged the interviewee to tell their life stories in a chronological order by asking them questions in a chronological order as much as possible. Each interview usually took place where it was convenient for the interviewees and private enough to protect their privacy. The typical length of each interview was an hour. The interviewees made their own interview schedules. The interviewer intended to make interviews less stressful. Some interviewees were interviewed multiple times, but others were only once. The total length of interview varies from two to ten hours depending on interviewee's availability.

In addition, biographies, autobiographies, and novels of people with color-blindness were also investigated. The written life stories were mainly collected through

NDL-OPAC, CiNii Articles, Google Scholar, university libraries, and Amazon. The collected narratives were transcribed at necessary by me and then categorized into the conceptual frameworks including self-awareness, self-examination, and self-disclosure of color-blindness. Finally, collected life stories were compared to each other in order to disclose regularities, similarities and differences between them.

2.3.5. Ethical Considerations

Ethical considerations for protecting the interview participants, their privacy, and well-being, remained a priority throughout the study. Sakurai (2002) asserts that "ethical considerations must be considered of priority for qualitative research rather than quantitative research" (p. 86). Although the nature of qualitative research does not usually allow the researcher to plan and evaluate ahead ethical validity of the study, it is exceptionally important for the researcher to remain considerate of ethical validity throughout the study (Sakurai, 2002). The researcher, thus, paid extra attention to interview participants of the study.

In this regard, the researcher made various safeguards to protect safety and rights of the interview participants. The research and its procedure were reviewed and approved by Institutional Review Board of Utsunomiya University (the numbers of

approvals: H17-0025; H19-0017). First, informed consent was carefully made with all the interview participants. Before proceeding to interview, the researcher explained interview intent to each participant with a letter of introduction and informed consent form. Then, the interviewer received a written consent to voluntarily participate in the interview from each participant. Second, the researcher placed the number one priority on rights and interests of participants throughout the study. In this regard, the researcher consulted with each interview participant on reporting and dissemination of their narratives in order to ensure their rights, security, and well-being were well protected. Accordingly, it was researcher's commitment that the significant identity characteristics of interview participants including their names and institutions they belonged to were kept confidential unless the interview participants approved not to do so. Third, all the records of their life stories and related data collected from the interview were secured with codes where only the researcher obtained access.

2.4. Chapter Summary

In summary, this chapter highlighted the literature review, the theoretical framework, and the methodologies of the study. Thoroughly reviewing the existing literature regarding the selected two topics: school color vision testing and color-blindness as a

social construct, the study addressed the following seven limitations of the existing literature. The first limitation the study addressed is that major literature in the domain of school health studies relies on the premise of medical definition. The second limitation is that there is no in-depth understanding of why people with color vision defects cannot possibly become aware of their defects unless they are screened by mandatory school color vision testing. Third, the study addressed the short of qualitative research in the study of school color vision testing. The fourth limitation the study addressed is that lack of earlier studies in the domain of disability studies in education. It reflects a debate that the social model of disability may or may not incorporate the personal experiences of people with mild impairments including color vision defects. The fifth limitation the study addressed is lack of data regarding the experience of people with color vision defects after abolishing mandatory school color vision testing in 2003. Sixth, there is lack of attempts to redefine color vision defects without adopting a medical definition of impairment in the areas of research. Lastly, the seventh limitation the study addressed is lack of in-depth understanding of the way in which the notion of color-blindness has been constructed and transformed.

To fulfill the gaps in the earlier literature, the study employed a social constructionist approach in which the notion of color-blindness was considered as a

discursive formation. In particular, the study drew from scholars in disability studies in education. The study elaborated on a social model of disability in order to redefine color vision defects as a social phenomenon. This approach, thus, allows the study to explore the way in which the notion of color-blindness has been discursively constructed and transformed through school color vision testing.

In light of the social model of disability, the study employed a Foucauldian genealogical discourse analysis as the methodology of data collection and analysis. The discourse analysis allows the study to investigate the way in which power has been exercised through school color vision testing to construct and transform the notion of color-blindness. Foucault's notion of genealogy allows the researcher to become skeptical about the existing norm regarding people with color-blindness. It also contributes to the better understanding of how the notion of color-blindness has been discursively transformed through the changes in school color vision testing. The existing literature in the area of school health studies has not examined yet the way in which the notion of color-blindness was constructed through school color vision testing. In addition, the area of disabilities studies has not discussed construct of color-blindness yet. Therefore, employing a Foucauldian genealogical discourse analysis allows the

study to contribute a new insight to both domains of school health studies and disability studies in education.

The study also inquired life stories of the people concerned who grew up after school color vision testing became optional in 2003. Life story interviews were conducted so as to particularly obtain the personal experience regarding color vision and color vision testing after 2003. The earlier literature regarding school color vision testing has not investigated the younger generation of people with defective color vision, who grew up under the optionalized school color vision testing. Therefore, the data examined in the study contributes to the better understanding of their lived experience. Life story analysis discloses the unknown lived experience of the younger generation of people with defective color vision without the mandatory school color vision testing experience.

The study sheds light on the way in which the notion of color-blindness has been discursively transformed. The study aims at providing a valuable insight to studies of color-blindness as a social construct through examining discursive formations of notions of color-blindness. This approach of the study raises awareness of people with color-blindness in Japan. I intend to problematize what is norm regarding color-blindness in society and to better understand issues of color vision.

CHAPTER THREE

MANDATORY SCHOOL COLOR VISION TESTING BETWEEN 1878 AND 1972

This chapter explores the way in which the notion of color-blindness was discursively constructed and transformed through the establishment of mandatory school color vision testing from 1878 to 1972. The establishment period was divided into the following four periods: notion of students' health as benefit of the public between 1878 and 1899, notion of students' health as disease free between 1900 and 1919, the birth of medical model of color-blindness between 1920 and 1957, and the reinforcement of coordinate power over color-blindness between 1958 and 1972. Primary texts include *Katsuryoku Kensa*, *Gakusei Seito Shintaikensa Kitei*, *Gakusei Seito Jidou Shintaikensa Kitei*, and *Gakkohokenho*, the Ishihara color blindness test, and written/unwritten life stories of people with color vision defects. Thoroughly examining the various texts, this chapter sheds light on the notion of color-blindness as failing the Ishihara test. The study addresses that the notion of color-blindness discursively reflects a medical model of disability. This chapter concludes with discussing that the notion of color-blindness corresponds to Takayanagi's notion of color-blindness (Takayanagi, 2014b).

3.1 Notion of Students' Health as Benefit of the Public between 1878 and 1899

This section explores the way in which notion of students' health was constructed through the changes of school health acts. Primary text is *Katsuryoku Kensa*. In light of Foucault's notion of power, this section seeks to shed light on the way in which bio-power was exercised through *Katsuryoku Kensa* so that notion of students' health as benefit of the public was constituted. Since *Gakusei*, in English known as school system, was proclaimed in 1872, school education had been criticized for the overemphasis of utilitarianism and cramming knowledge (Sugiura, 1975). Utilitarianism and cramming knowledge were typically emphasized for students to develop their career in the introduction of proclamation document of school system, "school education is a resource for career development" (Ministry of Education Japan, 1872; author's translation). However, students' health and physical strength were disregarded during the establishment period of *Gakusei*. According to Sugiura (1975), the lack of attention to students' health increased the number of absence and dropout due to illness from school.

In response to the increasing number of physically weak students, vitality exam, called *Katsuryoku Kensa* in Japanese, was incorporated with school curriculum in 1888 (Kitazawa, 2000). The purpose of vitality exam was to promote physical education

to improve strength of students' body through assessing effectiveness of American style physical exercise (Sugiura, 1975; Kawano, 1997; Nose, 1999). For example, Yorimichi Saigo, who was Minister of Education, claimed that students became negligent of their physical strength:

> Our education only focuses on cramming knowledge. These days we are not likely to find students who pay attention to their physical strength. In consequence, they do not have proper mind and body. It is imperative that strength of student's body must be improved. (Saigo, 1878; my translation)

Textbooks used in elementary school had illustrations explaining the way to practice American physical exercise. For example, physical exercise illustrations of an elementary school textbook, called *Shougaku Seito Taisou no Zu* (Hashimoto, 1886), have men and women in traditional clothes holding dumbbells behind the head for upper body workout and using wands to stretch shoulders. Students were taught with this textbook how to exercise with dumbbells and wands as part of physical exercise at school.

The exercise was first introduced by American physician Leeland at a school of gymnastics, called *Taisou Denshuujo* in Japanese, in Tokyo in 1878. Vitality exam, however, was only an assessment test for the effectiveness of practicing American

gymnastics. Test items included “height, weight, elbow-fingertip/shoulder-elbow length, chest size, arm span, number of pull-ups, grip-strength, lung capacity” (MEXT, 2013, p. 6; author’s translation). Arm span, however, was replaced by eyesight in 1888 (Japan Society of School Health, 1973). These listed items reflect that measuring body size and strength of students was the primary purpose of vitality exam. Therefore, vitality exam was not a health exam or even concerning students’ health at all until eyesight replaced arm span in 1888. According to Sugiura (1975), the inclusion of eyesight as one of test items represents a change over the course of vitality exam. It was also a turning point for vitality exam to have become a requirement for all the public schools in 1888.

This transition of school health administration represents shifting of technologies of disciplinary power and coordinate power which are exercised at vitality exam. First, test items including eyesight made specific parts of body targeted and visible for doctors to closely observe and examine. Listing test items of vitality exam allowed doctors to make hierarchical observation that listed items were more important than the other non-listed items. In this sense, the list of test items represents Fujita’s notion of tableaux aspect of disciplinary power. This entails that the listed items became considered as problems which should be treated. Therefore, the Fujita’s notion of

tableaux technology of disciplinary power was practiced through the establishment of vitality exam. Hierarchical observation was reinforced in eyesight after 1888.

Furthermore, students' body became assessed and ranked in accordance with the result of vitality exam. Conscription began in 1873 and physical strength of people was evaluated and categorized in terms of capacity to work as soldiers (Kitazawa, 2000). Since 1975, those who passed conscription were placed into the following two categories: *Ko* and *Otsu* (Kitazawa, 2000). *Ko* was given to those who were qualified as fully capable of military service. On the other hand, *Otsu* was given to the others who passed the exam but not as healthy as *Ko* (Kitazawa, 2000). In this regard, Kitazawa (2000) asserted that "conscription exam was to hierarchize bodies … the examiners observed bodies just like farmers checked their tomatoes with scratches, shape, color, size, and smell" (p. 190; author's translation).

The school health checkup was not required for all the schools until 1888. However, as Kitazawa discussed (2000), the notion of health was discursively in transition towards developing physical strength of the nation in Japan. For example, Yukichi Fukuzawa (1881), who was a famous educator in the period, addressed his idea that incorporating the physical exercise of army into education may be the most effective way to develop physical strength of the nation. In consequence, the same

vitality exam as the conscription exam was eventually incorporated into education in order to assess physical strength of students.

As a result, students' bodies became hierarchized. Students' health became individualized through recording on individual health report, and the results were then recorded into statistic table of vitality exam, called *Katsuryokukensa Toukeihyou* in Japanese. For example, the following statistic table of vitality exam calculated the maximum, the minimum, the average, the comparison with the previous year of each test items at a higher normal school in 1892 (see Table 5).

Table 5

A Statistic Table of Vitality Exam

Year	Exam date	Hight	Weight	Arm span				Grip strength		Number of pull-ups	Chest size			Lung capacity	Eyesight		
				Right		Left		Right	Left	Times	Full	Empty	Regular	Left Right	Normal	Near	Far
		Bu	*Monme*	Upper	Lower	Upper	Lower	Kg	Kg		*Bu*	*Bu*	*Bu*	cm			
3rd year	Maximum	597	17,000	108	88	98	88	62	54	14	312	270	286	5,100	N/A	N/A	N/A
	Minimum	503	12,250	87	78	85	75	33	24	4	260	222	240	32,00	N/A	N/A	N/A
	Average	534	14,489	94	84	89	81	43	37	9	281	249	262	4,089	19	8	N/A
	Comparison/UP	4	57	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	/DOWN	N/A		N/A	6	N/A	5	1	2	N/A	N/A	12	10	124	N/A	N/A	N/A

Note. 1 *bu* equals 3 mm. 1 *monme* equals 3.75 g. Adapted from *Gakkohoken hyakunenshi* (p. 41), by Japan Society of School Health, 1973, Tokyo: Daiichi Houki. (author's translation)

This method of recording individual students' health assessment reflects Fujita's notion of exercises technology in which students' health was examined for a certain time

framework and evaluated in terms of their physical strength as potential soldiers. In this regard, students' health became considered as benefit of the public at large.

Accordingly, maneuver as another technology that Fujita (2000) addressed was also practiced in education. Vitality exam was only a way to assess the effect of American style physical exercise. Students were instructed by teachers to improve their physical strength. Not only physical exercise but also field day was a part of Fujita's notion of exercises technology through which students were disciplined (Kano, 2001). According to Hirata (1999), the first field day, called *Kyoutou Yuugikai* in Japanese, was held at Imperial Japanese Naval Academy in 1874. Students competed in "flat race, long jump, high jump, throwing the shot, three-legged race, pole jump, walking match" (as cited in Hirata, 1999, p. 91; author's translation) and the other programs that even visitors could participate in. Students' body movements were observed and managed by teachers through physical exercise and field day.

Fujita's notion of maneuver technology reflects a standardization of students' bodies in which a notion of ideal body was constructed. In addition, what was regarded as norm of students' health was measured in terms of distance from the idealized body. This idealized body is what Miura (1994) regarded as "body at zero degrees Celsius" (p. 221; author's translation). Miura's notion of body at zero degrees Celsius refers to the

most ideal body which satisfies any requirements for soldier. The idealized body, therefore, was needed by the modern army as “the healthy soldier” (Miura, 1994, p. 218; author’s translation). In accordance with Miura’s notion of the healthy soldier, industrial revolution sought the idealized body for “the healthy labor” (Miura, 1994, p. 218; author’s translation). According to Miura (1994), “it was possible to cast soldiers’ body movement, face expressions, and behaviors into a mold” (p. 198; author’s translation). Through the standardized and idealized body, what was regarded as abnormal or disabled were foregrounded. In this regard, Miura (1994) asserts that “elementary and secondary education were a pre-conscription education” (p. 198; author’s translation). Therefore, school and army shared the disciplinary nature of society. As a result, physical exercise became a part of education and students’ bodies were standardized (Miura, 1994).

In summary, Fujita’s notion of tableaux technology consisted of hierarchical observation at vitality exam. In addition, Fujita’s notions of exercises and maneuver technologies consisted of normalizing judgment. These three technologies together discursively formed normalizing gaze in which anatomo-politics of body was operated and thus disciplinary power was exercised over the students’ bodies. In addition, *Katsuryoku Kensa Toukeihyou* was sent to the government (Kitazawa, 2000; Sugiura,

1975; Japan Society of School Health, 1973). In this regard, students' bodies and health became recognized and subject of official statistics. The statistics allowed the government to exercise coordinate power through the technology of bio-politics of the population. As a result, both anatomo-politics of body and bio-politics of the population were established through *Katsuryoku Kensa* in which bio-power was exercised over students' bodies. Students' health became considered as the benefit of the public as soldiers (Kano, 2001), instead of the students themselves. Notion of students' health as the public good was constituted.

3.2. Notion of Students' Health as Disease Free between 1900 and 1919

This section explores the way in which notion of students' health was discursively constructed through the changes of school health acts. Primary text is *Gakusei Seito Shintaikensa Kitei*. In light of Foucault's notion of power, this section seeks to highlight that the shifting of school health acts foregrounded power relations in which notion of students' health as disease free was constructed. Although vitality exam was renamed as *Shintai Kensa*, in English known as physical examination, the school health checkup still required to measure body size and strength of students in 1897 (Ministry of Education Japan, 1897; Kitazawa, 2000). However, the renaming of vitality exam

reflected the shifting of focus from body measurement to detecting diseases of students. Regulations of physical examination for students, called *Gakusei Seito Shintaikensa Kitei* in Japanese, was renamed from *Katsuryoku Kensa* and enacted in 1900 (Japan Society of School Health, 1973). Then, physical exam became a requirement for all the elementary school students (Kitazawa, 2000; Japan Society of School Health, 1973; Ministry of Education Japan, 1900). Regulations of physical examination for students (Ministry of Education Japan, 1900) defined that all the students but older than twenty years old were required to take *Shintai Kensa* twice a year, "the physical examination of students must be conducted every April and October. Students who are older than twenty years old should take only once in every April" (p. 372; author's translation). Regulations of physical examination for students reflected the following three features.

First, the purpose of the regulations became more nationalistic by focusing on developing the very best Japanese for the national interest. Yamamoto asserts that the goal of *Shintai Kensa* was to develop "the very best human species" (1999, p. 34; author's translation). The regulations enforced all the schools including local schools which were not directly managed by the government to conduct the standardized physical examination (Yamamoto, 1999). In this sense, students' bodies became sites where personal interests in being healthy meet the public interests in healthy citizens

under the enforcement of new regulation. Students' bodies became visible to not only students themselves but also examiners through the standardization of mandatory physical exam. The new direction of school health exam disciplined students' health and thus represented Fujita's notion of tableaux technology. In other words, the birth of school health exam discursively constituted hierarchical observation between students and examiners. Power, therefore, was exercised through the technology of hierarchical observation so as to constitute a notion of students' health.

Second, test items of the regulations started to include various diseases. This change reflects a shift in the focus of exam from measuring body size and strength towards detecting diseases. Test items required for the physical examination are the following: "height, weight, chest size, the spine, physique, eyesight, eye disease, hearing ability, ear disease, teeth, other diseases" (Ministry of Education Japan, 1900, p. 372; author's translation). Adding diseases including eye and ear diseases to the test items reinforces the shifting of notion of students' health from physical strength towards disease free. It was the birth of school health examination (Sugiura, 1975; Kawano, 1997; Japan Society of School Health, 1973) that students' health was sought by removing diseases. Students' health became normalized and annually tested for the purpose of early detection of diseases. This shift in physical exam reflects Fujita's

notion of exercises technology of normalizing judgment in which Foucault's notion of power was exercised so as to discursively form the notion of students' health as disease free.

This notion of health as disease free also highlights the birth of medical model of disability in school health examination. Healthy students' bodies were identified with bodies without any defects or malfunctions. Therefore, students' health was sought for non-disabled bodies. As a result, the test result was used rather excluding students with diseases and impairments than providing individual supports to integrate them into the mainstream education. As Sugiura (1975) discussed, students with special needs were "granted permission not to complete compulsory education, suspended from schools, or granted permission to leave school early" (p. 273; author's translation). In this regard, students with special needs became visible through physical exam. Physical exam set a standard of educational quality to generate a division between those who are entitled to go to school and those who are not. Fujita's notion of exercises technology, therefore, was practiced through physical exam in school health examination.

Third, the regulations continued to require schools and doctors to record results in the individual report and the statistics table. Each students' health was medically assessed based on the test items required by the health exam. The result of the health

exam was written on the individual report (Ministry of Education Japan, 1900). Results of individual students' health checkup were summarized and recorded in the statistics table (Ministry of Education Japan, 1900). The test results were collected by the government and kept in the national statistics record (Sugiura, 1975). The results were also sent to students in question and their parents to let them become aware of their health condition and self-disciplined to watch their own health (Japan Society of School Health, 1973).

In addition, Yamamoto (1999) asserts that the test results were also used by the government to improve school health environment so as to better develop the very best human species. Imposing ranks on students' health reinforced students' bodies to be observed and fixed under the regulations. In other words, the change in the procedure reflects students' health became not only individual but also, probably more, the national interest (Kawano, 1997). To name but a few, minister's observatory tour, conscription physical examination, and rich country strong army policy were practiced during the same period. In 1906, ex-Minister of Education Kubota wrote the following, in the classroom, "students were labelled with color coordinate medals such as red for severe trachoma, yellow for mild trachoma, and no medal for non-trachoma" (Sugiura, 1975, p. 274; author's translation). In consequence, students' health became a national

interest and thus collected as well as managed by the government. The same perspective was also reflected on the popular slogan, rich country strong army, through which students were discursively encouraged to become soldiers and young women to work at factories in order to support the war after compulsory education.

As Oliver (2006) also argues, industrialization had influence on people with disabilities. Tokugawa (2016), accordingly, claims that adopted technology defines which impairments or deficiencies of humans should be considered as disabilities. Industrialization constituted the need for detecting defects or diseases in society (Rosenthal & Phillips, 1997). The need for detecting defects eventually created the norm of students' health and underpinned the division between who's normal and abnormal. In addition to the government observatory tour, both teachers and parents observed students' body movement and health so that students became self-disciplined to watch their health through the observation. This reflects Fujita's notion of maneuver technology. Students' body and health were constantly observed and assessed by what was regarded as normal or ideal. Accordingly, the results were repeatedly collected and evaluated by the routine school health exam. Students' health was managed by the government as the population which was considered as the resource of solders. Notion of students' health, therefore, became disease free and foregrounded the medical model

of disability discourse in the school health examination. The notion of students' health as disease free reflects the medical model of disability.

To summarize, the enforcement of *Gakusei Seito Shintaikensa Kitei* entailed Fujita's notion of tableaux technology of body. The regulations also entailed Fujita's notion of exercises and maneuver technology through which normalizing gaze was practiced at the school health examination. In addition, statistics table, individual health cards, and ministry's observatory tour constituted bio-politics of the population. Through the anatomo-politics of body and bio-politics of the population, bio-power was exercised so as to discursively construct the notion of students' health as disease free.

3.3. Notion of Students' Health as Colorblind Free between 1920 and 1957

This section explores the way in which the notion of color-blindness was discursively constructed through the enactment of mandatory school color vision testing in 1920. Primary text is regulations of school health checkup for children and students, called *Gakusei Seito Jidou Shintaikensa Kitei* in Japanese. In light of Foucault's notion of power, this section seeks to highlight how bio-power was exercised through the mandatory school color vision testing so as to foreground color-blind students under the medical model of color-blindness. This part argues that the regulations of 1920 reflected

three technologies of normalizing gaze including Fujita's notions of tableaux, exercises, and maneuver.

Fujita's notion of tableaux technology was reflected on the text of mandatory school color vision testing itself. *Gakusei Seito Jidou Shintaikensa* (Ministry of Education, 1920) stated that "regarding color vision, those who have defective color vision should be divided into totally color-blind and partially color-blind" (p. 623; author's translation). In addition, Yano and Nakamura (2016) asserted that the amendment of 1920 "reflected the objective of recognizing all the students with defective color vision" (p. 1474; author's translation). Color vision testing became a requirement of school health checkup. Color vision testing was only required once in six years of elementary school by the amendment. However, it was eventually developed into annually mandatory school color vision testing for elementary school students older than eight years old in 1937 (Yano & Nakamura, 2016). Color-blindness, therefore, not only became considered as disease but also visible in the classroom. In this regard, the school color vision requirement represented Fujita's notion of tableaux technology in which not only examiners but also students themselves became aware of the difference in color vision.

Exercises as another technology that Fujita (2000) addressed was practiced through the Ishihara color blindness test. In 1916, Shinobu Ishihara invented a new pseudoisochromatic plate, commonly known as Ishihara's Tests for Colour Deficiency or the Ishihara color blindness test in English, for the use of conscription (Ohta, 2005; Ishihara, 1952). Based on the original test plates, Ishihara repainted and replaced figures with numbers in order to publish the Ishihara color test for school use in 1921 (Yano & Nakamura, 2016). Since color vision testing became mandatory at school health checkups, all the school infirmaries were required to have color vision test plates (Shibuya, 2001). In consequence, the Ishihara test became the standard of school color vision testing. For example, Takayanagi (2004) asserted that 90% of schools still used the Ishihara test for the color vision testing until the abolition of mandatory school color vision testing in 2003.

In light of Foucault's account of power, Baba (2013a) described the Ishihara color blindness test as "colorblind panopticon" (p. 154; author's translation). Through the Ishihara test, examinees were observed and normalized. According to Baba (2013a), the Ishihara color blindness test has the following four aspects. The first aspect of Ishihara Color Test is "controlling time" (Baba, 2013a, p. 154; author's translation). Response time is normalized so as to require examinee to answer within a certain time

span. The second aspect of the Ishihara test is “controlling space” (Baba, 2013a, p. 154; author’s translation). The testing environment is normalized so as to require the examinee to read plates under a standardized condition. The third feature of the test is “high mobility” (Baba, 2013a, p. 154; author’s translation). The examiner is de-normalized so as to allow various types of people including teachers to conduct the test to students in the classroom. Lastly, the fourth aspect of the Ishihara test is “illusion of doctor’s intervention/gaze” (Baba, 2013a, p. 154; author’s translation). Color vision testing using the Ishihara color blindness test allows diagnosis of color vision defects by anybody to be considered as serious as doctor’s medical diagnosis.

This fourth feature of the test plates made the students who misread the Ishihara color blindness test believe that they must be colorblind even though the testing was often conducted by non-medical professions including homeroom teachers or *Yogo* teachers. *Yogo* teachers, who are often in charge of school health checkups, are “a special licensed educator who supports children’s growth and development through health education and health services on the basis of principles of health promotion in all areas of educational activities at schools” (Kamata, 2011, p. 481). All these four aspects together constitute a notion of students who failed the Ishihara color blindness test as

color-blindness. In this regard, students with color vision defects were standardized and normalized by the Ishihara test through mandatory school color vision testing.

Fujita's notion of maneuver technology was typically exercised through the homeroom teacher and classmates. According to Sugiura (1975), *Gakusei Seito Jidou Shintaikensa Kitei* featured "a law in which students with deficits or diseases were carefully and continuously observed and treated after the health checkup" (p. 88; author's translation). The school health checkup was aimed at identifying who would need continuous attention and support in class. The mandatory school color vision testing allowed teachers and school doctors to identify students who failed color vision testing so that those students were supposed to be well supported by teachers to learn better in class.

However, school color vision testing only made colorblind students visible and inferior to the other students in class. Yano and Nakamura (2016) asserts that career counseling was the most use of school color vision testing results, as they addressed "it was career counseling for schools to legitimate mandatory school color vision testing" (p. 1474; author's translation). The Ishihara test had career suggestions for students with color vision defects in its appendix (Ishihara, 1920, p. 15). As a result, the identified

colorblind students became only visible in class and informed of their less career options.

The inferiority of colorblind students was even reinforced through the gaze of other classmates. Wakabayashi (2005), who was born in 1946, wrote his life story as one of the people with defective color vision. He described his experience with the mandatory school color vision testing when he was 10 years old. According to his experience, school color vision testing was typically conducted in open classrooms where all the classmates made a line and could see each other's test result:

> I was the last in the boy's line [of color vision testing] because my family name, Wakabayashi, was the last in the order of kana syllabary. My turn, I stood in front of homeroom teacher and female students were waiting close just behind me. … The teacher started questions. … "Wakabayashi, you must be colorblind". … Since then, art classes turned to be very frightening. I tried to avoid using light or neutral colors and instead using vivid colors. … I was always afraid that my friends glanced over my paint and said "what? can you really see that in such color?". … I even tried to avoid talking about color with my friends. I was worried that my friends would say that "what are you saying? It is not pink, it is purple. Retarded, can't you see colors?" if I accidentally said

"That pink flower is beautiful" in front of my friends. (Wakabayashi, 2005, p. 20-35; author's translation)

Although the testing procedure typically involved the homeroom teacher, all they could do as non-medical examiner was to simply follow what was written in the instruction of the Ishihara test. This led to the construction of stereotype among classmates, which presupposed that students who failed the test plates must have been seriously defective. What was worse, at the school color vision testing, classmates made a line in the order of kana syllabary in front of the teacher. Therefore, those students behind the colorblind student could see test plates and hear the colorblind student's different answers.

The procedure of mandatory school color vision testing during this period became common later. For example, Yamazaki (1996 Aug. 23-30) drew an illustration of his experience of mandatory school color vision testing. Yamazaki (1996 Aug. 23-30) probably experienced mandatory school color vision testing only after 1957 because he was born in 1954. However, his experience with mandatory school color vision testing reflects the common procedure of mandatory school color vision testing. In the picture, a boy in the front who is reading an Ishihara test plate says 26 with his face sweating. The image implies that the boy in the front may not be confident of his answer. His classmates are behind and making expressions of surprise with voice and

face. Students behind the colorblind student must have been surprised to see him answering different numbers from what they saw in the Ishihara test plates. The numbers drawn in the Ishihara test plates must have been easy for those who do not have defective color vision to read. The open classroom style testing reinforced the notion of color-blindness as failing the Ishihara test. As a result, not only teachers but also classmates became curious enough to continuously observe how the colorblind student might see colors in different ways. The colorblind student became afraid of classmates' curious gaze even outside the classroom. This led the student to behave in a certain way including avoidance of art class, using confusing colors, or even talk about color. In this regard, teachers' as well as classmates' gaze constituted Fujita's notion of maneuver technology so as to self-discipline the student in question.

Disciplinary power was exercised through the technology of normalizing gaze over the students who failed the Ishihara test at the school health checkup. They were recorded in the official transcript and statistics table (Takayanagi, 2014b; Japan Society of School Health, 1973). The recording systems were methods of the government to manage color vision of the population. In this regard, coordinate power was also exercised through the construction of bio-politics of the population in which students with color-blindness were recognized as a problematic group. Both the individual

record of school color vision testing result in the official transcript and the statistic table made color vision defects as a category of statistical survey more visible than the other categories which were not listed. In this sense, they were not only the system to control the population but also discursively practiced Fujita's notion of tableaux technology.

The anatomo-politics of body and bio-politics of the population are intertwined in the exercise of Foucault's notion of bio-power. The Ishihara test functioned as if a technology of "panopticon" (Foucault, 1995, p.171). Those who failed the Ishihara test, consequently, were physically categorized in the unfit, abnormal, and defective. They were continuously but invisibly observed in the community. In consequence, bio-power was discursively exercised over students who failed the Ishihara test so as to construct the notion of students' health as color-blind free.

3.4. The Reinforcement of Coordinate Power over Color-blindness between 1958 and 1972

This section explores the way in which the notion of color-blindness as failing the Ishihara test was reinforced through the enactment of *Gakkohokenho* of 1958.

Gakkohokenho, in English known as School Health Act, was enacted in 1958 after the allied occupation of Japan following World War II. Some test items including color vision became temporarily optional during World War II for the purpose of cost cutting

(Yano & Nakamura, 2016). However, *Gakkohokenho* of 1958 took over the same test items including color vision from *Gakusei Jidou Seito Shintaikensa Kitei* (Yano & Nakamura, 2016). Primary texts in this section are *Gakkohokenho* and a life story which was collected through the life story interview of the person with a defective color vision.

Through thoroughly examining discourses of *Gakkohokenho* and the life story, this section sheds light on the way in which coordinate power was exercised over color vision defects by various technologies so as to reinforce the notion of color-blindness as the failure of the Ishihara test. The technologies on Foucault's account include the anatomo-politics of body and bio-politics of the population. The following paragraphs discuss the way in which the anatomo-politics of body technology was conducted through the normalizing gaze which consists of Fujita's notions of tableaux, exercises, and maneuver technologies. Accordingly, the way in which the bio-politics of the population was reinforced through the particular practice of hand-over the test result is also described in the following paragraph.

Fujita's notion of tableaux technology was exercised through the annual requirement of school color vision testing. The purpose of *Gakkohokenho* of 1958 in the section one of the law states that "educational effects shall be increased by promoting

and maintaining health of students and teachers" (Gakkohokenho 1958, p. 2; author's translation). As of 1958, a concept of educational efficacy was incorporated in the purpose of school health checkup. Health maintenance, accordingly, was regarded as the way to accomplish the effective education. In this regard, color vision testing also revived as one of the requirements at annual school health checkups. Under the regulations, students' color vision was annually examined so as to completely screen out students with abnormal color visions. Students' color vision became hierarchized. The abnormal color vision was considered as unhealthy color vision. Therefore, the annual requirement of color vision testing reflects Fujita's notion of tableaux technology through which hierarchical observation between normal color vision and abnormal color vision was constituted. In this sense, disciplinary power was exercised through the annual school color vision testing to reinforce attention to students' color vision.

Fujita's notion of exercises technology was recognized through the requirement to have color vision test plates at *Yogo* teacher's office. As of 1958, color vision test plates became a requirement at *Yogo* teacher's office although any particular name of testing was not mentioned in the law (Japan Society of School Health, 1973). In other words, any other school color vision testing could have replaced the Ishihara test. Based

on Takayanagi's findings (2004), however, at least 90% of the reserved color vision test plates was the Ishihara test. Consequently, students who were screened out at the school health checkup were most likely failures of the Ishihara test. The requirement of color vision test plates reflects the reinforcement of examining students' color vision and associating color vision testing with teachers as examiner. In other words, attention to students' color vision was even more emphasized in order to identify what was normal color vision and what was not. The raised attention to color vision addresses Fujita's notion of exercises technology through which normalizing judgment was practiced. Accordingly, teachers including *Yogo* teachers were even more than before associated with color vision testing as examiner under the regulations.

This change may not only reflect the educational efficacy of the school health examination but also teachers may find better use of it than doctors. In other words, students' color vision became considered as more of barriers than diseases. If defective color vision is considered as a disease, doctors should have conducted the testing. However, school color vision testing tended to be conducted by mainly *Yogo* teachers and homeroom teachers (Takayanagi, 2014b). In this regard, the notion of color-blindness in education seems to have been shifted towards barriers or difficulties that students face in society rather than diseases to be medically treated. Fujita's notion of

exercises technology, therefore, was practiced through the requirement of color vision test plates at *Yogo* teacher's office. Consequently, the requirement of color vision test plates discursively constitutes the notion of color-blindness as a problem in education.

Finally, Fujita's notion of maneuver technology continued to have been exercised through not only teachers' but also classmates' gaze at failures of the Ishihara test. In order to understand the individual experience of annual school color vision testing, the researcher conducted a life story interview with a man with defective color vision who experienced the annual testing. Carefully following all the procedures described in the second chapter, the researcher explained the interview intention and methodology to make an informed consent. The interview participant, anonymously named as A, was introduced by one of researcher's informant who the researcher knew before the interview. The interview was about two hours long. The interview was not recorded by IC recorder. Instead, the researcher took a field note. Interviewee A was in his 60s at the time of interview. He experienced annual mandatory school color vision testing when he was in elementary school. The following quotation is excerpt from the interview:

> Sometime during my elementary school, homeroom teacher tested us on a color vision test plate.…My turn, I could not read the plates. The teacher, in front of

> all the classmates waiting behind curiously looking at me, made a joke, "What? Are you French?" Every classmate laughed hard, so I had to laugh too… But the experience was quite traumatic for me. Until I became 45 years old, I could not tell anyone except my parents that I failed a color vision test. Even to my wife, I did not tell…. (Field note, 2017 July 21; author's translation)

Interviewee A described that "homeroom teacher tested us on a color vision test plate" (Field note, 2017 July 21; author's translation). In this regard, homeroom teachers seemed to have continued to conduct color vision testing to students as they did before. Therefore, students who failed the test was regarded as colorblind. This was only possible because there was an information gap between those who could read the plates including the examiner and other classmates and those who could not read. In other words, students' color vision was hierarchized through school color vision testing. The majority, who could read the plates, could easily misunderstand that they were normal and those who failed the test plates must have been abnormal.

In addition, Interviewee A described his experience of school color vision testing as follows, "every classmate laughed hard, so I had to laugh too… but the experience was quite traumatic for me" (Field note, 2017 July 21; author's translation). Therefore, the traditional open style testing had also been maintained so that the other

classmates in the line not only could see who failed the testing plates but also could hear the comments the teacher gave to the student on the test result. What was worse, the same thing repeated every year since school color vision testing became an annual requirement. This repetitive testing experience reinforced the notion of the student who failed the school color vision testing every year as serious disease or impairment among most students who could read the plates.

Finally, Interviewee A claimed that "even to my wife, I did not tell" (Field note, 2017 July 21; author's translation) his defective color vision. Interviewee A who failed the testing also became aware of difference in color perception himself and tempted to hide it from the classmates. Interviewee A did not come out as defective color vision until he was 45 years old. This episode, therefore, highlights that the annual testing experience was not only traumatic for Interviewee A but also forced him to behave in a certain way. It was because he was afraid of being judged as abnormal and ashamed of his abnormal color vision. The annual school color vision testing reinforced the notion of color-blindness as the failure of the Ishihara test. It was something negative to be ashamed of and hide from others. In this sense, Fujita's notion of maneuver technology was practiced through teachers' and classmates' observation at those who failed school color vision testing. Interviewee A, who failed the testing

plates, became self-disciplined not to tell anyone his defective color vision until many years after he had school color vision testing.

Lastly, as of *Gakkohokenho* 1958, handing over previous school color vision testing results to the next schools became mandatory for teachers and schools. This requirement was called *Moushiokuri* in Japanese and the format of handed-over information was also fixed (Yano & Nakamura, 2016). Therefore, students had ever been labeled as colorblind once they failed the Ishihara test. They were categorized in the failure of school color vision testing. This system required students with color vision defects to recognize their color perception as a problem. In consequence, students with color vision defects became continuously observed by both teachers and schools, and therefore self-disciplined to hide their abnormal color perception from others.

This particular procedure of handing over color vision testing results reflects Foucault's account of bio-politics of the population on school color vision testing. The student population was divided into two groups between those who failed the testing and those who did not. Even after graduation, the previous testing results were passed on to the next school so that their negative label remained as is. Therefore, school color vision requirements function as if the technology of panopticon in which those who failed the Ishihara test were physically categorized in unfit, abnormal, and deficits.

Consequently, they were observed and categorized by the community as ones with color vision defects. Coordinate power was exercised and even reinforced on students who failed school color vision testing through the technology of bio-politics of the population as of *Gakkohokenho* 1958. This entailed the reinforcement of notion of color-blindness as the failure of the Ishihara test.

3.5. Discussion: The Birth of Medical Model of Color-blindness

The study recognized the notion of color-blindness as the failure of the Ishihara test, which corresponds with what Takayanagi (2014b) previously argued in her study. However, she has not disclosed yet the way in which the notion was discursively constructed through various alterations of school health acts. Students who failed the Ishihara test were considered as color-blind, which reflects the medical model of disability discourse. By applying a social model of disability, this study recognized the way in which color-blindness was discursively constructed as lacking or defective color perception through mandatory school color vision testing.

The notion of students' health as benefit of the public was discursively constructed between 1878 and 1899. The notion of students' health was eventually shifted towards the notion of students' heath as disease free after 1900. Once school

color vision testing was commenced in 1920, the notion of students' health incorporated colorblind free. The notion of students' health as colorblind free remained unchanged through World War II. After 1958, coordinate power, which Osawa (2013) addressed, had been reinforced at defective color vision through School Health Act until 1972. During the period, the traditional notion of color-blindness as failing the Ishihara test was discursively constructed through the exercise of Foucault's notion of bio-power over students' color vision defects.

During the mandatory school color vision testing period, failing the Ishihara color test was regarded as lacking or defective color perception. In this sense, the study argued that the notion of color-blindness would reflect a medical model of color-blindness. The medical model was discursively generated by the illusion of doctor's authoritative gaze reflected in the Ishihara test. The medical model of color-blindness was normalized through mandatory school color vision testing as doctor's authoritative gaze for teachers and classmates as well as Ishihara's authoritative gaze for ophthalmologists. Bio-power was exercised on color-blindness through a merger between self-disciplined/normalized colorblind students. Coordinate power was also exercised at school color vision testing.

Accordingly, the study employed Foucault's notion of power in order to discuss the construction of color-blindness. The study successfully incorporated what the people in question experienced in the social model of disability. The research approach addressed an insight into post-social model of disability. In this regard, this chapter examined Morris's criticism by disclosing the way in which the medical model of color-blindness was discursively constructed through school color vision testing.

This study therefore contributes to improving validity of a social model of disability in the domain of disability studies in education. The findings of the study will contribute to developing theoretical discussions of disability studies in education. In addition, the findings of the study may also improve understanding of students with color-blindness as well as the social construction of school color vision testing in school health studies. As a result, the analysis of the way in which the notion of color-blindness was discursively constructed and transformed through mandatory school color vision testing contributes to better understanding of color-blindness as a social construct in Japan.

CHAPTER FOUR

SHIFTING TOWARDS ABOLISHING SCHOOL COLOR VISION TESTING BETWEEN 1973 AND 2002

This chapter explores the way in which the notion of color-blindness was transformed through the mandatory school color vision testing abolition movement from 1973 to 2002. First, this chapter reviews School Health Act 1973 and highlights changes in school color vision requirements. Second, this chapter sheds light on Takayanagi's model of color-blindness and reflects a social model of disability discourse on the mandatory school color vision testing abolition movement. Finally, as an extension of Takayanagi's model, the chapter investigates the construction of notion of pilots with color vision defects in color vision requirements for aviators in Japan. This approach allows the study to discuss transferability of Takayanagi's model as well as its theoretical limitation. In conclusion, the study argues that Takayanagi's model of color-blindness as the birth of social model of color-blindness and also faces the same theoretical issue which the social model theory was criticized by Morris (1993).

Primary texts include Amendment of School Health Act 1973, Amendment of School Health Act 1995, Takayanagi's works, the Ishihara color blindness test, color

vision requirements for aviators, and written/unwritten life stories of people with color vision defects. Thoroughly examining the various texts, this chapter sheds light on the construction of notion of color-blindness as failing the Ishihara test, which reflects a social model of disability discourse.

4.1. School Health Act 1973

This part highlights changes in School Health Act 1973, which include school color vision testing prior to school doctor's medical examination, assessing severity of color vision defects, and reducing frequency of school color vision testing. First, school color vision testing became a requirement of preliminary examination for annual school health checkups. This change entails that school color vision testing became a requirement prior to school doctor's medical examination. Regulations for enforcement of school health act, called *Gakkohokenho Shikoukisoku* in Japanese, which described instructions of school color vision testing, was revised according to the amendment:

> Procedures of fixed term health checkup were described and timing of execution of periodic health checkup were rescheduled. Preliminary examination such as … color vision … should be done prior to school doctor's medical examination. School doctors should refer to the preliminary testing results at medical

examination. (The Director of Physical Education in the Ministry of Education, 1973, pp. 123-124; author's translation)

Color vision testing was defined as one of preliminary examination for school health checkup under the revision. In consequence, teachers including homeroom teachers and *Yogo* teachers, were officially assigned as examiner of school color vision testing. Although school color vision testing was sometimes conducted by homeroom teachers before the amendment, the amendment officially required homeroom teachers and *Yogo* teachers to practice school color vision testing by law.

This change, therefore, reinforced teacher's and classmates' gaze at students who failed color vision testing. Since the open style examination remained unchanged, color vision testing would be normally conducted in the classroom. This allowed classmates to see who misread color vision testing plates. Those who were behind the student who failed color vision testing in the same line could see it from the back of the line. Because all the school color vision testing should have been done by either homeroom teachers or *Yogo* teachers, all the students who failed the testing must have shared the same experience. The amendment, consequently, raised the number of actors who practiced Fujita's notion of maneuver technology. The increased effect of maneuver technology reinforced exercise of Foucault's notion of power. As a result,

those who failed the color vision testing would continue to hide it from the public under the amendment of 1973.

Accordingly, the color vision testing standard was revised by the amendment. Severity of defective color vision became a requirement. The Director of Physical Education in the Ministry of Education stated that "school color vision testing used to require examiners to 'detect and categorize color vision defects' but it is revised and it requires to 'detect and assess severity of color vision defects'" (1973, pp. 124-125; author's translation). This amendment reflects a change in Fujita's notion of tableaux technology. The Ishihara color blindness test was originally designed to screen out applicants with defective color vision at physical examination for conscription (Suda, 1984). According to Suda, "99.5% of color vision defects can be screened out by the Ishihara color blindness test under the ideal setting" (1994, p. 104; author's translation).

Suda (1984), however, asserted that Anomaloscope Test showed better results on classification of color vision defects. In addition, Takayanagi (2014a; 2014b) insists that Anomaloscope Test is the most reliable classification exam for color vision. Lantern Test is one of the most popular severity assessment test of color vision defects for certain types of occupation but not for school use (Suda, 1984). The choice of severity assessment test depends on the purpose of color vision testing. The Ishihara

color test, obviously, does not match with the revised purpose of school color vision testing because the Ishihara test is not designed for severity assessment (Takayanagi, 2014b). In these senses, the Ishihara test would not be an appropriate option for either classification or severity assessment under the amendment.

However, the Ishihara test remained as the standard school color vision testing. As a result, most of students with color vision defects were screened out and also assessed either mild or severe color vision defects in front of classmates. Not only different types but also different severities of color vision defects became visible among students. The requirement of school color vision testing practiced Fujita's notion of tableaux technology through the revised standard. Color vision remained the focus of attention of school health checkup. Students who failed color vision testing were unconsciously assumed by other classmates as colorblind. The notion of color-blindness as failing the Ishihara test remained unchanged. As a result, the amendment of 1973 discursively reinforced practice of students' hierarchical observation of color vision.

Finally, the amendment of 1973 reduced the number of school color vision testing from annual testing to four times until post-secondary education. Therefore, annual mandatory school color vision testing was abolished by the amendment of 1973. The reduced number of school color vision testing was divided into the following four

times, “fourth year and sixth year of elementary school, second year of junior high, and high school” (The Director of Physical Education in the Ministry of Education, 1973, p. 124; author’s translation). The reduced number of testing reflects a shift in the focus of school color vision testing from educational use towards career counseling. Requirements for second-year junior high and high schoolers were left mandatory as it was. Junior high and high schoolers would most likely refer to their second-year health checkups in order to determine their career paths.

Although the number of testing was reduced, Fujita’s notion of exercises technology might be even reinforced because students became more aware of existing barriers in society. The reduced number of testing made the purpose of testing more visible than before. As a result, those who failed the Ishihara test once in previous years might have felt pressured to pass the test in order to establish a career. For example, the following life story of Shouichi Manabe, a medical doctor, highlights how much he felt pressured about taking color vision test as part of medical school requirements:

> I was diagnosed with red-green color vision weak when I was in elementary school. Following father’s path, I always knew that I wanted to become a physician. However, I was always worried about color vision requirements for medical school but kept anxiety in my mind. As expected, I was told to take

> color vision tests as part of medical school requirements and could not read the Ishihara test plates well. However, my test results were fine in the other requirements. Therefore, I was accepted into a medical school. (as cited in Takayanagi, 1998, p. 81; author's translation)

As Manabe asserts, he felt pressured to take color vision testing and he worried about his career opportunity. Although he failed the Ishihara test, he was accepted into a medical school. The feeling of job insecurity was even more increased in 1973 because labor safety and health regulations, called *Roudou Anzen Eisei Hou* in Japanese, was enacted. Color vision requirements became part of recruitment requirements under the regulations (Yano & Nakamura, 2016). Since color vision testing became once every two years, students who failed the testing were more self-disciplined to avoid unnecessary embarrassment and rejection from their classmates. As a result, the reduced frequency of school color vision testing might have reinforced Fujita's notion of exercises technology in a way that the students concerned were expected to improve their color vision, which was obviously impossible, at the next exam. Consequently, they would constantly experience pressure at the school color vision testing.

As a short summary, School Health Act 1973 had the following three features. They included school color vision testing as preliminary testing, revision of testing

standard, and reduced number of testing. These three features together practiced the technology of normalizing gaze at students who failed school color vision testing. Consequently, the amendment of School Health Act 1973 exercised disciplinary power over students' color vision defects. In addition, the use of individual report and statistics record remained unchanged under the amendment. This entailed that bio-politics of the population was continuously practiced through the amendment. In consequence, coordinate power continued to be exercised over students' color vision defects under the amendment of School Health Act 1973. As a result, Foucault's notion of bio-power was exercised through the practice of anatomo-politics of the body and bio-politics of the population over students' defective color vision.

4.2. The Birth of Social Model of Color-blindness

This section explores the way in which Takayanagi developed her notion of color-blindness by thoroughly reviewing her works and newsletters of *Nihon Shikikakusabetsu Teppai no Kai* for which Takayanagi has been an advisor since it was established. Topics covered in this section include Yasuyo Takayanagi, the mandatory school color vision testing abolition movement, and a bio-power analysis of School Health Act 1995. In light of the social model of disability, this section sheds light on the

way in which social model of color-blindness was discursively constructed through the mandatory school color vision testing abolition movement.

4.2.1. Yasuyo Takayanagi

This part highlights Takayanagi's notion of color-blindness and her approach to colorblind issues through exploring her publications. The following paragraphs will discuss Takayanagi's experience to become aware of colorblind issues, her terminology of color-blindness, and her perspective in capability assessment. Yasuyo Takayanagi achieved her medical degree in 1958 and married to a neurologist in 1959 (Takayanagi, 2014b). Due to her husband's work, she spent two years living in the United States from 1969 (Takayanagi, 2014b). Takayanagi described how the experience in the United States made her realize colorblind issues in Japan:

> In the United States where I spent two years from 1969 to 1971, color vision defects were no problem at all. … I became close to local people including students who went to the same university with my husband, his colleagues, and neighbors. Actually, more than a few of them told me that 'I have a color vision defect', including a professor of anatomy and a professor of faculty of engineering. I began realizing how different colorblind people were treated in

> society between the United States and Japan. In 1974, I became a school doctor of Itaka Public Junior High School. … Soon I became aware of issues regarding boys who were interested in going to technical high schools. Engineering high schools required all the applicants to submit medical certificates prior to the entrance exam. Therefore, I was eventually interested in color vision. (Takayanagi, 2014b, p. 17-18; author's translation)

After living in the United States for two years, Takayanagi realized a gap of treating people with color vision defects in society between Japan and the United States. Comparing with the United States where many friends of Takayanagi had successful careers in various fields, Takayanagi realized that students with defective color vision were severely and unreasonably restricted in Japan. As Takayanagi (2014b) discussed, her experience with colorblind people in the United States allowed Takayanagi to criticize high school entrance requirements in Japan. It became Takayanagi's approach to question the adequacy of requirements.

Furthermore, Takayanagi's definition of color-blindness reflects a medical model of disability discourse. Takayanagi defines color-blindness as "a condition of seeing colors in slightly unique ways" (Takayanagi, 2014b, p. 21). The definition she addressed is drawn from ophthalmological diagnosis of defective color vision:

> Some people with color vision deficiency have color discrimination ability that is somewhat weak in certain areas, but most have no special problems in daily life. Therefore, words such as disability or impairment are not appropriate, and also give rise to misunderstandings. (Takayanagi, 2014a, Color Vision Q&A)

Takayanagi argues that color vision deficiency is not always disabling but sometimes is. Especially when the people concerned look for jobs, apply for certificates, or go to higher education, they face difficulties with their different color perception. In other words, Takayanagi admits that color vision requirements are sometimes necessary if the requirements meet reasonable standards as she asserted, "of course it is true that some special occupations may require 'good color vision'. Therefore, the people concerned must accept the fact and pass the reasonable color vision requirements" (Takayanagi, 2014b, p. 23; author's translation).

Takayanagi, therefore, differentiates daily use of color vision from professional use of color vision. For the daily use of color vision, color-blindness is an inappropriate terminology to describe condition of seeing colors in a different way from what majority people would see. That is because people with color-blindness can still see colors. In order to describe people with color vision defects, Takayanagi suggests a term "color special vision" (Takayanagi, 2014a, Color Vision Q&A), *Shikikaku Tokusei* in

Japanese. It, however, may be necessary only for the purpose of professional use of color vision to screen out condition of seeing colors in different ways.

Takayanagi intentionally avoids the use of term color-blindness to refer to condition of seeing colors differently. However, her differentiation of color-blindness from the other non-colorblindness, which may be commonly regarded as the normal color vision or common type, seems to be underpinned by medical concepts drawn from the ophthalmological diagnosis. One example is her understanding of color vision deficiency as having somewhat weaker ability to discriminate the difference between colors. Accordingly, she regards non-colorblind people as having good color vision.

In addition, Takayanagi's classification of color-blindness may also reflect her ophthalmological understanding of color-blindness. Takayanagi defines that there are three major types in color vision deficiency including "protanopia: decreased sensitivity to red, deuteranopia: decreased sensitivity to green, tritanopia: decreased sensitivity to blue" (Takayanagi, 2014a, Color vision Q&A). These three types are categorized by differences in sensitivity to the three primary colors. Therefore, it seems that Takayanagi assesses visual ability to see the difference between colors and compares it to what is regarded as the standard or normal in context. In this sense, Takayanagi

defines condition of color special vision as defective or lacking color perception, which reflects the medical model of disability discourse.

Takayanagi also argues that color vision testing should be done by doctors because it is equivalent to genetic testing. She asserts that majority of color-blindness is congenital so that multiple testing procedures need to be taken, “the condition generally referred to as color blindness is congenital. This is something that a doctor diagnoses using a variety of test instruments” (Takayanagi, 2014a, Color Vision Q&A). The reason Takayanagi suggests a variety of testing methods may reflect her notion of the Ishihara test as a genetic test, “the Ishihara test that is generally used gives results that are equivalent to a genetic test, and so should not be used by school nurses in schools. It should be used by school doctors” (Takayanagi, 2014a, Color Vision Q&A).

As described in the previous section, the Ishihara test is very sensitive and may screen out those who have no problem with studying and working in regular school environments. In other words, the use of the Ishihara test may easily go beyond what is reasonably required for students. Therefore, the use of it must be reconsidered if there may be better testing methods available than the Ishihara color blindness test. Without the effort of reconsidering validity of the Ishihara test, Takayanagi (2014b) claims the testing violates human rights of the subject as follows, “every human being has unique

color perception and it should not be pried into or interrogated by other people. It is a human rights issue" (p. 23; author's translation). In this regard, Takayanagi asserts that color vision testing should be done by doctors, especially when the Ishihara test is in use. In other words, Takayanagi implies that doctors are the ones who can provide appropriate genetic counseling at color vision testing. In addition, multiple testing options may improve validity of the test and lower the risk of violating human rights.

Finally, Takayanagi argues that validity of capability assessment needs to be pursued as much as possible. Following all the arguments made so far in this part, Takayanagi's notion of color-blindness became disclosed and can be summarized into the following three elements. The first element of Takayanagi's notion of color-blindness is that color-blindness is color special vision. Takayanagi claims that color-blindness is not a disability or an impairment but a color special vision because the majority of colorblind people can see the difference between colors. The second element of Takayanagi's notion of color-blindness is that color special vision has decreased perception to primary colors. According to Takayanagi, color special vision may only have difficulty with seeing the difference between certain ranges of colors but not often and most of the time they have no problem in daily life. The difficulty is caused by decreased perception to primary colors. The third element of Takayanagi's

notion of color-blindness is that color vision testing is a human rights issue. Takayanagi asserts that color vision testing may violate human rights of the subject because the Ishihara test, especially, is a genetic test. Therefore, doctors should operate multiple tests and provide appropriate genetic counseling to the patient.

Takayanagi is skeptical about negative nuances that the traditional term color-blindness may have in context. Although Takayanagi proposes color special vision instead, she still defines color special vision as condition in which some people with defective color perception may encounter difficulty to differentiate certain colors. In this sense, Takayanagi reflects the medical model of disability discourse on her definition of color special vision. However, Takayanagi suggests multiple testing procedures as well as criticizing the Ishihara test as an unnecessary genetic test. In this sense, she approaches to colorblind issues as a social construct. In other words, Takayanagi not only defines color-blindness as decreased or defective color perception but also understands that different degrees of color perception are required for different purposes of color vision testing.

In this regard, Takayanagi pursues reasonable capability assessment. Her notion of capability assessment is a countermeasure for the traditional assessment of color vision which relies on the Ishihara color blindness test. Takayanagi argues that

capability assessment of people with defective color vision must be reasonable as follows:

> Even though [school] color vision testing was abolished, people with special color vision remains alive. Panel D-15 Test remains required for police officers, self-defense force officials, JR employees, and captains of large ships. As forthcoming challenges let's hope that the reason for the requirements are presented. The requirements must be legitimized by the reasonable capability assessment rather than congenital defects. (Takayanagi, 2014a, Shikikaku no Matome; author's translation)

Takayanagi (2014a) claims that color vision requirements must represent reasonable capability assessment of people with defective color vision. The notion of reasonable capability assessment overlaps with what Takayanagi wrote in her previous works. Takayanagi separates color perception for daily use from the one for occupational use. The distinction between daily use and occupational use must be the way to ensure reasonable capability assessment for each circumstance. She intends to define color vision requirements case by case. Therefore, Takayanagi not only reassesses what is actually required in the job but also assesses individual abilities to discriminate the difference between colors.

In this sense, Takayanagi's capability assessment approach reflects the medical model of disability in which color-blindness refers to the decreased color perception. However, Takayanagi's capability assessment also examines validity of requirements case by case. Takayanagi, therefore, takes both medical and social model of disability approaches. This ambivalence of Takayanagi's approach reflects a theoretical limitation of social model of disability, which will be further discussed in the following part.

4.2.2. Development of Mandatory School Color Vision Testing Abolition Movement

This part investigates the way in which a color vision discrimination abolition movement began, the movement has incorporated Takayanagi's theory into their theories of movement, and it was developed into the mandatory school color vision testing abolition movement. This part highlights the way in which Takayanagi's theoretical insight into school color vision testing developed the mandatory school color vision testing abolition movement. The color vision discrimination abolition movement began as Takayanagi had a counseling session with a father of colorblind student. The father told Takayanagi about how difficult his son studies with the government authorized textbooks in 1980 (Takayanagi, 2014b). Takayanagi (2014b) suggested first time to committee for school ophthalmologists of Japan Ophthalmologists Association

that writing black circles around orange and red objects might make it easier for students with color vision defects to read textbooks.

Four years later in 1984, Takayanagi began collecting color vision requirements for university entrance exams. She continued to collect them for 10 years. The following figure shows the way in which postsecondary education institutions alleviated color vision requirements for entrance exams (see Figure 4).

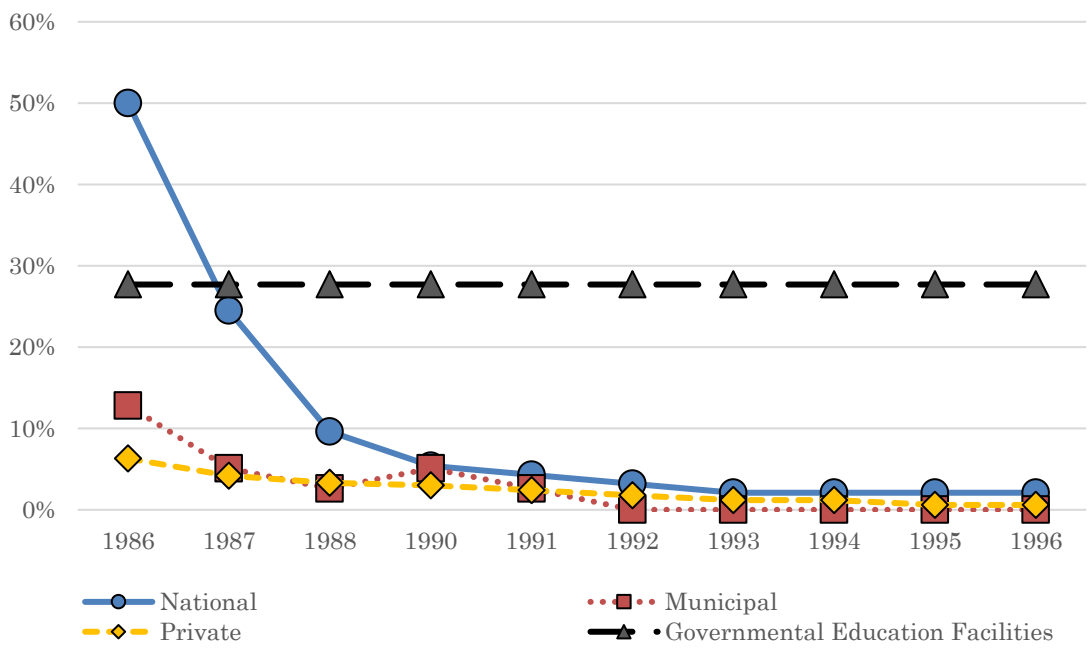

Figure 4. Alleviation of color vision requirements for university entrance exams. More national and municipal universities had color vision requirements than private universities did. In this figure, the institution was counted as one if it had at least one department having color vision requirements. I made this graph based on findings discussed by Takayanagi (2014b, p. 55). Adapted from *Tsukurareta shougai "shikimou" (Rev. ed.)* (p. 55), by Takayanagi, 2014b, Tokyo: Asahi Shimbun.

According to Takayanagi (2014b), more national universities had color vision requirements than private universities did. In 1986, 50% of national universities had color vision requirements. In contrast, only 6.3% of private universities had color vision requirements. Although national universities significantly alleviated their requirements to 2.1% by 1996, governmental education facilities remained since 1986. In addition, requirements were different by faculties. According to Takayanagi (2014b), Faculty of Science, Medicine, Dentistry, Pharmacy, Agriculture, and Education had relatively higher percentages of color vision requirements than other faculties.

In 1986, there were two turning points regarding the alleviation of university color vision requirements. One was a newspaper article published by Asahi Simbun. The following excerpt is from the newspaper article which investigated color vision requirements for national university entrance exams, titled *Shikimou/Shikijakusha wo Kokuritsudai ga Sossen Sabetsu Gankaikai Nyuushiyoukou wo Chousa* (Shikimou/Shikijakusha wo Kokuritsudai ga Sossen Sabetsu Gankaikai Nyuushiyoukou wo Chousa, 1984, February 17):

> A survey conducted by Japan Ophthalmologists Association for 1985's entrance requirements disclosed a surprising fact that about half of national universities

> closed the door for students with color vision defects even though they would not have problems with studying and daily life. (p. 12; author's translation)

This article reported Takayanagi's findings including 50% of national universities had color vision requirements. The percentage was higher than any other post-secondary education institutions. Consequently, the article raised awareness of color vision requirements for university entrance. The article marked the first turning point of the movement and was followed by official letters of higher education authorities, including the following Marui's letter (Takayanagi, 2014b).

> The second turning point was the letter of Fumio Marui, who was the chairperson of second committee in committee for entrance exam of the Japan Association of National Universities. Marui sent an official letter, named as Guidelines of University Entrance Exam for Applicants with Color Vision Defects (Takayanagi, 2014b). This letter stated that it would be appropriate for all the national universities to alleviate or abolish color vision requirements for university entrance exam (Takayanagi, 2014b). Following the letter, Ministry of Education sent an official notice that it would be appropriate if post-secondary education institutions began considering alleviation and abolition of color vision requirements for entrance exam (Takayanagi, 2014b). The following excerpt is from the letter, "In light of protecting educational opportunity for

applicants with the impairments [color vision defects], it is appropriate to seriously alleviate or abolish color vision requirements unless the requirement is truly educationally necessary" (as cited in Takayanagi, 2014b, p. 64; author's translation). Following Ministry of Education, Japan Ophthalmologists Association sent an official letter of request to the Japan Association of Public Universities and Association of Private Universities of Japan. A few months later, Shiro Hatake, the chairperson of the Japan Association of Public Universities, officially requested all the public universities to alleviate or abolish color vision requirements, "It is appropriate for public universities to alleviate or eliminate color vision requirements" (as cited in Takayanagi, 2014b, p. 64; author's translation).

As a short summary, the university color vision requirements alleviation movement started as Takayanagi began collecting university requirements in 1984. In this sense, Takayanagi took the initiative in the movement and researched university color vision requirements. She influenced the following movements including color vision requirements for elementary, junior high, and high school entrance as well as requirements for employment. The official letters reflected Takayanagi's insight into validity of capability assessment and concluded requirements as unnecessary for the purpose of most university education. However, the movement was started by

Takayanagi alone and was not organized until families of the people with defective color vision formed a group of the people concerned later. The following paragraphs, therefore, highlight the way in which Takayanagi's private work was developed into an organizational movement.

Furthermore, the following paragraphs investigate the way in which the color vision discrimination abolition movement became organized by the people concerned and their families under the influence of Takayanagi. While Takayanagi's movement became recognized by Japan Medical Association in 1991 and Japan Medical Women's Association in 1992, she was feeling that the people concerned must have taken the initiative in the movement (Takayanagi, 2014b). In 1986, Takayanagi began inviting students with color vision defects and their parents to her information session regarding color vision defects, called "what is color vision defect?" (Takayanagi, 2014b, p. 141; author's translation). In those sessions, Takayanagi addressed necessity of organizing a group of the people concerned in order to improve the common social image of color-blindness (Takayanagi, 2014b). According to Takayanagi (2014b), twenty people remained after the session of 1992. They formed a promotion group for people with color vision defects to improve social life, in Japanese originally called *Shikikakuijousha no Seikatsukoujou wo Suishinsuru Kai*. Soon after the establishment,

the promotion group had over 250 members, and advocated abolition of school color vision testing to Ministry of Education (Takayanagi, 2014b).

The founding members were parents of children who were invited by Takayanagi to her information session about color vision based on the result of school color vision testing. They all shared the same concern about their child's opportunities as follows:

> Those parents who stood up at the session agreed on starting a movement for eliminating discriminations. They said that "I lost hope for my child's future because I was told by school that my child had a color vision defect. I was feeling unfair why we would have to go through such a difficulty. We [father and mother] came here together feeling really unhappy because the board of education called us to join this session today. However, I felt relieved because I realized that we were not alone concerning about the issue, and there were many families who shared the same concern here today. Let's start a movement to eliminate discrimination". (Takayanagi, 1996a, p. 128; author's translation)

At the session, parents of students with defective color vision finally realized that they shared the same concern about their child's career. Therefore, the session was the best place where an advocacy group was formed regarding color vision issues. The shared

concern among the founding members reflect the reason *Shikikakuijousha no Seikatsukoujou wo Suishinsuru Kai* advocated elimination of mandatory school color vision testing right after the organizational movement was launched in 1992 (Takayanagi, 2014b). Takayanagi (2014b) explains that color-blindness tends to be a bolt out of the blue for parents of the children who were screened out at school color vision testing, especially if it was the first time for their children to take color vision testing. For junior high schoolers, the school color vision testing makes them worried about their career paths. Therefore, both students and their parents may simply follow what the school career counselor tells them to do and not to do (Takayanagi, 2014b).

In consequence, mandatory school color vision testing became a primary target for the color vision discrimination abolition movement. The movement incorporated Takayanagi's perspective in its mission and set the goal for alleviating mandatory school color vision testing. The establishment of *Shikikakuijousha no Seikatsukoujou wo Suishinsuru Kai* reflects the same construct of discourse as Takayanagi uses. That is, school color vision testing is a discrimination against people with color vision defects.

Finally, the following paragraphs disclose the way in which the incorporation of Takayanagi's perspective in the theory of the color vision discrimination abolition movement was developed into abolishing mandatory school color vision testing.

Following *Shikikakuijousha no Seikatsukoujou wo Suishinsuru Kai*, another advocacy group was organized, called *Nihon Shikikakusabetsu Teppai no Kai*. According to Takayanagi (2014b), *Nihon Shikikakusabetsu Teppai no Kai* was established in 1994 by the people concerned who had successful careers in different industries and remaining members of *Shikikakuijousha no Seikatsukoujou wo Suishinsuru Kai*. It was Takayanagi's another approach to school color vision testing that she invited people with color vision defects with successful careers in order to encourage students to pursue what they want to accomplish for their lives. The following founding message of *Shikikakuijousha ni taisuru Sabetsu Teppai wo Suishin suru Kai*, was delivered by the founding president Yoshihiko Nagata, and highlights the goals of *Nihon Shikikakusabetsu Teppai no Kai*:

> Thanks to Takayanagi, color vision requirements for high school and university entrance were recently alleviated but there were remaining color vision requirements for nurse, fire fighter, and horse racing jockey. What is worse, school color vision testing remains mandatory as part of school health. … Is it acceptable to let ridiculously sensitive color vision testing in which daily color usage is totally ignored continue? This situation supports not only existing stereotypes against people with color vision defects in Japan but also creates

> discriminations. In order to remove restrictions and social stereotypes against people with color vision defects, we, the people concerned and their parents, shall stand up and deliver our messages to society. (as cited in Takayanagi, 2014b, pp. 145-146; author's translation)

Shikikakuijousha ni taisuru Sabetsu Teppai wo Suishin suru Kai developed into *Nihon Shikikakusabetsu Teppai no Kai*, which advocates the abolition of color vision discrimination. *Nihon Shikikakusabetsu Teppai no Kai* was supported by the students concerned and their parents. As Takayanagi (2014b) discussed, legitimacy of school color vision testing was criticized of its sensitivity and unreasonable testing criteria. The criticism reflects Takayanagi's insight into school color vision testing as unreasonable capability assessment. This notion of school color vision testing as unreasonable capability assessment highlights Takayanagi's perspective. As long as the ability to see the difference between colors defines color vision defects, there are cutting-off points depending on requirements. The color vision discrimination abolition movement was the criticism of status-quo and cutting-off point of color vision requirements.

In this regard, one of the most significant arguments Takayanagi made was her notion of color-blindness as failing the Ishihara test. Takayanagi investigated almost all the color vision requirements for university entrance exam and took initiative in the

color vision discrimination abolition movement. Takayanagi (2014b) argued that most university color vision requirements were unnecessary and underestimating capability of people with color vision defects. Takayanagi (2014b) asserted that individual potential was never reasonably assessed in Japan as follows:

> It is a waste of human resource that universities do not accept students with color vision defects because some of them may have good potential. In this sense, Japanese universities are not meeting the world standard. … What has made such a stereotype become a common knowledge? I believe the reason is in the history of the Ishihara color test for school use. (pp. 36-37; author's translation)

Takayanagi claims that color vision requirements for university entrance are wasting valuable human resources. The requirements are based on a stereotype against students with color vision defects. Takayanagi, therefore, saw the Ishihara test as the source of unreasonable color vision requirements.

Takayanagi (2014b) described the way in which the stereotype against people with color vision defects was constructed by the Ishihara test as follows:

> It was a taboo to criticize the Ishihara test because of Ishihara's political power as army medical officer as well as his authority as professor of University of

> Tokyo. … Although testing results do not change, color vision testing was a requirement of annual school health checkups. The same students failed the test every year and had stamps of abnormal on their individual health cards, but no follow-up support was provided for them…. It is how the stereotype was formed. … I believe that remaining critical situations regarding color vision defects in Japan has been constructed by Shinobu Ishihara and his following researchers. Therefore, color vision defects are artificial impairments. (pp. 38-39; author's translation)

It is Takayanagi's theory that annual school color vision testing with the Ishihara test created notion of color-blindness as inability to see the difference between colors. The annual school color vision testing also influenced severe color vision requirements. The color vision discrimination abolition movement also shares the same perspective with Takayanagi. Therefore, the movement requested abolition of mandatory school color vision testing at first place. In short, the mandatory school color vision testing abolition movement was developed under the influence of Takayanagi's theoretical insight through the establishment of the color vision discrimination abolition movement.

4.2.3. Deconstructing the Traditional Notion of Color-blindness under School Health Act 1995

This section sheds light on the deconstruction of traditional notion of color-blindness by thoroughly examining School Health Act 1995, Takayanagi's Color Mate Test, and newsletters and the website of *Nihon Shikikakusabetsu Teppai no Kai*. First, changes in School Health Act 1995 are reviewed in order to describe the way in which notion of color-blindness was discursively shifted in school color vision testing. It is followed by an analysis of Color Mate Test which was specially designed by Takayanagi in order to meet the new criteria of school color vision testing. Finally, *Nihon Shikikakusabetsu Teppai no Kai*'s argument about abolishing school color vision testing is examined in order to address significance and limitations of the mandatory school color vision testing abolition movement. This part intends to better understand the social movement of school color vision testing. Therefore, the study sheds light on the way in which school color vision testing was discursively in transition towards the following optionalization of school color vision testing in 2003.

First, in light of Foucault's notion of bio-power, this part explores shifting of notion of color-blindness and school color vision testing through School Health Act 1995. Foucault's notion of bio-power consists of two kinds of power including disciplinary power and coordinate power. Disciplinary power is exercised on human

bodies through the anatomo-politics of body. The three technologies including Fujita's notions of tableaux, exercises, and maneuver compose the anatomo-politics of body. Accordingly, coordinate power is exercised through the bio-politics of the population. The technology of the bio-politics of the population is composed of various techniques managing individual bodies as part of larger biological groups of the population. The typical techniques may include collection and use of national statistics of health, life expectancy, and longevity, which may enforce individual bodies or body parts to be observed and to act in certain ways. In this regard, the following part examines changes of the technologies in School Health Act 1995 so that shifting of notion of color-blindness and school color vision testing can be addressed.

Amendments of School Health Act 1995 include the following three elements: the purpose of school color vision testing, the reduced frequency of color vision testing, and the use of private exam rooms. For the purpose of school color vision testing, the follow-up care was emphasized in the amendment as follows:

> The school health checkup is to maintain and promote students' health by making students become aware of their health conditions and also teachers to use appropriate and effective pedagogies. (The Director of Physical Education in the Ministry of Education, 1994, p. 159; author's translation)

Teachers' pedagogical modifications were incorporated into the purpose of school health checkup. As of the amendment, providing an appropriate follow-up care to students who fail the test was emphasized. This change in the focus of school health checkup reflects a shift of purpose of school color vision testing from detecting color vision defects towards screening out only suspicious students so that they can have appropriate educational supports. Health checkup manual for school children and students, in Japanese called *Jidouseito no Kenkou Shindan Manyuaru*, was issued by Japan Society of School Health in 1995 and sent to public schools (Takayanagi, 1996b). In the manual, the purpose of school color vision testing was clearly defined as not only detecting color vision defects but also assessing learner needs:

> The purpose and significance of color vision testing: Following the purpose of School Health Act, school color vision testing shall be conducted in order to assess learning difficulty of students, or educational needs regarding color recognition. Therefore, school color vision testing is not only for detecting color vision defects. (Japan Society of School Health, 1995, p. 29; author's translation)

The purpose of school color vision testing became an assessment of learner needs. This change reflects that Fujita's notion of tableaux technology was also shifted along with

the change of law. Under the amendment, color vision defects became considered as part of learning needs instead of diseases, illnesses, or even impairments. In consequence, those who fail school color vision testing may be more accommodated in the class. In this regard, Fujita's notion of tableaux technology was modified. Consequently, school color vision testing became focused on assessment of learning needs.

Following the tableaux technology, Fujita's notion of exercises technology was also changed. Frequency of school color vision testing was reduced from four times until post-secondary education towards only once in the fourth year of elementary school by the amendment of 1995:

> Regarding color vision testing, it is not necessary to repeat testing because color vision defects would not change as time passes. Considering adaptability to the test, once in the fourth year of elementary school would provide the most reliable testing results. (The Director of Physical Education in the Ministry of Education, 1994, p. 157; author's translation)

As of the amendment, once in the fourth year of elementary school became only a requirement of school color vision testing. The reduced frequency of testing entails the following two changes: the reduced effect of Fujita's notion of exercises technology of

disciplinary power, and reinforcement of the medical model of disability discourse. Under the amendment, those who failed color vision testing would become less frequently required to take color vision testing and realize their color vision defects. This shift in frequency, therefore, would allow students with color vision defects to less normalize stereotypes against people who fail color vision testing. Consequently, the students in question would become less likely to hide their defects.

Fujita's notion of exercises technology would be less practiced through school color vision testing under the amendment. In other words, disciplinary power became less exercised than before. On the other hand, the notion of color vision defects as lacking or defective color perception was reinforced by the amendment. As stated in the law, most defective color vision usually does not get better or worse as time passes. In this regard, congenital color vision defects are more emphasized than the acquired ones by the amendment. The emphasis of congenital color vision defects reinforces the notion of color-blindness as lacking or defective color vision.

Under the amendment, school color vision testing became more focused on capability assessment of students' color vision than before. Those who failed school color vision testing used to be able to take color vision testing every year although their results might remain the same as before. Although the previous annual testing was

criticized for stigmatizing those who failed, the frequency of testing might have also raised awareness of another aspect of color vision defects. That aspect is acquired color vision defects that color vision defects might also change as people age. Furthermore, color vision defects can only be recognized by color vision testing, not usually by the people concerned themselves. In this regard, the emphasis of congenital color vision defects in the amendment reinforces the medical model of color-blindness, which refers to the notion of color-blindness as lacking or defective color vision.

Consequently, those who fail school color vision testing are still enforced to become self-aware of their lacking or defective color vision. Accordingly, their parents may also understand the reason of their children failing color vision testing as lacking proper color perception. In this sense, School Health Act 1995 created an ambivalent effect of Fujita's notion of exercises technology between the reduced effect of disciplinary power and the increased intensity of the medical model of disability discourse. As a result, Fujita's notion of exercises technology was discursively in transition under the amendment.

Accordingly, Fujita's notion of maneuver technology became less exercised by the introduction of private exam rooms for school color vision testing. School Health Act 1995 emphasizes that student privacy must be protected at health checkups:

> In light of privacy protection, schools must carefully keep information about health checkups confidential so that other students should not know about it. In this sense, schools should reconsider the way health checkups are conducted and the way the results are sent to students and their parents. (The Director of Physical Education in the Ministry of Education, 1994, p. 159; author's translation)

It became school's responsibility to protect students' privacy of health checkup. In this regard, the way in which school color vision testing was practiced was changed in order to protect students' privacy. Following the amendment, an example of school color vision exam room arrangement was introduced in a health exam manual for students, in Japanese called *Jidouseito no Kenkou Shindan Manyuaru 1995* (see Figure 5). As alternatives to a single room, curtains or portable partition walls can be used in order to make the examination space private (Japan Society of School Health, 1995). In this way, those who fail school color vision testing are separated from the other students. The instruction even states that "the testing must be carried out where other students cannot see or hear either examinee or examiner" (Japan Society of School Health, 1995, p. 29; author's translation).

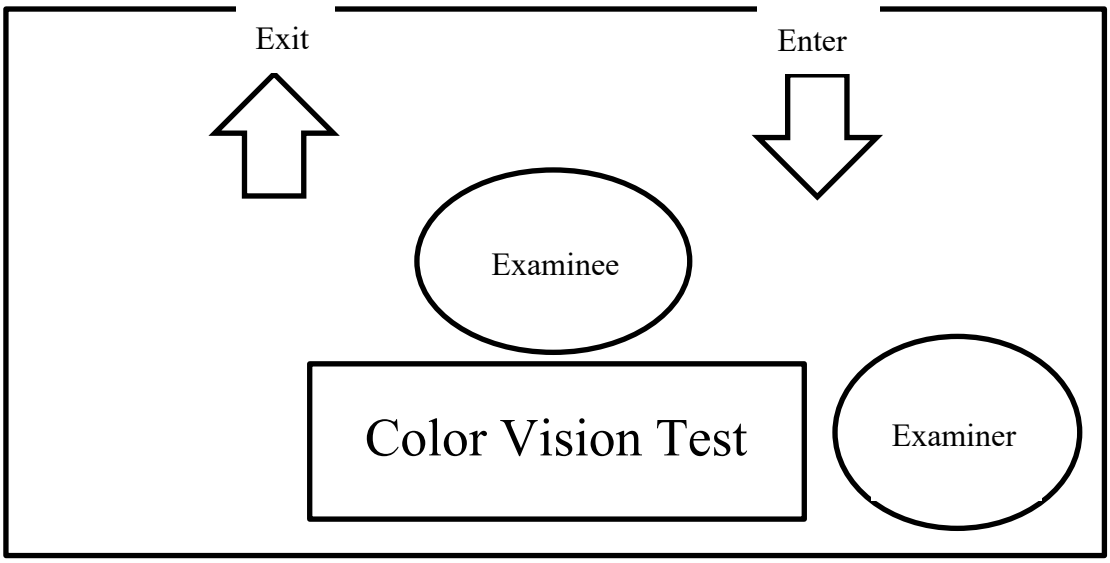

Figure 5. A practical example of color vision testing. Students come in one by one. Other students wait for their turns outside the room. Adapted from *Jidouseito no kenkou shindan manyuaru* (p. 30), by Japan Society of School Health, 1995, Tokyo: Daiichi Houki. (author's translation)

Although this change of space coordination made Fujita's notion of technology of exercises less effective, disciplinary power was still exercised due to the remaining teacher's gaze in the examination room. In other words, other students' gaze was removed from school color vision testing. However, teachers were still required to know about who failed color vision testing in order to provide appropriate and effective supports to the student. In this regard, the use of private color vision testing room might have weakened the exercise of disciplinary power on students with color vision defects. However, disciplinary power was not completely removed.

Results of school health checkups were still required for all the schools to make statistics tables and the record of individual health cards (Japan Society of School Health, 1995). For example, MEXT annually published the result of statistical surveys of school health after 1996. According to MEXT (1996, 1997, 1998, 1999, 2000, 2001, 2002), the students with color vision defects had remained between 2% and 4% from 1996 to 2002. After 2003, the category of color vision defects was removed from the result of statistical surveys. The individual results were also sent to students and their parents (Japan Society of School Health, 1995).

The procedure was part of aftercare treatment through which those who failed school color vision testing would be encouraged to take follow-up testing at an ophthalmological clinic. Color vision defects were still considered as an educational problem. They were regarded as a disease that required teachers' attention and medical treatment under the amendment. In this sense, not only those who fail school color vision testing but also their parents and classmates would consider color vision defects as something should be hidden or removed.

Therefore, coordinate power can be discursively exercised through collecting individual health records and making statistics tables. In other words, students and their parents are unconsciously taught about color vision defects as something negative and

feeling pressured to hide them from the public. The exercise of coordinate power, consequently, remained still under the amendment. In summary, although each technology was modified by the amendment, hierarchical observation and normalizing judgment were practiced so that normalizing gaze was discursively constructed over students with color vision defects. This entailed that the exercise of disciplinary power became weakened but still remained effective under the amendment. Coordinate power, on the other hand, remained still. As a result, bio-power over school color vision testing was discursively exercised and remained effective under School Health Act 1995.

However, the discursive formation of notion of color-blindness was partially deformed by Takayanagi's introduction of Color Mate Test. Color Mate Test was designed by Yasuyo Takayanagi and Takayoshi Kaneko. The purpose of the test is to help teachers assess student color perception so that effective pedagogical improvements can be provided in the class (Takayanagi & Kaneko, 1998; Takayanagi, Kaneko, Murakami & Miyao, 2002; Takayanagi, 2014b). Color Mate Test plates consist of one practice test and four test plates. Each test plate has five color coordinated square shapes and examinees are asked to answer either vertical or horizontal pairs are matched hue. The plate on the right is the answer and only examiners should see it. The right answer for this plate is that the vertical pairs are matched hue. For example, Figure 6

shows an example of the CMT plates. Examinees are asked to see only the color coordinated plate on the left (see Figure 6).

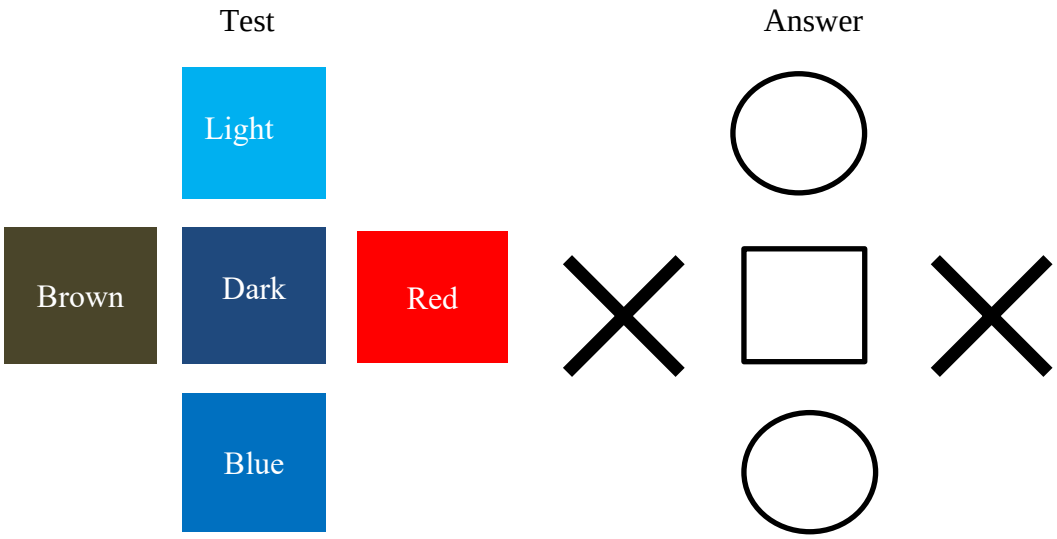

Figure 6. An example of color mate test plates that I modified based on the original test. The left plate is a test plate. The plate on the right is the answer. I wrote colors in the squares for reader's convenience. The original test plates do not write colors. This plate is an example of plates which all the people should be able to see the difference between vertical and horizontal pairs. Adapted from *"Irononakama ga wakaruyo!"* (pp. 7-8), by Y. Takayanagi, 2014c, Nagoya: Hamajima Shoten.

Color Mate Test was intended to help teachers make reasonable assessment of student color perception in class. It was because School Health Act 1995 required teachers and schools to provide effective aftercare to students who would fail school color vision testing. Color Mate Test was meant to replace the Ishihara color test for school use. According to Takayanagi, Kaneko, Murakami, and Miyao (2002), no testing measures were available yet in order to assess learning abilities of students. Therefore,

Color Mate Test was the first and the only testing measure. In this sense, Color Mate Test reflects Takayanagi's approach to school color vision testing, which is reasonable capability assessment of students.

Color Mate Test is a countermeasure for the traditional notion of color-blindness as failure of the Ishihara test. Therefore, Fujita's notion of exercises technology might be deformed by the introduction of Color Mate Test plates. The use of the Ishihara test used to create Foucault's notion of panopticon system in which examinee's color vision was discursively normalized by the four aspects of the Ishihara color blindness test that Baba (2013a) addressed. The four aspects include Baba's notions of controlling time, controlling space, high mobility, and illusion of doctor's intervention and gaze (Baba, 2013a). However, the introduction of Color Mate Test removed effects of the four elements of the Ishihara test. In consequence, the traditional notion of color-blindness as failing the Ishihara test was partially deconstructed and shifted towards the notion of color-blindness as educational or learning needs. In this sense, the introduction of Color Mate Test underlines the birth of the social model of disability discourse regarding school color vision testing.

Nihon Shikikakusabetsu Teppai no Kai was established in 1994 when School Health Act 1995 was enforced. The establishment of *Nihon Shikikakusabetsu Teppai no*

Kai underlines the birth of the mandatory school color vision testing abolition movement. This part sheds light on the construction of the mandatory school color vision testing abolition movement model of color-blindness by thoroughly reviewing primary arguments *Nihon Shikikakusabetsu Teppai no Kai* made. The argument this part addresses is abolition of mandatory school color vision testing.

Nihon Shikikakusabetsu Teppai no Kai addressed a criticism against mandatory school color vision testing and use of the Ishihara test. They insist that mandatory testing without appropriate aftercare should be abolished. The founding president of *Nihon Shikikakusabetsu Teppai no Kai*, Yoshihiko Nagata (1996) asserts the following:

> If there are no aftercare instructions provided for school color vision testing, mandatory school color vision testing might as well be abolished. Unless thoughtful advice and career counseling are provided, we [Nihon Shikikakusabetsu Teppai no Kai] insist testing might as well be abolished. … We [Nihon Shikikakusabetsu Teppai no Kai] do not argue that all color vision testing must be abolished. We [Nihon Shikikakusabetsu Teppai no Kai] only disagree with the mandatory school color vision testing with the Ishihara test. (pp. 187-188; author's translation)

Nagata (1996) claims that school color vision testing without aftercare must be stopped because they create only discrimination. In this regard, Nagata addresses that the Ishihara test was only screening out students with defective color vision without providing appropriate aftercare to them. Although the number of school color vision testing was reduced to only once until high school under School Health Act 1995, school color vision testing was still required for all the fourth-year students. Mandatory school color vision testing remained.

In addition, there remained only a single set of test plates for school color vision testing. *Jidouseito no Kenkou Shindan Manyuaru 1995*, which was published by Japan Society of School Health, only explained about the Ishihara test as one of the recommended testing measures as follows:

> Additional Information:
>
> There are currently various color vision test plates available. Ishihara's Tests for Colour Deficiency is the most popular test plates among them. Therefore, this part explains about what color vision test plates are with Ishihara's Tests for Colour Deficiency as an example. … the Ishihara test has various kinds, but the Ishihara color test for school use is the most commonly used test. Ishihara's Tests for Colour Deficiency is designed with confusing colors. The feature of

> test plates allows the Ishihara test to make a reputation for the most efficient way to screen out suspected defective color vision students. (p. 31; author's translation)

Only the Ishihara test among various color vision test plates was specifically named and introduced as the most common test plates in this manual. This type of additional information would allow the featured test plates such as the Ishihara test to be recognized as the most recommended testing plates. This reflects Fujita's notion of tableaux technology through which hierarchy was discursively built between the Ishihara test and the other options. In consequence, even though Takayanagi released Color Mate Test just after the amendment was issued, the priority of the Ishihara test might have not been replaced yet.

Therefore, the color vision discrimination elimination movement became focused on abolishing mandatory school color vision testing. It was because the Ishihara test might never be replaced by other color vision tests including Color Mate Test as long as school color vision testing remained mandatory. In this sense, the school color vision testing abolition movement was discursively constructed as a countermeasure for the traditional notion of color-blindness. The movement was led by those who succeeded in their career with defective color vision including medical doctors,

university professors, and lawyers and families of the people concerned. They claimed to make career opportunities open for the younger people with color vision defects by sharing their experience.

The mandatory school color vision testing abolition movement entailed academic ableism in its theory because the theory was developed from Takayanagi's notion of color-blindness. Academic ableism regarding color vision defects reflects another aspect of Fujita's notion of maneuver technology in which the people concerned are constantly observed by teachers and classmates. Academic ableism is creating the circumstance in which "academic environments put pressure on students with special needs to function/learn without special supports through an academic discourse students should advocate their needs" (Dolmage, 2017, p. 89). Through academic ableism, the people concerned are discursively enforced to become aware of and self-advocate their needs. In consequence, they would become disciplined to pretend to be able to differentiate the difference between colors. Under academic ableism, they have to help themselves find solutions to cope with confusing colors including red, green, and pink. Academic ableism regarding defective color vision may make the people concerned voiceless and their needs invisible in the class.

Takayanagi's notion of color-blindness has the following two key concepts. One is the notion of color-blindness as a human-made impairment constructed by the Ishihara test. The other key concept is reasonable and practical assessment of color vision ability. Although the former underlines social construction of color-blindness, the latter admits color vision defects have lacking or defective perception of certain colors. In this sense, Takayanagi's notion of color-blindness reflects an ambivalent discourse between the social model of disability and the medical model of disability.

This theoretical ambivalence, however, overlaps with a theoretical limitation of the social model of disability. In this regard, Sakakibara (2016) claimed that the social model would not successfully objectify impairment in its theory. Sakakibara (2016) addressed that the famous definition of social model of disability presented by Michael Oliver entailed and thus absolutized impairment in its theory. Oliver's social model of disability addressed that "disability is the disadvantage or restriction of activity caused by the political, economic and cultural norms of a society which takes little or no account of people who have impairments and thus excludes them from mainstream activity" (Oliver, Sapey & Thomas, 2012, p. 16). Oliver's account of social model of disability regards disability as the restriction that people with impairments experience. In this sense, Impairment is a premise of social model of disability. Social model of

disability criticizes impairment, but it entails impairment in order to set an object of the criticism. Therefore, impairments themselves must be objectified in order to develop the social model.

According to Hoshika (2013), there may be two countermeasures that the social model of disability researchers can take. One is to address existence of disabling environments and relativize them. The mandatory school color vision testing abolition movement has been successful on this approach. The mandatory school color vision testing abolition movement addressed that the Ishihara test would be the primary source of color vision discrimination. The other countermeasure is to objectify ableism in which people tend to believe that being able to do something is better than being unable to do. In other words, people with able bodies are preferred. Therefore, people with disabilities are underestimated. The mandatory school color vision testing abolition movement, however, was not successful on this approach. Since Takayanagi's view includes reasonable capability assessment, ableism regarding school color vision testing was never objectified. The color vision discrimination abolition movement as well as the mandatory school color vision testing abolition movement underlines the birth of social model of color-blindness although the ableism requires further discussion.

4.3. The Social Model of Color-blindness and Ableism

The previous section addressed the construction of social model of color-blindness and its theoretical limitations including academic ableism. This section, accordingly, explores color vision requirements in other fields. In addition to school color vision testing, Takayanagi and *Nihon Shikikakusabetsu Teppai no Kai* have worked for alleviation and abolition of color vision requirements for various qualifications and professional careers including Class 4 boat license and electricians (see Table 3). Takayanagi has applied the same model as the one for school color vision testing to the requirements in various fields and she successfully achieved deregulations. However, aviation medical requirements as one of the oldest and most severe color vision requirements remained untouched.

The lack of attention from the color vision discrimination abolition movement might imply another example of social model's theoretical limitation. That is the hidden ableism of color vision in the theory of the color vision discrimination abolition movement. Ableism of color vision tends to cause a conflict of interest between self-accomplishment of people with color vision defects and the public concern about aviation safety. Therefore, this section will explore aviation color vision requirements by drawing on both disability studies and Foucault's notion of power in order to further

discuss ableism of social model of color-blindness. This section aims at highlighting the way in which ableism of color vision is discursively embedded in color vision requirements for aviators and the social model of color-blindness.

Color vision requirements for aviators are one of the oldest and on-going misconceptions. Approximately 38 countries have direct flights to Japan, but every single country sets their own standards for the pilot medical qualifications. The world standard is set by International Civil Aviation Organization (hereafter ICAO) and Japan joined ICAO in 1953. ICAO concerns about the principle of non-interventionism. Non-interventionism means that ICAO and other ICAO countries do not intervene in the Japanese aviation requirements as long as they follow the minimum ICAO standard. Under the principle, each international pilot only needs to be qualified in the home country to fly into Japan. However, there is a condition that the Japanese standard does not allow pilots with color vision defects to fly while some other countries including Canada allow them to do so. In this sense, there seems to be a stereotypical notion in Japan that people with color vision defects should not be allowed to fly a plane.

Primary texts include aviation medical regulations and aviation television series. A textual analysis was employed in this analysis. This section is based on my article (Moriya, 2015), which was originally published in *Studies in Comparative*

Culture. I employed Foucault's notion of bio-power in order to elaborate on the discussions addressed in the journal article. The study reexamined the data and rewrote the analysis in light of Foucauldian genealogical discourse analysis. Consequently, this section addressed a new insight into the discursive formation of color-blindness.

This section is divided into the following two parts. First, Japanese aviation color vision requirements will be compared with the world standard, and the Canadian requirements in order to recognize characteristics of the Japanese standard. In consequence, the study will address disablism safety as the notion of pilots with defective color vision in Japanese color vision requirements. The notion of disablism safety reflects the notion of color-blindness as failing the Ishihara test. Following the comparative policy analysis, narratives obtained from aviation television series between Japan and Canada will be examined in order to develop an insight into deconstruction of disablism notion of color vision. The study argues that the Canadian notion of pilots with defective color vision reflects ableism notion. In this sense, the Canadian requirements allow pilots with defective color vision to fly but makes their needs invisible. In closing, this section addresses the social model of color-blindness in the Canadian notion of ableism safety.

4.3.1. A Comparative Textual Analysis of Color Vision Requirements for Aviators between Japan and Canada

This part sheds light on notions of color-blindness that are embodied in color vision standards between Japan and Canada by employing a comparative textual analysis. In addition, the latest scientific studies about aviation color vision qualifications will be reviewed in this section in order to deconstruct the notions of color-blindness. As a result, this section argues that the Japanese standard reflects disablism safety in contrast to the Canadian standard reflecting ableism safety. In order to highlight the perspective of the Japanese standard, first this part compares the Japanese color vision standard with the ICAO standard. Throughout this comparative analysis, the study argues that the Japanese standard reflects the following two ideas including singularity, and impracticality or inflexibility as its underpinning value. In contrast, the ICAO standard reflects multiplicity, and practicality or flexibility.

The Japanese medically unfit condition is briefly stated in *Aviation Medical Examination Manual*, "the medical condition without any abnormality in color vision to violate safety of flights" (Ministry of Land, Infrastructure, Transportation and Tourism, 2013 Nov. 23rd; author's translation). Although the condition of abnormal color vision which may violate safety remains unclear, the standard clearly addresses that pilots with color vision defects cannot be qualified to fly in Japan. Accordingly, Ministry of Land,

Infrastructure, Transportation and Tourism defines a standardized procedure of color vision testing. That is Panel D-15 Test follows the Ishihara color blind test, “anyone who fails the Ishihara color blindness test but still wishes to pass the medical exam may apply to waiver with the result of Panel D-15 Test” (2013 Nov. 23rd; author’s translation). In this context, Panel D-15 Test is considered as waiver, which is usually a special accommodation for experienced pilots who fail the color vision requirement as they age in order to protect human resource for companies. Therefore, waiver may usually be issued to applicants who already have significant flight experience. They must be approved by designated medical examiners as being in the condition of stable and no risk of violating safety (Ministry of Land, Infrastructure, Transportation and Tourism, 2013 Nov. 23rd).

On the other hand, the current world standard set by the ICAO suggests a pack of three category assessment including use of multiple pseudoisochromatic plates (hereafter PIPs), flexibility, and medical tourism. Color vision testing available today lacks consistency, and also have potential unfairness (Squire, Rodriguez-Carmona, Evans & Barbur, 2005). As Birch (1985, Abstract) argues, there are three aims for current clinical tests including screening, diagnosing or classifying, and grading the severity. Therefore, a single test cannot fulfill all of the three. This is why ICAO

suggests a pack of three category assessment that should include one of PIPs for screening, then one of color lantern tests for diagnosing, and finally one of Anomaloscopes for grading the severity (International Civil Aviation Organization, 2012).

Flexibility in test options is another requirement of the ICAO standard. Medical flights such as light gun tests, practical tests or color lantern tests are often considered as the exercise of flexibility. These testing measures are designed to exam color perceptions of applicants under the condition of real flights. According to ICAO, flexibility protects not only human rights of applicants but also reliability of test results by giving better chances for applicants to pass (International Civil Aviation Organization, 2012).

Finally, the ICAO standard suggests those who fail all the requirements to take medical tourism. Medical tourism is to seek opportunities outside the home country. Those who fail the home country's color vision standard are encouraged to retake medical examinations in other countries which may have lower standards. Therefore, ICAO asserts that medical tourism is the last chance to pass color vision requirements and issue medical license as follows:

> The goal of harmonization across Contracting State is not achieved and the transfer of skilled personnel from one State to another is inhibited. It encourages "medical tourism" where a license holder, refused a license on medical grounds in one State because of stringent medical requirements, seeks to obtain one in another, less demanding State. (International Civil Aviation Organization, 2012, Foreword, p. vi)

Medical tourism is a last chance to obtain medical license in another country where medical requirements may be less severe than the home country. This solution implies that there is no valid scientific proof to normalize gaps between national standards today. In other words, ICAO admits the existence of gaps in color vision requirements between countries under their policy of non-interventionism. The ICAO policy raises the following question, what underpins the difference of color vision requirements between countries.

The current Japanese standard reflects severity in contrast to the world standard because the Japanese standard is primarily dependent on the Ishihara test. The Ishihara color blindness test is considered too sensitive to use even for aviation purpose in order to assess who is medically fit and who is not. Although the world standard suggests multiple sets of different color vision tests, the Japanese standard barely meets it. This

entails that one characteristic of the Japanese standard is the singularity of PIPs. In other words, there is lack of flexibility in testing options. In contrast, the world standard represents multiplicity and flexibility in testing options. As a result, the key concepts of the Japanese color vision requirements are recognized as severity, singularity of tests, and inflexibility in testing options.

Moreover, the following paragraphs will further discuss the key ideas underpinning the Japanese standard by comparing it with the Canadian standard. The current Canadian standard reflects the value of tolerance by daylight restriction, standardizing multiplicity, and flexibility in testing options. Thoroughly reviewing the difference of color vision requirements between Japan and Canada, this part will highlight that the Japanese standard reflects notion of disablism safety in its severity in comparison with the Canadian standard which reflects notion of ableism safety in its tolerance.

Canada was selected as the comparative subject for Japan based on the following criteria:

- A ICAO member country;
- B ICAO member country long enough to adjust its regulation;
- C Country outside of Asia;

- D Approximately the same number of passengers transported per year as Japan;
- E Meet and be possibly even more tolerant than the ICAO standard.

Canada has been hosting the headquarters of ICAO since its establishment. Canada is located in North America. Canada also has a similar market size to Japan in terms of passenger transportation, which reflects significance of aviation industry in the economy (Japan Aeronautic Association, 2011). Finally, the Canadian standard is one of the most tolerant aviation color vision requirements in the ICAO member states.

Under the current Canadian color vision requirements, those who fail the screening test would be issued with the daylight restriction as follows:

> Any applicants who fail on PIPs, will be qualified with daylight restriction: 2-way radio establishment is required at controlled airports, but those who wish to remove the restriction may take one of color lantern tests or Farnsworth D-15 test. (Transport Canada, 2004 March; Government of Canada, 2012 June 11c)

Daylight restriction regulates the license holder to fly within the legal daylight hours. In addition, as stated in the regulations, the license holder is required to always maintain two-way radio communication between the plane and the air controller within the controlled zone. Although the regulations prevent pilots who fail color vision

requirements from flying night, they allow those who are with the daylight restriction to fly during the day and even to fly for commercial airlines. In this sense, daylight restriction enables people with color vision defects to fly in Canada.

The regulations, accordingly, suggest that radio communication can be an alternative way for pilots to follow air controller's instruction within the controlled zone. The rationale of color vision requirements come from recognizing information that is delivered by lighting systems including lights on the airplane's wings, and light signals from air controller in the lost radio contact. ICAO describes the reason normal color vision is required in the current aviation medical as follows:

> Some of the typical conditions defining the visual abilities required of a general aviation pilot, … ability to recognize other aircraft approaching on a collision course (possibly by pre-arrangement), especially aircraft approaching from the far right or far left; … ability to read aeronautical maps in flight and to tune the radio on a predetermined station accurately and quickly; … ability to read instrument panels quickly and correctly (including overhead panel, if any). (ICAO, 2012, pp. l-2-13)

Color vision requirements are underlined by the importance of color perception in aviation including collision avoidance, map reading, tuning the radio, and instrument

reading. According to ICAO (2012), it is important for pilots to have “ability to recognize other aircraft approaching on a collision course” (pp. 1-2-13). The visual ability refers to the appropriate use of the lights on the airplane’s wings, known as anti-collision lights. Lights signals as in light guns, accordingly, are used only for communicating with pilots on a plane without radio equipment or lost radio contact within the controlled zone.

Light guns are designed for a few miles’ visibility, but they are not reliable ways for air traffic controllers to communicate with the pilot on board. Hovis, Casson, and Walter (2006) found out only 40% of the Light Guns at the airports were usable and various conditions exist between different models. The finding implies that visibility of light guns vary time to time, and place to place. Accordingly, the standard way for air traffic controllers to know if the pilot on board received the instruction is to watch whether the plane rocks its wings or not, which again tends to be not reliable information source since the plane may or may not be possible to rock its wings depending on the wind blowing. As a result, under the current law, Canadian Flight Supplement, which is required for all the pilots to take on board, includes phone numbers of the control tower of all the registered aerodromes. Pilots are encouraged to

call the number on their cellular phones in a case of emergency. Therefore, radio and phone communication are considered as alternative ways for light guns.

The current Canadian color vision standard gives multiple options to pass color vision requirements to candidates who fail the initial screening test. One option is to take another PIP including different versions of the Ishihara color blindness test. The Canadian standard currently lists four kinds of Ishihara color blindness test including the Ishihara test with 14 plates, 16 plates, 24 plates, and 36 plates (Government of Canada, 2015 Aug. 20, Part IV - Personnel Licensing and Training). In addition, the Canadian standard lists six kinds of PIPs in addition to the Ishihara test including the American Optical test with 18 plates and 20 plates, the HRR test, Titumus Vision Tester, Keystone Orthoscope, and Keystone Telebinocular (Government of Canada, 2015 Aug. 20, Part IV - Personnel Licensing and Training). PIPs are the most commonly used tests for screening purpose because of its sensitivity and simple use, however PIPs are primarily designed “to identify red-green color deficiency and does not quantify the color deficiency” (Delpero, O’Neill, Casson & Hovis, 2005, p. 127). The current Canadian color vision requirements allow aviation medical applicants to have multiple options of PIPs. This increases of flexibility in testing options.

Under the current requirements, the second chance for those who fail the initial screening test would usually be lantern tests (see Table 6), which are used to assess applicants' abilities to differentiate the difference between primary aviation colors: red, white, and green. There are currently three types of lantern tests available (Squire, Rodriguez-Carmona, Evans & Barbur, 2005). Holmes-Wright Type A lantern test is the most commonly used type of lantern test. It was primarily developed for the Royal Air Force, and still used for transportation industry today (Hovis, 2008, p. 1028). This test has an advantage on the ability to simulate relatively realistic colors in flight for the testing purpose. In this sense, lantern tests are considered as clinical testing which can test color vision under the realistic situation. Therefore, lantern tests are commonly used in order to efficiently test applicants' color vision in the exam room instead of the inefficient practical test. The third chance is a Farnsworth D-15 test (see Table 6). This test is designed to distinguish the severe color vision defects from the moderate ones (Lewis & Steen, 1971). Although Lewis and Steen (1971) argue that the D-15 test had the highest miss rate in major color vision tests, the D-15 test is the most commonly used test to quantify the degree of severity.

Following D-15 tests, applicants who fail all the three kinds of color vision tests may still take practical tests under the protection of CAR 424.05 (4), "a practical

test is in addition to all other standard medical requirements together with the licensing standards of skill, knowledge and experience for the permit or license applied for" (Government of Canada, 2012 June 11c). Although practical tests might provide inconsistent or unreliable test results and also be time consuming, it would protect the right of individual opportunities. The colorblind population of Canada is estimated about 8.5% of men and 0.4% of women (Transport Canada, 2004 March). The population which may obtain benefit from the fourth chance is almost double of the Japanese population with color vision defects. In this regard, it may not be small impact on the Canadians concerned that they have multiple options to receive the aviation medical certificate in Canada. The Canadian standard meets flexibility of the ICAO standard. Delpero, O'Neill, Casson, and Hovis (2005) analyzed that only a combination of clinical tests and practical testing can accomplish a reliable result as follows:

> Pre-employment screening for CVD [color vision deficiency] using PIPs is established practice; however, relying on a simple pass-fail without further quantification may unfairly discriminate against individuals with mid deficits and no significant functional impairment. On-site airfield testing of color vision ability holds intuitive appeal, but at present lacks controlled, validated parameters. Nevertheless, a combination of clinical and practical testing appears

to be indicated to maintain the balance between public safety and individual rights in evaluating fitness to fly. (p. 132)

Table 6
A Comparative Analysis of the Japanese, ICAO's, and Canadian Standards

	Japan	ICAO	Canada
1st test	The Ishihara color blindness test	Multiple sets of PIPs	Multiple sets of PIPs
2nd test	Waiver with Panel D-15	Lantern test	Lantern test
3rd test	N/A	Medical flights	Panel D-15 test
4th test	N/A	Anomaloscope	Practical test
5th test	N/A	N/A	Anomaloscope
Complete failure	Unfit to fly permanently	Aeromedical tourism	Daylight restriction

On one hand clinical testing using PIPs protects public safety, but on the other hand practical testing protects individual rights. In consequence, the current world standard of aviation color vision requirements is a combination of clinical testing and practical testing. However, the Japanese standard does not allow applicants to take practical testing at all. The Japanese standard only relies on the clinical testing results. In this sense, the Japanese color vision requirements do not value individual rights. On the other hand, the Canadian standard accepts both clinical and practical testing results, which meets the world standard. In consequence, the Canadian standard procedure of

color vision requirements for aviators allows pilots with diverse color vision while it protects public safety. Multiple choices of PIPs and also two more different tests meet the latest scientific findings as well as the ICAO standard. Consequently, values of the Canadian standard may reflect on daylight restriction, multiple PIPs, and flexibility.

Considering the criteria for daylight restriction, the perspective of the Canadian standard reflects tolerance regarding pilots with color vision defects, which may be underpinned by the value of equal results. Since daylight restriction enables any type of color vision defective pilots to fly, the Canadian standard represents ableism safety, which means that safety is aimed to accomplish by enabling diverse pilots to fly. On the other hand, the Japanese standard reflects severity and process-oriented value in the singularity of PIPs and no practice-based test options available. In this sense, the Japanese standard reflects disablism safety. Under disablism safety, safety is intended to be achieved by minimizing the potential risk which may be caused by allowing diverse pilots to fly. In short, this section addressed the difference in sense of risk regarding color vision between disablism safety of Japan and ableism safety of Canada.

In summary, the notion of disablism safety of Japan is underlined by the standard of the Ishihara color blindness test. On the other hand, the notion of ableism safety of Canada is embedded in flexibility of testing methods including multiple PIPs,

other kinds of color vision testing for the follow-up exam. In this sense, the social model of color-blindness is theoretically applicable to the aviation requirements. In other words, the Japanese color vision requirements for aviators reflect the notion of color-blindness as failing the Ishihara color blindness test. However, the color vision discrimination elimination movement did not incorporate the aviation requirements in their targets. Unlike other professions, therefore, pilots remained restrictive for colorblind people as Takayanagi and Sumita (1996) addressed the following:

> In Japan, you cannot become a pilot if you have color vision defects. In the United States of America, you cannot also become a first-class pilot, but some can become second-class or lower-class pilots depending on the color recognition competence. Some people with normal color visions also may not pass the requirements. The reason is that applicants are not examined by an ophthalmological color vision testing. That is the practical testing that the examinee is tested on their ability to recognize aviation red, blue, and yellow on the ground from an airplane at 1500 feet. (p. 156; author's translation)

The United States allows people with defective color vision to obtain the lower-class aviation medical license. In contrast, the Japanese requirements for aviators do not allow any color vison defects to fly at all. The Ishihara color blindness test suits the

purpose of the Japanese requirements because even mild color vision defects can be completely screened out by the test plates. The Japanese requirements for aviators have the same structure which relies on only the Ishihara test results.

Therefore, the abolition movement could have approached aviation requirements and advocated its alleviation. As a fact, according to Takayanagi (2014b), Takayanagi and *Nihon Shikikakusabetsu Teppai no Kai* addressed the issue of class 4 boat license. In consequence, the regulation was alleviated in a way that daylight restriction was established (see Table 3). The same approach might have been effective on aviation requirements since other countries have daylight restrictions under the ICAO approval. However, the Japanese aviation requirements were never criticized for its traditional notion of color-blindness as failing the Ishihara test.

The lack of attention to aviation color vision requirements from the color vision discrimination abolition movement raises the following question. What has prevented the social model of color-blindness from being applied to aviation color vision requirements in Japan. The following parts will investigate the construction of notion of color-blindness in the Japanese color vision requirements for aviators. Through this approach, the study will argue that the lack of attention to the aviator

requirements from the movement reflects ableism of color vision in the social model of color-blindness.

4.3.2. A Bio-power Analysis of Color Vision Requirements for Aviators and Ableism

This part sheds light on the way in which the notion of color-blindness was discursively constructed through color vision requirements for aviators. The Japanese requirements embodied the disablism notion of pilots with color vision defects. In light of Foucault's notion of power, the notion of pilots with color vision defects as failing the Ishihara test was illustrated in the disablism notion of Japan. In contrast, the Canadian requirements embodied the ableism notion of pilots with color vision requirements. By comparing the Canadian requirements with the Japanese ones, the study addressed theoretical limitations of the social model of color-blindness, which correspond with academic ableism of school color vision requirements.

The Japanese aviation color vision requirements reflect the notion of color-blindness as failing the Ishihara test. The requirements reflect singularity of the Ishihara test, and impracticality of color vision requirements. Under the current Japanese aviation medical regulations, the Ishihara color blindness test is the only accredited primary color vision testing. Although the Ishihara color blindness test is commonly

known too sensitive to be used for most recruiting purpose, the Japanese aviation requirements still rely on it as the standardized primary color vision testing. Those who have logged much flight hours may become eligible to take a Farnsworth D-15 test as the waiver, but the waiver does not apply to new license holders. As a result, the requirements function as Fujita's notion of tableaux technology in which color vision requirements are listed and paid attention to from aviation medical examiners.

The renewal of aviation medical is required from every 6 months to 5 years depending on the license classification. In this regard, pilots' color vision is examined on a regular basis, which reflects Fujita's notion of exercises technology. The exercises technology on Fujita's account is continuously practiced through aviation color vision requirements, which routinely examine the examinee's color vision. However, color vision does not change much significantly within a few years. Just like annual school color vision testing was aimed at completely screening out suspected color vision defects, the aviation regulations apply the zero-tolerance value to color vision requirements in Japan. Under the value, pilots must be perfectly normal in terms of color vision in order to improve aviation safety. In this sense, the singularity of color vision assessment by the Ishihara test can be legitimized because the Ishihara test is the most sensitive color vision testing available today. In consequence, pilots are enforced

to improve or maintain their color vision normal enough to pass the Ishihara test. In this regard, the Japanese color vision requirements for aviators address the notion of color-blindness as failing the Ishihara test.

Accordingly, Fujita's notion of maneuver technology functions through the other pilots' observation. For example, there is an episode that Flight Audit Office suspended a veteran pilot, captain Mizushima, from the flight schedule since he had a rumor suffering from severe backache in the television series, *Good Luck!!* (Inoue, 2003). Although the narratives about both Japanese and Canadian pilots the following paragraphs quote are fiction, they are discourses through which I, as the researcher, can access reality of life in light of Foucauldian genealogical discourse analysis. People experience and interpret the world through discourse, which gives meaning that shapes objects in reality (Burr, 1997). As Nouchi (2015) asserts, reality of life exists in linguistic representation including any textual and narrative data which can be read for meaning in the social constructionist's approach. In this sense, what meaning can be read in the quoted narratives is crucial for this analysis. The meaning is discursively constructed by the practice of reading, analyzing, and discussing the narratives. In other words, what is real or true about color vision requirements is also discursively formed in the practice of interpreting the meaning. In this sense, I intended to explore the way in

which notions of color-blindness and pilots with color-blindness were discursively constructed through color vision requirements in different socio-cultural backgrounds by comparing the two socio-culturally different narratives.

The story is about rookie pilot, Shinkai, who grows up to become an airline pilot. In the first episode, Koda, who is the manager of Flight Audit Office, blamed Shinkai and his mentor, captain Mizushima, on Mizushima's strained back in flight:

(Shinkai came in Koda's office and Koda asked about Mizushima's health condition)

Koda 1: Captain Mizushima must have taught you how to fly because you are just a crap pilot like Mizushima.

Shinkai 1: Wait a second, what did you just say?

Koda 2: Every flight must be perfect.

Koda 3: Also, every captain as the boss in a flight must be perfect. It is unacceptable that Captain Mizushima got sick in a flight because it is the responsibility as pilot.

Shinkai 2: Human beings cannot be always perfect, why can't you understand it?

Shinkai 3: So, obviously you have never had a cold throughout your entire career as pilot?

Koda 4: You have my word. I will retire if I catch a cold in flight.

Koda 5: Keep it in your mind that you are worse than amateur pilots

(Inoue, 2003, pp. 14-15; author's translation)

This conversation was held after Shinkai took over Captain Mizushima's control over and succeeded to land the plane safely due to the emergency situation which the captain became suddenly incapable of flying. Because Shinkai safely landed the plane in an emergency situation, he could have been rewarded by the success. However, Koda only questioned the qualification of Captain Mizushima as pilot due to his back pain. In addition, Koda clearly states that "also, every captain as the boss in a flight must be perfect. It is unacceptable that Captain Mizushima got sick in a flight because it is the responsibility as pilot" (Inoue, 2003, pp. 14-15; author's translation). As Shinkai says, it is unrealistic to expect perfection on human beings. Shinkai made a point. However, Koda continues that "I will retire if I catch a cold in flight" (Inoue, 2003, pp. 14-15; author's translation). Later on, the other episode, it is eventually going to be realized that Koda became such perfectionist after his previous experience of plane crash. Therefore, it is clear that Koda believes in perfect health as the qualification of pilot because he tries to lower the risk of accident. In other words, this episode also reflects

the zero-tolerance value which underpins the notion of color-blindness as failing the Ishihara test under the current Japanese aviation regulations.

Individual pilots are always observed regarding health condition by their colleagues as well as the company. Under the observation, pilots are enforced to discipline their health and notice their colleagues' change in health condition. Accordingly, pilots' condition is collected and analyzed in statistics in order to manage their health by the company and government. In this regard, the bio-politics of the population technology is practiced as part of the observation system. The disciplinary system, on the other hand, underpins homogeneity of normalized color vision in aviation. In other words, pilots with color vision defects cannot be considered to have pilot qualities because any difference in color recognition is risk of aviation safety. It is the exercise of disciplinary power by the practice of the anatomo-politics of the body.

Therefore, under the Japanese color vision requirements, technologies of Fujita's notions of tableaux, exercises, and maneuver are practiced together to constitute the notion of pilots with color vision defects as failing the Ishihara test and incapable of flying with the defective color visions. As a result, normalizing gaze is practiced through both hierarchical observation and normalizing judgment. In consequence, Foucault's notion of bio-power is exercised on pilots with color vision defects through

disciplinary power and coordinate power are exercised together. In this sense, the requirements reflect disablism safety in which color vision defects are completely screened out in order to improve aviation safety.

In contrast, Canadian aviation requirements reflect ableism of pilots with color vision defects. Through the practice of daylight restriction, multiple PIPs, and flexibility, the Canadian requirements enable pilots with color vision defects to fly for not only private, but also commercial purpose. Fujita's notion of tableaux technology is still practiced through the color vision requirements because color vision testing is required at regular aviation medical checkups by law. However, multiplicity of PIPs including the Ishihara color blindness test allows Fujita's notion of exercises technology to become less practiced. Those who fail the Ishihara test can retake color vision testing with other listed PIPs. The multiple options of color vision testing deconstruct "colorblind panopticon" (Baba, 2013, p. 154; author's translation) of the Ishihara test. In consequence, examinees with color vision defects may become less observed and normalized through aviation color vision testing.

Accordingly, Fujita's notion of maneuver technology also functions less effectively in Canada. For example, the television series, *Arctic Air* (Harvey, Schonbach & Wier, 2012), represents less observatory environments regarding pilots' health

condition in aviation. *Arctic Air* (Harvey, Schonbach & Wier, 2012) is a story of bush pilots in northern Canada. The story begins with the returning of Bobby Martin as the son of a legendary bush pilot and co-founder of an aviation company, called Arctic Air.

For example, an episode about Mel's heart attack particularly represents the notion of pilots' health in Canadian bush pilots. In this episode, Mel, who is a co-founder of Arctic Air, collapsed due to the deteriorating hearts and stress after he had arguments with his employee. Even though there was not an official doctor stop on him, the next day he insisted to fly a plane to the place hours away. He ended up completing the task and even became a hero by saving a pregnant woman who was about giving a birth to a baby. This episode addresses the value of All's well that ends well. Hence, what allows Mel to fly next day after he had a stress breakdown is the less observatory environments regarding pilots' health condition. No colleagues including himself stopped Mel from flying under the condition at health risk.

Therefore, the episode illustrates that less attention from other pilots or colleagues regarding pilots' health condition exists. The consequence of individual actions is the matter of individual responsibility. Individual pilots make their decisions and colleagues do not observe pilots' health condition. In this sense, Fujita's notion of maneuver technology may be less effective in the Canadian aviation environments.

As a result, the Japanese notion of pilots reflects disablism of pilots with imperfect health to minimize the risk of violating safety. Considering the regulations, pilots who do not maintain the perfect health condition including the perfectly normal color vision are not considered physically fit. This notion of pilots' health reflects disablism in color vision requirements for aviators in Japan. In other words, pilots with color vision defects tend to be screened out at the primary color vision testing in order to maximize aviation safety.

On the other hand, the Canadian notion of pilots reflects ableism notion of pilots with imperfect health to maximize safety. Carefully judging their color vision and abilities to fly safely, the Canadian regulations allow pilots with the different color perception to fly. The Canadian notion of pilots' health reflects that aviation safety can be maximized by alleviating color vision requirements. Appropriate flexibility is more beneficial and efficient to the society than the zero-tolerance regulation, as ICAO states "zero risk is unattainable and provides a benchmark that protects flight and at the same time is fair and transparent to the affected pilot" (International Civil Aviation Organization, 2012, p. I-2-11 *[sic]*). In this sense, the Canadian regulations disregard the way to maximize safety by raising the standard and lowering the risk as much as

possible, which is disabling color vision defects. Instead, they value ableism safety in which diversity of health is considered as the source of aviation safety.

Canadian Flight Supplement has contact information of all the registered airport control towers, which encourages pilots to call the tower in emergency instead of the traditional use of light guns. Considering the technology development, the Canadian laws represent reasonable color vision requirements. There is the intention to raise reliability of test results. In this regard, the Canadian notion of pilots with color vision defects relativize not only disabling regulations but also ableist notion of pilots' color vision in order to improve aviation safety.

In summary, Fujita's notions of exercises and maneuver technologies become less effective, which decreases the influence of the anatomo-politics of the body technology on color vision defects. Consequently, the decreased influence of normalizing judgment technology lessens effect of exercising disciplinary power on pilots with defective color vision. The regulations of the population, however, remain still in the way that individual pilots are recorded and statistically managed. Therefore, coordinate power may be discursively exercised through the statistical records of individual health reports. In this regard, bio-power of aviation color vision requirements

in Canada remains discursively exercised over color vision defects. As a result, the Canadian requirements reflect ableism in the notion of pilots with color vision defects.

Although the Canadian requirements embody ableism of pilots with color vision defects, the ableism notion entails the same theoretical limitation as the school color vision testing. That is academic ableism (Dolmage, 2017). Academic ableism entails silent pressure which discourages the disabled students to advocate their needs. As Dolmage (2017) asserts, barriers remain even after disabling regulations are removed. It is because teachers or people including the people concerned still consider that able body is better than disabled body. In light of academic ableism, the Canadian aviation requirements still remain insufficiently relativized.

Although ableism of pilots with color vision defects might be a downside of the Canadian color vision requirements, the study shed light on a countermeasure for the ableism notion as follows. That is set alternative ways of information sources including support from someone else who may be capable of doing what the people with impairments are unable to do. For example, the Canadian requirements list multiple steps and procedures to assess the color perception of pilots. In addition, the Canadian daylight restriction actually admits that pilots with color vision defects are capable of flying with radio instructions from air traffic controllers. In this case, radio contact is

provided as an alternative way of seeing the difference between colors in flight. In emergency, pilots with color vision defects may also call air traffic controller with their mobile phones in flight because airport control towers list their phone numbers in Canadian Flight Supplement by law. As a result, providing access for people with color vision defects to alternative ways of color recognition may lessen ableism of people with color vision defects in color vision requirements.

In a comparative analysis of color vision requirements, the Canadian requirements reflect the social model of color-blindness because it partially deconstructs the notion of color-blindness as failing the Ishihara test. The social model of disability is an insight into the notion of disability as social and environmental construction. Atwood (2004) asserts that "the central symbol for Canada – and this is based on numerous instances of its occurrence in both English and French Canadian literature – is undoubtedly Survival" (p. 41). For Canadians, the nature and the environment are the source of disaster and crisis. In this sense, it is the nature and environment that Canadian pilots fight for their survival.

As Mel in the episode of *Arctic Air* addressed the value of All's well that ends well, it is not the pilot's health condition for Canadians to consider as the main source of risking aviation safety. As Ishikawa (2012) discussed, many military chaplains serve

national armies including Canadian Armed Forces. Their role includes officiating at religious ceremonies or private counseling of members of the Navy, Army, and the Air Force (Ishikawa, 2012; Government of Canada, n.d., Chaplain). Since the environment is the main source of disaster or crisis that Canadian Armed Forces members wish to prevent from, they pray to God for the calm or safe environment. In this sense, the social model of disability, which is discursively represented in the Canadian aviation color vision requirements, corresponds to the socio-cultural value of Canadian society.

In contrast, the Japanese requirements reflect the medical model of color-blindness because of its singularity of the Ishihara color blindness test and impracticality of testing measures. As previously discussed, the Ishihara test is sensitive enough to completely screen out the people with defective color vision. Therefore, the singularity of the Ishihara test addresses an insight into the disability as individual problem. As Oyama (1976) notes, the Japanese government used to try protecting the entire nation by purifying Emperor and the capital city in the Heian period:

> Clearly, the government tried to prevent the city as Emperor's place and other areas of the country connected with roads from impurity of death. The purification structure was that Emperor was the centre of the purity and the purity spread over other areas with the roads. (p. 281; author's translation)

The government created a special department called *Kenpiishi* in Japanese. They were in charge of purification of death impurity (Niunoya, 1986). As Akasaka (1999) notes, *Kenpiishi* led *Hijin* who practically conducted purification under the supervision of *Kenpiishi*. In the Heian period, there were no graveyards. Therefore, people used to bury dead bodies in their gardens. *Hijin*, instead, took dead bodies of humans and animals to the riversides where they processed and disposed the bodies (Niunoya, 1986). Individual bodies were considered as the source of impurity, which might cause disaster or crisis. Therefore, the Japanese people purified the environment by cleaning what represented impurity. There is Haneda Shrine in Tokyo where people especially pray to the Shinto gods for aviation safety (Haneda Shrine, n.d., Sora no anzen kigan). Individual impurity includes disability. Pilots with disabilities including defective color vision may impurify the sky and cause natural disaster and crisis. As a result, aviation color vision requirements must be strict enough to purify the environment and flight so that aviation safety can be best secured.

In consequence, the Canadian ableism safety and the Japanese disablism safety correspond to each socio-cultural value. However, the Canadian requirements entail ableism of pilots with color vision defects. Although the Canadian ableism allows pilots with defective color vision to fly a plane, it also leaves pilots with color vision defects

less supported due to the discouragement of their self-advocacy of needs. The aviation ableism corresponds to academic ableism (Dolmage, 2017) through which pilots feel less comfortable to advocate their needs because they are enabled to fly a plane in Canada. In other words, they are discursively enforced to accommodate their needs in order to protect their privileges as Mel hid his medical condition from his colleagues in the quoted episode of *Arctic Air*. The following section will elaborate on theoretical limitations of social model of color-blindness through reexamining the birth of social model of color-blindness.

4.4. Discussion: The Birth of Social Model of Color-blindness

This chapter highlights the way in which the notion of color-blindness was shifted through the mandatory school color vision testing abolition movement between 1973 and 2002. Takayanagi started the color vision discrimination abolition movement by herself. The movement eventually developed into an advocacy group of people with color vision defects and their families, called *Nihon Shikikakusabetsu Teppai no Kai*. Thoroughly reviewing Takayanagi's works, this chapter addressed the notion of color-blindness as failing the Ishihara test in both Takayanagi's model and *Nihon*

Shikikakusabetsu Teppai no Kai's model of color-blindness. The notion of color-blindness as failing the Ishihara test reflected the social model of color-blindness.

Adopting the Takayanagi's model of color-blindness, *Nihon Shikikakusabetsu Teppai no Kai* advocated abolition of mandatory school color vision testing and other regulations. Although Takayanagi and the advocacy group successfully deregulated many professional color vision requirements, aviation requirements remained untouched. Therefore, this chapter investigated the notion of color-blindness in Japanese aviation color vision requirements by employing a comparative analysis between Japan and Canada. As a result, the notion of color-blindness as failing the Ishihara test was also represented in the Japanese aviation color vision requirements. In this sense, the study argued that Takayanagi's model of color-blindness would supposedly be effectively applicable to the aviation requirements.

The reason aviation color vision requirements were left untouched by the color vision discrimination abolition movement may be embedded in the Takayanagi's theoretical model. Thoroughly reviewing the disablism safety discourse of Japanese aviation color vision requirements, the study addressed the notion of color-blindness as failing the Ishihara test. On the other hand, the Canadian aviation requirements reflected the ableism notion. The social model of color-blindness was embedded in the Canadian

ableism notion. Therefore, the Canadian color vision requirements reflect the same theoretical shortcoming as the social model of disability was criticized for by Morris (1993). The criticism Morris (1993) addressed is that the social model of disability tends to disregard the restriction that people with impairments experience.

As a countermeasure for the theoretical shortcoming, Hoshika (2013) suggested that the social model of disability scholars must deconstruct not only disabling environments but also ableism notion. Dolmage (2017), accordingly, addressed academic ableism as a current issue of higher education in which students with special needs would remain unsupported and enforced self-supporting. Both discourses of abolishing school color vision testing, and the Canadian color vision requirements share the same ableism of color vision in which the people concerned became enabled in exchange for being left unsupported and enforced self-supporting. Therefore, the study claimed that the reason Takayanagi's model of color-blindness was not applied to aviation requirements might be underpinned by the same ableism regarding pilots with color vision defects. The notion of ableism raised concern about aviation safety for both Takayanagi and the advocacy group. The ableism of the social model of color-blindness might have prevented Takayanagi's notion of color-blindness as failing the Ishihara test from being applied to aviation color vision requirements.

CHAPTER FIVE

OPTIONAL SCHOOL COLOR VISION TESTING BETWEEN 2003 AND 2014

This chapter sheds light on the way in which the notion of color-blindness was discursively transformed through the optionalization of school color vision testing in 2003. While the mandatory school color vision testing abolition movement was taking place, mandatory school color vision testing was abolished and became optionalized by the issue of School Health Act 2003. This chapter, therefore, will further discuss the way in which the younger generation of people with defective color vision live with their vision under the optionalized school color vision testing. Through the discussion, the study will address a third model of color-blindness in-between the medical and social model of color-blindness, called a strategic model of color-blindness. The third model of color-blindness considers defective color vision as an optional identity to choose depending on situations. Therefore, people with defective color vision may choose to move between inclusive and exclusive circumstances in society. In this model, ableism of the social model of color-blindness will be theoretically overcome.

Firstly, this chapter will investigate the way in which bio-power was discursively exercised under the amendment. The amendment of 2003 deformed the

way in which bio-power was discursively exercised through school color vision testing. In consequence, the notion of color-blindness as failing the Ishihara test was discursively deconstructed by the optionalization of school color vision testing. This change entails that self-advocacy of needs of students with color vision defects was reinforced by the amendment. Accordingly, this chapter will highlight a reconstructed notion of color-blindness through examining the collected life stories of people with defective color vision. Through the life story analysis, the study argues that the emphasis on self-advocacy of the students concerned discursively transfigured exercise of bio-power and enforced self-disclosure of defective color vision to become strategic.

This chapter elaborates on the strategic model of color-blindness by thoroughly examining life stories of the younger generation of people with defective color vision who do not experience mandatory school color vision testing. The study intends to provide an insight into the way in which the notion of color-blindness was discursively constructed through optionalized school color vision testing. The study also aims to better understand changes in the individual experience of people with defective color vision after school color vision testing was optionalized. It is a scope of this study to discuss color-blindness as one of mild disabilities by which ableism in the social model of disability can be further explored.

5.1. A Bio-power Analysis of School Health Act 2003

This section explores the way in which the notion of color-blindness was discursively transformed from failing the Ishihara test towards self-advocacy of color vision needs. Primary texts are School Health Act 2003 and *Shikikaku ni kansuru Shidou no Siryou*. Through lens of Foucault's notion of power, the study sheds light on the way in which bio-power was discursively exercised to deconstruct and reconstruct the notion of color-blindness through optionalized school color vision testing. School color vision testing became optional under the enactment of School Health Act 2003. Both Fujita's notions of tableaux and exercises technologies regarding color vision defects were partially removed from the annual school health checkup.

The objective of amendment 2003 describes the reason mandatory school color vision requirements was abolished was the inadequacy of color vision testing for educational purpose. MEXT (2002 March 29) asserts that "color vision testing is removed from requirements of school health checkups because … in most cases failures of color vision testing can maintain their academic performances without serious problems" (author's translation). Those who failing the Ishihara test became understood

as functioning impairment in education. In consequence, school color vision testing became considered as unnecessary.

Color vision testing became optional at annual school health checkups under the amendment of 2003. However, the abolition of mandatory school color vision testing does not entail the total abolition of school color vision testing. By law, *Yogo* teacher's offices, health care rooms, were required to have a set of color vision test plates in case students request taking color vision testing (MEXT, 2002 March 29). Intention surveys about color vision testing were required for students to take school color vision testing. In this sense, school color vision testing was not completely abolished under the amendment. Instead, the enactment of School Health Act 2003 only optionalized school color vision testing.

Most schools eventually stopped including color vision testing as part of school health checkups. The number of schools which requires students to take color vision testing has decreased to almost zero after the amendment (Hara, 2018 Dec.). As a result, it should be noted that the practice of school color vision testing has been almost removed from the regular school health checkup. However, it was only optionalized under the amendment.

The abolition of mandatory school color vision testing, therefore, partially removed Fujita's notion of tableaux technology regarding students with color vision defects. Color vision testing would no longer enforce all the students to make their color vision defects observable for other non-defective color vision classmates through school health checkups. In consequence, Fujita's notion of hierarchical observation technology was also partially deconstructed by the amendment. However, school color vision testing remained optional in case of individual requests from students. Color vision test plates, most likely the Ishihara test, remained kept in *Yogo* teacher's office by law. Therefore, some technology of Fujita's notion of tableaux remained effective under the amendment because the law specifically required a set of color vision test plates to be kept in the health care room. Fujita's notion of exercises technology would be less often and less effectively practiced by far. The reserved color vision test plates, however, shows some remaining possibility of its use under the amendment. In this regard, part of normalizing judgment remained effective, but it was discursively deformed under the amendment.

Accordingly, Fujita's notion of maneuver technology was reinforced through the optionalization of school color vision testing. An official manual regarding how to teach students with color vision defects, called *Shikikaku ni kansuru Shidou no Siryou*,

was redistributed to schools by MEXT in 2003 prior to the amendment. The manual was updated from *Instruction Manual of Color Vision Issues* (Ministry of Education Japan, 1994), in Japanese originally called *Shikikaku ni kansuru Shidou no Tebiki*, in order to correspond to the optionalized school color vision testing. The updated manual was intended to provide teachers with practical advice of how to accommodate students with color vision defects without ophthalmological assessment in classes. MEXT (2003) suggested in the manual that teachers should talk to the student individually and provide appropriate educational support. Teachers were encouraged to ask the student about educational support that he/she needs. In other words, the amendment enforced the students concerned to self-advocate their individual needs. In this sense, students with color vision defects would be evaluated upon how well they advocated their needs, which might reflect the practice of Fujita's notion of maneuver technology.

As a result, the students with color vision defects would be observed by teachers. The teacher's gaze at students' defective color vision, therefore, would control their behaviors in the way that they would feel constantly pressured to be responsible for the self-advocacy of their color vision needs. In this regard, Fujita's notion of maneuver technology was reinforced under the amendment. In consequence, the normalizing judgement technology was discursively deformed in the way that Fujita's

notion of exercises technology was lessened in contrast Fujita's notion of maneuver technology was emphasized.

Academic ableism (Dolmage, 2017) regarding color vision defects was, therefore, discursively reinforced through the amendment. The partial removal of Fujita's notion of tableaux technology regarding color vision defects enabled the students concerned to be accommodated in the class. On the other hand, the reinforcement of Fujita's notion of maneuver technology would enforce the students concerned to self-advocate their needs. This shift in the balance allowed the normalizing judgment technology to have monopoly of exercising disciplinary power. Consequently, students with color vision defects were considered as the primary source of information of their needs. Therefore, they were assumed by teachers as knowing everything about their own color needs.

However, the notion of students with color vision defects as self-advocator of their color vision needs would have an ambivalent effect on the students. That is the enforcement of the students concerned to choose either self-awareness or silence of their defective color vision. In order to self-advocate their color vision needs, the students concerned must know the difference between their own defective color recognition and the others' non-defective one. Those who feel responsible for advocating their needs in

the class, they would feel pressured to become self-aware of their color vision needs. In consequence, they would end up taking one of ophthalmological color vision testing, most likely the Ishihara test. In this sense, the enhanced pressure of self-awareness might leave some space for medical model of color-blindness discourse to get in the discussions regarding school color vision testing. The reinforced Fujita's notion of maneuver technology, consequently, would discursively allow the medical model discourse to be emphasized under the amendment.

On the other hand, the notion of students with color vision defects as self-advocator of their needs might also make them remain silent about their needs. Dolmage (2017) asserts that "academic environments put pressure on students with special needs to function/learn without special supports through an academic discourse students should advocate their needs" (p. 89). The students concerned are discursively enforced to become aware of and self-advocate their needs in school. In other words, students with special needs are regarded as the last resort for teachers to know their individual needs.

However, the students with special needs are sometimes not even aware of their own learning needs. Even if the students with special needs are aware of their needs, they may be still not sure about what the best or better way to accommodate their

needs. Therefore, even though the accommodation they requested did not work, they might just pretend that it would work for them. That is because they are also students who concern about impressions they make on the teacher. In this regard, the notion of students with color vision defects as self-advocator may enforce the students concerned to remain silent regarding their color vision needs.

In summary, anatomo-politics of body of students with color vision defects was deformed in the way that normalizing gaze was discursively organized and practiced. Therefore, self-advocacy of color vision needs was reinforced. As a result, disciplinary power continued to be discursively exercised under the amendment. The bio-politics of population, accordingly, was discursively deformed. Schools would no longer provide the demography of students with color vision defects after color vision testing became optional in 2003.

Coordinate power, which is discursively exercised in the regulations, would no longer be exercised at students with color vision defects through school color vision testing. The regulations of the population were displaced from school color vision testing due to the optionalization of school color vision testing in 2003. However, the people concerned with defective color vision remain discursively managed through another technology other than the school health examination. One is universal design,

which the following section will further elaborate on. In consequence, bio-power was no longer exercised in the same way as it used to be through the abolition of mandatory school color vision testing.

Disciplinary power, which was exercised at individual bodies of color vision defects, became more concentrated in the practice of Fujita's notion of maneuver technology. This change in power reflects shifting of notion of students with color vision defects from failures of the Ishihara test towards self-advocator of color vision needs. In other words, students with color vision defects may become easier to disclose their color vision needs to their friends. Correspondingly, the notion of color-blindness was discursively transformed from failing the Ishihara test towards self-advocacy of color vision needs.

The following section, therefore, will elaborate on the notion of color-blindness embedded in life stories of the younger generation with color vision defects, who grew up under the optionalized school color vision testing. This approach allows the study to further discuss the way in which bio-power was discursively transfigured into the concentration of disciplinary power through the optionalization of school color vision testing. Accordingly, the following sections will address the way in which coordinate power has been discursively exercised outside school color vision testing. In this regard,

within daily life, the study will argue that bio-power remains exercised at people with color vision defects under the optionalization of school color vision testing.

5.2. A Life Story Analysis of Optionalized School Color Vision Testing

This section further investigates the way in which the notion of color-blindness as self-advocacy of color vision needs was discursively reconstructed through optionalized school color vision testing. As discussed in the first chapter, no earlier literatures are available yet regarding the individual experience of optionalized school color vision testing after the amendment of School Health Act 2003. There has been a significant lack of data regarding the younger generation of people with defective color vision who grow up under the optional school color vision. This section, therefore, employed a life story interview to collect the individual experience of young people with defective color vision without mandatory school color vision testing experience.

Four people with defective color vision were interviewed between 2016 and 2018 (see Table 7). I met both Interviewee B and Interviewee E through my personal contact. On the other hand, I met Interviewee D through my informant. Interviewee C was introduced to me by Interviewee D. Except for Interviewee D, the other interviewees never took neither an ophthalmological color vision testing or school color

vision testing. The interviewee D told the interview that he remembered that he took an optional school color vision testing as per his parents' request. However, the did not remember the experience until his mother told him that.

Life Story Interviews of Optional School Color Vision Testing

	Gender	Birth Year	School Color Vision Testing	Occupation	Interview Period	The Total Hours of Interviews
Interviewee B	M	1993	None	Graduate Student	2016-2017	11.4 hours
Interviewee C	M	1993	None	Real Estate Company	2018	2 hours
Interviewee D	M	1994	Optional test	Real Estate Company	2018	1.4 hours
Interviewee E	M	1995	None	Undergraduate Student	2017	4.4 hours

The interviews were sub-structured in order to fill in the life chronology sheet (see Appendix A). The interviews were recorded with an IC voice recorder, and the interviewer also took field notes. The interview data was transcribed as necessary for analysis. In light of life story analysis, field notes, audio recordings, and transcriptions were analyzed. In order to protect interviewees' privacy, all the excerpts from the interviews in the study were anonymized by encryptions and any personally identifiable

information was removed. In the following excerpts, M stands for interviewer, which is the researcher.

In light of Foucault's notion of bio-power, the following sections argue that bio-power was discursively exercised through optionalized school color vision testing. However, the ways in which disciplinary power and coordinate power were exercised became different under the optional school color vision testing. The first section will shed light on the way in which the optionalization of school color vision testing reflected Fujita's notion of tableaux technology on interviewees' experience that they became self-aware of their unique color vision. Accordingly, the following section will disclose the way in which Fujita's notion of exercises technology was shifted from school color vision testing towards self-examination of color vision difference. Third, Fujita's notion of maneuver technology will be highlighted on the way in which interviewees disclosed their color vision needs to their friends and colleagues. In consequence, the study elaborates on the way in which the notion of color-blindness was discursively shifted from failing the Ishihara test towards a strategic option for the younger generation of people with defective color vision to survive in society through the optionalization of school color vision testing.

5.2.1. Self-awareness of Color-blindness

Since school color vision testing was optionalized, the people concerned became aware of their color vision difference within daily life except for Interviewee D. First, Interviewee B became aware of a difference in color vision when he played a soccer video game with his friends. According to Excerpt B1 (see Appendix B), Interviewee B realized that he could not see the difference between red and green uniforms on the TV screen. However, his friends played the soccer video game without a problem. Therefore, the experience of being unable to play the soccer video game remained in Interviewee B's mind.

In the case of Interviewee B, he realized that his color vision might be different from his friends through a soccer video game. However, he said he was not sure yet what it meant to him or what caused the difference. He continued his story and talked about his first time to hear weak color vision from his mother. According to Excerpt B2 (see Appendix B), Interviewee B was watching a TV show with his family. It was a quiz show with a mistake-searching game regarding the color difference between two pictures. The TV show reminded Interviewee B of his difficulty with seeing the difference between red and green. He told his parents that he sometimes had hard time to see the difference between colors. In response to the disclosure of Interviewee B, his

parents mentioned his grandfather's weak color vision to him. Parents gave Interviewee B the word, weak color vision, to describe his difficulty to see the difference between colors. Consequently, Interviewee B identified himself with a weak color vision. In this sense, Interviewee B became aware of his unique color vision within daily life.

Another example is Interviewee C's experience. According to Excerpt C1 (see Appendix C), he also became aware of his different color vision through the communication with his mother. Interviewee C's mother suspected that he might have different color vision from hers by reading books to him. Eventually, she took him to a local ophthalmologist for color vision testing when he was nine or ten years old. According to Excerpt C2 (see Appendix C), the experience of seeing an ophthalmologist must have remained in Interviewee C's mind. He said that he must have become aware of his defective color vision through the experience.

In consequence, Interviewee C's mother also realized his defective color vision first time within daily life. However, it was later that he became aware of his own color vision when he took a color vision test at an ophthalmologist. Therefore, without school color vision testing, parents can realize their child's defective color vision. Furthermore, they may voluntarily take their child to color vision testing.

Following Interviewee C, a similar example was found in the life story of Interviewee E. He also remembered how his family realized his different color vision within daily life. According to Excerpt E1 (see Appendix E), Interviewee E told his parents how the color of toy train changed in dark from blue to green in his eyes. The experience of toy train was not the moment when Interviewee E became aware of his defective color vision first time. However, Interviewee E said that he remembered how strange he felt about his parents' reaction to him. The strange feeling must have remained in Interviewee E's mind.

Interviewee E remembered his first time to feel uncomfortable with his parents' response regarding color vision. Although his parents did not name his different color vision at that time, they must have recognized his defective color vision. A few years later, Interviewee E pointed out his sister's use of color. Then, Interviewee E's parents and younger sister told him that they found strange in his color vision. In this sense, Interviewee E's defective color vision was also first recognized by his family within daily life.

Accordingly, Interviewee E continued his story about how his mother made him realize that he could not see certain colors. According to Excerpt E2 (see Appendix E), Interviewee E's mother showed him a color vision test plate on the internet. She

intended just to check whether he actually could see certain colors or not. Considering the previous story regarding Interviewee E's experience with color identification, Interviewee E was suspected by his family as defective color vision by then. However, this experience, seeing color vision test plates on the internet with mother, remained in Interviewee E's memory. In consequence, the moment of color vision testing on the internet turned out to be the Interviewee's first memory to become aware of his unique color vision. In this sense, Interviewee E's became aware of his defective color vision through the communication with his family.

In contrast, Interviewee D has a different experience with the optionalized school color vision testing from the other interviewees. According to Excerpt D1 (see Appendix D), Interviewee D's parents recognized his defective color vision first time through school color vision testing. However, the result was never told to Interviewee D until he asked for it during job hunting. Interviewee D had a school color vision test when he was eight or nine years old. By law, school color vision testing became optional by the time. Therefore, Interviewee D thought that it must have been required for school to have parents' permission in order to conduct a color vision testing to the interviewee.

According to Excerpt D2 (see Appendix D), Interviewee D remembers that he took the test at school. However, it took him more than ten years to become aware of his defective color vision. He could not even suspect his defective color vision until he had another color vision test at job interview. Although Interviewee D took a school color vision testing before, he did not know the result until he asked his parents about it. It was even after he failed a color vision testing at job interview. In the case of Interviewee D, therefore, he became aware of his defective color vision after many years since he took the school color vision testing. After he found out he might have a defective color vision, he decided to take another color vision test at an ophthalmologist and became aware of his defect.

The Interviewee D's story highlights that parents must tell their children about color vision in order to make them aware of their defective color vision. In other words, Fujita's notion of tableaux technology was removed from school color vision testing by Amendment 2003. Instead, Fujita's notion of tableaux technology was practiced at home under the optionalized school color vision testing. Comparing with the other three interviewees, only Interviewee D's parents did not tell him about the test result. In consequence, Interviewee D did not know about his color vision until he had a color vision test at job interview. The other interviewees also showed some symptoms of

defective color vision at the same young age. However, they only remembered their defective color vision through parents' reactions to it. In this regard, under optionalized school color vision testing, Fujita's notion of tableaux technology was discursively practiced through parents' reactions. Through the parents' observation to their child's color vision difference, the hierarchical observation technology between what was normal and abnormal color vision was discursively practiced at defective color vision.

5.2.2. Self-examination of Color-blindness

Fujita's notion of exercises technology was also displaced from ophthalmologists or color vision testing examiners under the optionalized school color vision testing. Fujita's notion of exercises technology was discursively practiced as self-examination of color vision. For example, Interviewee B and D would check color vision requirements prior to applying for a position opening. In other words, they self-examined color vision in order to choose their careers. According to Excerpt B3 (see Appendix B), Interviewee B's senior, who applied for JR East before, took a color vision test in the selection process. Because Interviewee B heard about the color vision requirement, he was not thinking about applying for JR East at the interview.

Interviewee B removed JR East from his career options based on the color vision requirement.

Although there might be various color vision standards, Interviewee B self-examined his job application for JR East. As Interviewee B asserted (May 18, 2016; see Excerpt B3), “I feel I must check whether there is color vision test in the selection process or not” (author’s translation). Therefore, color vision testing would no longer necessarily for the people concerned to take under the optional school color vision testing. Instead, they self-examine their color vison and make own decisions. In this regard, Fujita’s notion of exercises technology is discursively practiced at self-examination of color vision under the optionalized school color vision testing.

Accordingly, Interviewee D also supports self-examination of color vision regarding job hunting. According to Excerpt D3 (see Appendix D), he insisted that it would be better for the people concerned to know their defective color vision as early as possible. The early detection of defective color vision makes job hunting easier for the people concerned. If the people concerned find out their defective color vision in the middle of job hunting, it makes them difficult to rebuild their career plan. Interviewee D asserts that the early detection of color vision defects may help the people concerned efficiently choose a career. The assertation made by Interviewee D entails self-

examination of color vision for his career planning. The premise of self-examining defective color vision prior to job application is reflected in the notion of job hunting. In this sense, Fujita's notion of exercises technology was discursively shifted from color vision testing towards self-examination to be practiced. Under the optional school color vision testing, instead of school color vision testing, the self-examination of color vision is emphasized.

In addition, Fujita's notion of exercises technology was practiced on the internet. Interviewee C and E used online color vision testing in order to assess their color vision. According to Excerpt C3 (see Appendix C), Interviewee C played an online color vision test with his friends at school. Prior to the online testing, Interviewee C disclosed his defective color vision to his friends. Therefore, the online testing was only the next step for Interviewee C and his friends to examine how different Interviewee C's color vision is from his friends. Interviewee C took an online color vision test with his friends to show how different his color vision might be from theirs. The intention of taking the online color vision test, therefore, was to compare the color recognition of Interviewee C with his friends'. In this regard, it should be noted that taking an online color test was also another form of self-examination of color vision.

Fujita's notion of exercises technology was discursively exercised on the internet through the online color vision testing.

Interviewee E also had an experience with an online color vision test. In his case, however, his mother showed it to him just to check how much Interviewee E could or could not distinguish the difference between colors. According to Excerpt E2 (see Appendix E), Interviewee E's mother used to take school color vision testing when she was a student. Therefore, she had some idea about defective color vision. However, she might have never known how different defective color vision might be from hers. By the online testing, Interviewee E's mother clearly could perceive the gap between normal and abnormal color vision. Her surprise was reflected on her reaction to Interviewee E's color vision test result. She said that she was amazed by Interviewee E's result of color vision testing.

Interviewee E saw color vision test pictures on the internet with his mother. Since his mother intended to know how much he could or could not see colors, the online color vision test pictures functioned as a color vision testing. Throughout the interview, interview E mentioned a few times during the interviews about "some color vision test on which we are supposed to see numbers" (Interviewee E, June 28, 2017; author's translation). He also described the test pictures as many color full polka dots

during another interview (Interviewee E, May 18, 2016). It became clear to me that he saw a picture of Ishihara color blindness test with his mother on the internet.

According to Baba (2013), the Ishihara test discursively functions as the technology of "colorblind panopticon" (p. 154; author's translation). In consequence, the examinee's color vision would be normalized. The failures of reading the test plates would be regarded as color-blindness. In this sense, since smartphones became popular, Fujita's notion of exercises technology might have been practiced through color vision test pictures including the Ishihara test on the internet. Consequently, Fujita's notion of exercises technology continues to be practiced at defective color vision through self-examination of color vision.

Under the optionalized school color vision testing, Fujita's notion of exercises technology remains effective through self-examination of color vision and personal judgment of color vision validity. In this regard, Fujita's notion of exercises technology was displaced from ophthalmologists and health examination sites including school color vision testing. This shift in the location of technology entails that the way in which the technology of normalizing judgment is discursively practiced would have also been changed. In order to further discuss the normalizing judgment technology, the

following section will investigate the way in which Fujita's notion of maneuver technology was discursively practiced.

5.2.3. Self-disclosure of Color-blindness

Fujita's notion of maneuver technology was discursively practiced at defective color vision. However, it was transfigured into self-advocacy of color vision needs under the optionalized school color vision testing. All four interviewees: Interviewee B, C, D, and E, talked about disclosure of their color vision needs. Thoroughly exploring narratives regarding self-disclosure of color vision needs, this section will highlight the way in which the notion of color-blindness is discursively reconstructed as a strategy.

First, Interviewee C talked about how he disclosed his color vision needs to his friends. According to Excerpt C4 (see Appendix C), Interviewee C thinks of his defective color vision as a conversation topic. Therefore, he talked about his defective color vision with his friends. As Interviewee C said, the talk about his defective color vision was nothing like a serious conversation or confession. It was just a plain talk with friends. Interviewee C used his unique color vision as a conversation topic. In light of Interviewee C, talking about his own difficulty and difference with his friends seems to be quite natural.

Although Interviewee C said that there was no intention to talk about it, he elaborated on the intention of color vision talk later in the interview. According to Excerpt C5 (see Appendix C), Interviewee C told his defective color vision to his project members as necessary. Interviewee C said he intended to make it easier for his project members to work with him. His intention of color vision talk is to make it easier for his colleagues to point out his use of color. In other words, color vision talk is a strategy to improve communication in order to create friendly atmosphere for Interviewee C to obtain necessary support. In this sense, the self-disclosure of defective color vision is to cooperate with friends and colleagues in order to obtain a better outcome.

On the other hand, Interviewee C talked about his hesitation to self-disclose his color vision needs at his office. According to Excerpt C6 (see Appendix C), Interviewee C tries to avoid color vision talk at his office. The company he works for owns an art museum so that defective color vision may create some career restriction for him. In this regard, Interviewee C tends not to openly discuss his color vision needs at the office because he concerns about making a negative impression on colleagues. Interviewee C concerns about negative impact that his defective color vision may make on his job evaluation.

Depending on situations, he chooses the way in which he discloses his defective color vison. Interviewee C disclosed his color vision to his project members because they became close to each other. Interviewee C also hoped to develop efficiency of group work by obtaining support from the team members. In this sense, the self-disclosure of color vision may be a strategic option for the people concerned under the optionalized school color vision testing. The people concerned choose to whom and where they disclose their defective color vision.

The same self-disclosure strategy is employed by Interviewee E. According to Excerpt E3 (see Appendix E), Interviewee E disclosed his defective color vision to his friends at school and colleagues at his part-time job. With friends at school, Interviewee E used his color vision as a conversation topic. Interviewee E said that color vision talk was a popular topic for his friends. In this sense, defective color vision is not considered as disadvantage for him.

Accordingly, Interviewee E regarded his defective color vision as an insurance. Letting his friends know about his needs makes him easier to be around his friends. In light of Interviewee E, the self-disclosure of his defective color vision is a conversation topic as well as an insurance in case he makes any mistake about color use. In addition, he mentions to whom he would feel disclosing his color vision. He would not disclose it

to everybody, but only his close friends. Although defective color vision is his popular conversation topic, he would choose not to talk about it without building friendship. In this sense, he chooses the self-disclosure of color vision as his strategy to improve relationship with his close friends.

In addition to friends, Interviewee E also discloses his defective color vision to his colleagues at his part-time job in order to work efficiently. According to Excerpt E4 (see Appendix E), Interviewee E works at a video rental shop. As part of his job, he must color coordinate rental videos with yellow, gray, yellowish green, and orange stickers. Interviewee E talked about his difficulty he has encountered with the particular task. The task he could not accomplish by himself is to tell the difference between color coordinated stickers. Therefore, Interviewee E asked his colleagues for help. In consequence, Interviewee E disclosed his color vision to colleagues in order to complete his job assignment. In this regard, the self-disclosure of defective color vision is to work efficiently at the part-time job by obtaining help from the colleagues. Therefore, self-disclosure is also a working strategy for Interviewee E at his part-time job.

On the other hand, Interviewee E was also concerned about negative effect of self-disclosing his defective color vision at a full-time job in the future. According to Excerpt E5 (see Appendix E), Interviewee E concerns about self-disclosure after he

graduates university and starts working full-time. What Interviewee E worries about is that he would lose career opportunities if he informs his boss about his defective color vision. Therefore, Interviewee E would not disclose his defective color vision to everybody. Self-disclosing his defective color vision may depend on the situation. He is worried about making a negative impression on colleagues and losing career opportunities.

However, it may also be necessary for him sometimes to obtain help from colleagues to work efficiently. Therefore, he seems to have a mixed feeling about the self-disclosure of his defective color vision. Interviewee E concerns about negative impact that his self-disclosure makes on his career path. In this sense, the Interviewee E's concern reflects "academic ableism" (Dolmage, 2017, p. 89). Academic ableism is the way of education to make students feel pressured to self-advocate their needs but also hesitate to do so because they are afraid of making negative impressions on teachers. Interviewee E's concern was mainly outside education institution. Therefore, the study addresses that Interviewee E's concern can be regarded as occupational ableism at the workplace in accordance with the concept of academic ableism. The people with color vision needs may feel the same pressure as they do in education at their workplace so that they tend to choose self-enclosure of their needs. In this sense,

the occupational ableism the study addressed may enforce color vision needs at workplaces to remain invisible.

As Interviewee C and E disclosed their defective color vision to friends and colleagues, Interviewee D and B also did the same. According to Excerpt D4 (see Appendix D), Interviewee D told his defective color vision to his colleagues when he accidentally chose a brown font color instead of a black one to make an entry in a shared Excel file. Although he did not realize his mistake by himself, his senior pointed out it. After making the mistake, he said he started to tell colleagues about his defective color vision.

Accordingly, Interviewee B worked at a cram school for his part-time job. According to Excerpt B4 (see Appendix B), Interviewee B told his defective color vision to only students who he built close relationship with. Just the same as the other interviewees, Interviewee B disclosed his color vision only to close students who he taught for a long time. He disclosed his color vision to his students in order to efficiently teach his students.

The self-disclosure of defective color vision became a common strategy for the young generation of people with defective color vision to improve relationship and work efficiently under the optionalized school color vision testing. On the other hand,

they sometimes are afraid of making negative impressions on colleagues by disclosing their color vision needs at their workplace. In this regard, there seems to be an ambivalent feeling between disclosure and hiding of defective color vision among the younger generation. The ambivalence regarding self-disclosure reflects occupational ableism in which the people concerned feel pressured to self-advocate their needs. However, they may also remain silent due to the concern about making negative impressions at their workplace.

In summary, Fujita's notion of maneuver technology remains effective under the optionalized school color vision testing. The technology of maneuver on Fujita's account was even reinforced in a way that the people concerned with defective color vision feel necessary to advocate their needs. On the other hand, the technology of Fujita's notion of maneuver was practiced through hiding their needs from whom they do not feel close to. People with defective color vision seem to be concerned about making negative impressions particularly at workplace. In consequence, the optionalization of school color vision testing discursively constructed the ambivalence of Fujita's notion of maneuver technology between the disclosure and enclosure of color vision needs. The ambivalence of Fujita's notion of maneuver technology reflects occupational ableism which the study addressed in accordance with Dolmage's notion

of academic ableism. The occupational ableism the study addressed is another form of ableism through which people with special needs feel pressured to advocate their needs at their workplace.

5.3. A Bio-power Analysis of Notion of Color-blindness as Self-advocacy of Color Vision Needs

Thoroughly reviewing the findings of life story interview, this section shed light on the way in which notion of color-blindness has been shifted from failing the Ishihara test towards self-advocacy of color vision needs. Under the optionalized school color vision testing, hierarchical observation was discursively practiced through Fujita's notion of tableaux technology by parents at home. In consequence, the people concerned became self-aware of their defective color vision within daily life. Accordingly, normalizing judgment was discursively practiced through the combination of Fujita's notions of exercises technology and maneuver technology. Fujita's notion of exercises technology was practiced by self-examination and online color vision testing. Fujita's notion of maneuver technology was practiced by the strategic self-disclosure of defective color vision. As a result, hierarchical observation and normalizing judgment technologies are discursively practiced together to construct the normalizing gaze technology, through which disciplinary power is discursively exercised at defective color vision.

Accordingly, bio-politics of the population technology was also displaced from school color vision testing due to its optionalization. Since 2003, there have been no official statistic records regarding students with color vision defects. However, the population of people with defective color vision is still managed through another technology, called universal design. Since Color Universal Design Organization was established in Japan in 2004 (Color Universal Design Organization, 2019), the number of local governments including cities and prefectures which employ color universal design concept in the city planning have risen.

Color universal design is a design concept which standardizes the color use for various products which the people with defective color vision can easily use. The design concept follows the simple criteria of three rules as follows:

a) Choose color schemes that can be easily identified by people with all types of color vision, in consideration with the actual lighting conditions and usage environment;

b) Use not only different colors but also a combination of different shapes, positions, line types and coloring patterns, to ensure that information is conveyed to all users including those who cannot distinguish differences in color;

c) Clearly state color names where users are expected to use color names in communication. (Color Universal Design Organization, 2019, English Pages)

According to Color Universal Design Organization (2019), many public buildings and facilities including university and hospital also have adopted color universal design. As of 2019, there are 21 local governments have issued official guidelines regarding color universal design (Color Universal Design Organization, 2019). In addition, there are various color universal design products available in the market (Color Universal Design Organization, 2019).

In this regard, the population of people with defective color vision are targeted by local government policies and company marketing. Therefore, bio-politics of the population remain active at people with defective color vision in a way that they are targeted for improvement and development of accessibility to social resources. Therefore, coordinate power is discursively exercised on people with color vision defects through the technology of the regulations of the population under the optionalized school color vision testing. Consequently, bio-power remains exercised over people with defective color vision after Amendment 2003.

In summary, the anatomo-politics of body and bio-politics of the population are practiced together to discursively exercise bio-power over bodies of people with color

vision defects under the optionalization of school color vision testing. In consequence, the notion of color-blindness is discursively transfigured into color-blindness as self-advocacy of color vision needs. The same notion of color-blindness is reflected on the analysis of collected life stories of the younger generation of people with defective color vision. They choose the way to disclose their color vision needs. The strategic disclosure reflects the notion of color-blindness as self-advocacy of color vision needs under the optionalized school color vision testing. Therefore, students' bodies and color vision are continuously targeted for discursively exercising bio-power. The students with defective color vision, who fail the Ishihara color test, are enforced to become aware of their capabilities and self-advocate their color vision needs. As a result, the strategic self-disclosure of defective color vision seems to correspond with the notion of color-blindness as self-advocacy of color vision needs. In this regard, the notion has been discursively constructed through the strategic self-disclosure of defective color vision under the optionalization of school color vision testing.

5.4. Discussion: The Birth of Strategic Model of Color-blindness

Bio-power is discursively exercised through the anatomo-politics of body of people with color vision defects and the bio-politics of the population of people with color

vision defects under the optionalized school color vision testing. The notion of color-blindness has been discursively transformed from failing the Ishihara test towards self-advocacy of color vision needs under the optionalization. This entails a change in the way which the people concerned disclose their defective color vision. Thoroughly examining life stories of the younger generation of people with defective color vision, the study highlighted that the people concerned strategically choose to whom, when, and where they self-disclose their defective color vision. The self-advocacy of color-blindness among the younger generation seems to be a strategic option to live better in society. Therefore, depending on the situation, the younger generation of people concerned informs other people about their color vision needs.

Considering the previous generation of people who grew up with mandatory school color vision testing, they used to hide their defective color vision. They never intended to disclose their defective color vision. However, the younger generation who grew up under the optionalized school color vision testing tends to self-disclose its defective color vision in order to communicate smoothly and work efficiently. The optionalization of school color vision testing reflects a shift from the enclosure of defective color vision towards the strategic self-disclosure. In this sense, a strategic

model of color-blindness is discursively formed under the optionalized school color vision testing.

This strategic model of color-blindness seems to correspond to what a disability studies theorist Akikaze (2013) called as “identity game regarding disability certificates” (p.77; author’s translation). Akikaze (2013) implied that people with mild disabilities choose when and where they disclose their special needs. Akikaze (2013) examined life histories of twenty-one people with mild disabilities in light of disability studies. One of the stories was told by a woman with an internal disease. She has a grade 1 disability certificate, which makes her eligible for a discount of public transportation. However, she said she would facilitate the privilege only when she is alone or with her husband. However, she would never do with her friends. She is concerned about negative impact on her social image as well as taking advantage of the privilege unless it is necessary for her to accompany a helper to take public transportation. In this case, the interviewee with an internal disease strategically self-discloses her needs depending on the situation, and the relationship with the companion. Although Akikaze (2013) did not include people with color vision defects in her interview subject, her research finding came across the strategic self-disclosure of defective color vision that the study addressed.

The strategic self-disclosure of defective color vision is supported by positive intensions of the people with defective color vision to improve themselves and obtain a better outcome. For example, Interviewee C disclosed his defective color vision to his colleagues in order to work efficiently with them by improving relationships (see Appendix C). In addition, Interviewee E also self-disclosed his defective color vision to his colleagues at his part-time job (see Appendix E). His intention was to efficiently complete the task he was given. Interviewee B also disclosed his defective color vision to his close students at his part-time job in order to efficiently teach them (see Appendix B). Accordingly, Interviewee D disclosed his defective color vision to his colleagues at his office after he became aware of his unique color vision (see Appendix D). His intention was to obtain a better outcome by improving efficiency and cooperation of his team. As a result, all of the interviewees disclosed their defective color vision to others in order to improve themselves, relationships, and work efficiency. In this sense, the self-disclosure of color-blindness entails both technologies of enforcing self-advocacy and allowing resistance.

The practice of self-disclosure of defective color vision addresses the "arts of existence" (Foucault, 1990b, p. 10). Foucault's notion of "arts of existence" (Foucault, 1990b) is the intention and voluntary actions to change and improve oneself in order to

live better. Fujita (2003) argues that Foucault's notion of arts of existence addresses the source of efficacy of Foucault's notion of strategy. Foucault's notion of strategy can increase its efficacy of fluidizing Foucault's notion of tactics (Fujita, 2003). Accordingly, Fujita (2003) asserts that Foucault's notion of strategy entails both the strategy of power and the strategy of confrontation. Fujita's notion of strategy of power is to maintain the way in which Foucault's notion of power is discursively exercised. Instead, Fujita's notion of strategy of confrontation is to counteract Fujita's notion of strategy of power. That is resistance against power within power. These strategies are intertwined to constitute Foucault's notion of power.

In this sense, the notion of strategy in the strategic model of color-blindness reflects Fujita's notion of strategy of confrontation. The self-disclosure of defective color vision is a source of Fujita's notion of strategy of confrontation in which Foucault's notion of bio-power is discursively exercised. Akikaze's notion of strategy also corresponds with Fujita's notion of strategy of confrontation. Akikaze (2013) shed light on a strategic self-disclosure of her interviewee with an internal impairment by examining the way she hesitated to disclose her disabled body by taking advantage of disability discount in public. Akikaze's interviewee is one example of people with disabilities who strategically choose self-disclosure of their disabled body.

Akikaze (2013) shed light on the construction of strategic model of mild disabilities including an internal impairment. Color-blindness is an example of mild disabilities. Therefore, the strategic model of color-blindness contributes a new insight into the way in which the social model of disability can deconstruct impairment, which is the premise of defining disability, in theory. In this sense, the strategic model would further develop the social model of disability by theoretically incorporating the restriction that people with disabilities experience.

Therefore, this chapter contributes not only to better understanding of life courses of people with mild disabilities, but also to implicating incorporation of color-blindness in the domain of disability studies. Furthermore, the strategic model of color-blindness allows us to observe from the third person point of view the existence of dichotomous discourses regarding school color vision testing between the medical and the social model under the optionalized school color vision testing. In this regard, the recent revival of mandatory school color vision testing discourse only reflects the ableism notion of color vision in the optionalized school color vision testing. Consequently, the strategic model of color-blindness implies that the following research should listen for the hidden voice of people with defective color vision without the mandatory school color vision testing experience.

CHAPTER SIX

CONCLUSION AND IMPLICATIONS

This chapter elaborates on the findings of the study and the implications of the study. The first section of this chapter will answer the four research questions that the study addressed in the first chapter. Thoroughly reviewing the research questions, the first section will conclude the discussion of the study by highlighting the findings of the study. The second section, accordingly, will address the implications of the study including research implications of the study and social implications of the study. The second section will conclude with addressing significance and transferability of the study. In closing, this chapter elucidates the contribution of the study to the areas of study and society at large.

6.1. Conclusion

This section further discusses the findings of the study in order to conclude the discussion of the study. This section, therefore, intends to answer the following research questions which were previously addressed in the first chapter. To restate them, first, how the notion of color-blindness in school color vision testing has been discursively

constructed and transformed in Japan. Second, how the debate in 2003 regarding the abolition of mandatory school color vision testing was theoretically framed and different from the increased debate in 2014. Third, how the experience of school color vision testing has been changed from the mandatory testing through the optional testing. Fourth, how the social model of disability can be theoretically developed so as to incorporate color-blindness and school color vision testing as a possible theme of disability studies in education.

The first question I asked was how the notion of color-blindness in school color vision testing has been discursively constructed and transformed in Japan. In order to answer the first question, the findings of previous chapters need to be briefly reviewed. Chapter three explored the way in which the traditional notion of color-blindness as failing the Ishihara test was discursively constructed through the establishment of school color vision testing. The traditional notion of color-blindness was underpinned by the medical discourse of color-blindness in which bio-power was exercised through various technologies.

Accordingly, chapter four highlighted the establishment and theoretical background of the mandatory school color vision testing abolition movement. Thoroughly examining Takayanagi's works, the chapter addressed the birth of social

model of color-blindness in the discourse of the abolition of mandatory school color vision testing. The chapter highlighted the way in which the traditional notion of color-blindness as failing the Ishihara test was discursively deconstructed through the mandatory school color vision testing abolition movement, which was underpinned by the social model of color-blindness. In light of Foucault's notion of power, bio-power was discursively exercised over bodies of people with defective color vision, but some technologies underwent changes through the mandatory school color vision testing abolition movement.

Chapter five illustrated the way in which the traditional notion of color-blindness has been shifted through the optionalization of school color vision testing since the enactment of School Health Act Amendment 2003. The life story analysis of the younger generation of people with defective color vision addressed the birth of strategic model of color-blindness, which was underpinned by the notion of color-blindness as self-advocacy of color vision needs. Various technologies underwent changes and displacements under the optionalized school color vision testing. However, bio-power has been discursively exercised over people with defective color vision by the technologies of the anatomo-politics of body and bio-politics of the population.

In conclusion, the notion of color-blindness has been discursively shifted from the notion of color-blindness as failing the Ishihara test towards self-advocacy of color vision needs. The shift of notion of color-blindness underwent various amendments of school health acts regarding school color vision testing. In accordance with the changes of notion of color-blindness, the discursive formations of color-blindness have been transfigured from the medical model towards the social model of color-blindness. Through the optionalization of school color vision testing, the notion of color-blindness has been discursively shifted from the social model towards the strategic model of color-blindness.

The second question I asked was how the debate in 2003 regarding abolishing the mandatory school color vision testing was theoretically framed and different from the increased debate in 2014. In order to answer the second question, the study must briefly reengage in the current debate regarding school color vision testing which was addressed in the first chapter. In 2014, MEXT (2014b) released a notice and memorandum of school color vision testing, which stated that “school color vision testing must properly be conducted” (author’s translation). Although school color vision testing was optionalized in 2003, the official statement was regarded as an official support for revival of school color vision testing by the mandatory school color vision

testing abolition movement. In this sense, they argued that school color vision testing would be “all pain, no gain” (Nihon Shikikakusabetsu Teppai no Kai, 2019, p. 3; author’s translation). On the other hand, supporters of school color vision testing argued with a survey of a very large sample size in which ophthalmologists concluded that “it is important for students to become aware of their color vision to choose a career” (Japan Ophthalmologist Association, 2013, p. 2; author’s translation).

In consequence, the notice of 2014 divided discourses regarding school color vision testing into the following two discursive formations of notion of color-blindness. There are discourses of opponents and supporters of mandatory school color vision testing. The opponents’ discourse reflects the social model of color-blindness, which was addressed in the mandatory school color vision testing abolition movement. In contrast, the supporters’ discourse reflects the medical model of color-blindness, which used to underpin the mandatory school color vision testing. The social model of color-blindness was discursively constructed in order to counteract the mandatory school color vision testing. The social model theoretically underpinned the mandatory school color vision testing abolition movement and the school color vision testing optionalization of School Health Acts Amendment 2003.

Since 2003, the notion of color-blindness has been discursively shifted from failing the Ishihara test towards self-advocacy of color vision needs according to the life story analysis of the fifth chapter. In this sense, the opponents' argument does not reflect the way in which the younger generation of people with defective color vision live with their defects under the optionalized school color vision testing. As previously discussed in chapter five, the younger generation seems to strategically choose to self-disclose their needs to close friends and colleagues. Although they are sometimes concerned about making negative impressions by the self-disclosure, disclosing defective color vision became easier and an available option under the notion of color-blindness as self-advocacy of color vision needs.

The notion of color-blindness is discursively underpinned by the strategic model of color-blindness. The construction of color-blindness can depend on the circumstances that the people concerned are surrounded by. Color-blindness is discursively located in-between normal color vision and abnormal color vision depending on the choice of the people with defective color vision. Both supporters' and opponents' discourses regarding school color vision testing do not reflect the strategic model of color-blindness.

The strategic model of color-blindness corresponds with the finding of Akikaze (2013). Akikaze (2013) argues that people with mild disabilities may need to remain positioned between exclusion and assimilation in order to keep seeking a way towards the location of differentiation and inclusion. Akikaze's perspective reflects Ishikawa's account of disability identity as differentiation and inclusion as follows, "if the disabled seek establishment of disability culture without asking for inclusion, no matter what inclusion or differentiation is discussed, the intention of society to exclude the disabled would be hidden or invisible" (Ishikawa, 2000, p. 38; author's translation). Ishikawa's notion of disability is a strategic identity that the disabled people choose in order to survive in society.

Sakakibara (2016) drew from their notion of disability as a strategy in order to further develop his definition of disability for disability laws. Sakakibara's insight into the definition of disability is inclusive differentiation in which the people with impairments find their position in-between differentiation and assimilation as in the same treatment, and exclusion and inclusion in reference to the quadrant diagram of treatment (see Figure 2). Accordingly, it seems that the younger generation of people with defective color vision may find their position in-between differentiation and assimilation as in the same treatment, and exclusion and inclusion. Under the

optionalized school color vision testing, they strategically move from exclusion to inclusion by disclosing their color vision needs.

The strategic model of color-blindness, which is reflected on the life stories of the younger generation of people with defective color vision, suggests another discourse and another way to discuss about school color vision testing. The strategic model of color-blindness underpins the increase of debate regarding school color vision testing between the optional and the mandatory testing. For example, Interviewee D (see Appendix D) did not remember the fact that he took a school color vision testing. As a result, the school color vision testing did not directly influence his career choice. However, after he found out his defective color vision in a recruitment process, he eventually became aware of his unique color vision through a color vision testing and communication with his mother. Once Interviewee D realized his unique color vision, he became strategic of self-disclosing his color vision needs. According to Interviewee D's narrative, he was the only one among the interview participants who probably experienced an optional school color vision testing. However, just the same as the other interviewees, he chose to disclose his color vision needs as soon as he became aware of his color vision needs. In this regard, Interviewee D's life story addresses an alternative

discourse to investigate school color vision testing rather than restricting the discussion to the current debate whether it should be mandatory or optional.

In light of Foucault's notion of power, Interviewee D's self-disclosure reflects Fujita's notion of strategy of confrontation regarding defective color vision. The strategy of confrontation is driven by Foucault's notion of arts of existence, which is reflected on Interviewee D's will to work efficiently and obtain a better outcome. Therefore, Interviewee D's self-disclosure of his color vision needs is an example of Fujita's notion of strategy of confrontation. In this sense, the notion of strategy in the strategic model of color-blindness corresponds to Fujita's notion of strategy of confrontation. The strategic model of color-blindness reflects Foucault's notion of strategy. Foucault's notion of tactics is discursively in transition under the influence of the strategic model of color-blindness. In consequence, discourses regarding school color vision testing are discursively in transition under the optional school color vision testing.

The revival of mandatory school color vision testing after 2014 is an example of fluidization of discourses by Fujita's notion of strategy of confrontation regarding color-blindness. The revival corresponds to the increase of the discussion about school color vision testing whether it should be mandatory or optional. As previously discussed

in the fourth chapter, the optional school color vision testing reflects the social model of color-blindness. The social model of color-blindness entails ableistic notion of color vision in theory. The ableism notion of the social model of color-blindness discursively supports the value of the right people for the right job. In other words, the ableism notion of color-blindness makes it difficult for us to ask why able body or being able to do things is better than disabled body. Because of the strategic model of color-blindness, the resistance to the optional testing, which includes the social model of color-blindness, was reinforced after 2003. Consequently, based on the ableistic notion of the social model of color-blindness, the medical model of color-blindness reappeared in the increased debate regarding school color vision testing after 2014.

In conclusion, the study cannot discuss further about the way in which Foucault's notion of power is discursively exercised through the alternative discourse until sufficient data regarding school color vision testing after 2014 become available in the future. However, it is true that the current debate regarding school color vision testing does not reflect much the younger generation of people with defective color vision who grow up under the optionalized school color vision testing. In this regard, the gap of experience with the mandatory school color vision testing may create a distance or a barrier between the younger generation without the mandatory testing

experience and those who have experienced it including both the opponents and supporters of school color vision testing. Academic and occupational ableism might have made the younger generation invisible and voiceless under the optionalized school color vision testing. Therefore, the younger generation's voice needs to be heard more in society. As Tokugawa (2016) asserts, people in society should listen for silenced voice of others. It may be necessary to build a social system that the younger generation of people with color vision defects can make their voice heard in society.

The third question I asked was how the experience of school color vision testing has been changed from the mandatory testing through the optional testing. Under the mandatory school color vision testing, students with color vision defects used to become aware of their defects at school color vision testing. Mandatory school color vision testing entailed the Ishihara test and became a traumatic experience for the people concerned. Those who were screened out by the test became visible in front of classmates. In this sense, the experience of mandatory school color vision testing used to be traumatic for the people concerned.

In contrast, under the optionalized school color vision testing, most students with color vision defects never experience school color vision testing and only a few become aware of their defects at school. Instead, they seem to become aware of their

defects through the communication with their families, specifically their mothers within daily life. According to the life story analysis of chapter five, mothers have noticed their children's difference in color vision through communication within daily life. Another case was that the interviewee himself claimed his difficulty to see colors on the TV screen. Then, his mother identified the difficulty as a color vision defect. The people concerned tend to experience color vision testing within daily life rather than school or medical examination under the optional school color vision testing.

In conclusion, the difference of experience with school color vision testing created different notions of color-blindness. Along with the changes of school color vision testing, the notion of color-blindness has been discursively shifted from failing the Ishihara test towards self-advocacy of color vision needs. In this sense, it should be noted that the younger generation of people with color vision defects who grew up under the optionalized school color vision testing have the different experience with color vision testing from those who grew up with the mandatory school color vision testing. Although school color vision testing was a trauma for the older generation, it was no more something to avoid for the younger generation. Instead, color vision testing became a strategic option for the younger generation to make a reasonable career choice and work efficiently after Amendment 2003.

Finally, the fourth question I asked was how the social model of disability can be theoretically developed so as to incorporate color-blindness and school color vision testing as a possible theme of disability studies in education. The study of the mandatory school color vision testing abolition movement in chapter four addressed a social model of color-blindness. This finding implies that the social model of disability theory works for the issue of color-blindness in Japan. Furthermore, the social model of color-blindness has been developed from discourses regarding school color vision testing. Therefore, the finding of the social model of color-blindness suggests that school color vision testing can theoretically be incorporated into disability studies in education.

However, the mainstream of disability studies has not paid much attention to not only color-blindness, but also mild disabilities. In this regard, the study argued in the fourth chapter that the premise of impairment in the social model of disability prevents mild disabilities including color-blindness from discussions of disability studies. However, the premise of impairment in theory may be discursively deconstructed and relativized by the discussion of the strategic model of mild disability including color-blindness. The strategic model was developed from the social model of color-blindness through the life story analysis of the younger generation of people with

defective color vision. The younger generation flexibly moves from exclusion to inclusion by strategically self-disclosing their defective color vision in reference to the quadrant diagram of treatment (see Figure 2). Therefore, the strategic model reflects the social model of disability. The premise of impairment can be discursively deconstructed by the application of strategic model because the notion of impairment is in-between impairment and non-impairment depending on the choice of the people concerned.

In conclusion, the strategic model of disability may incorporate color-blindness and school color vision testing into the discussion of disability studies in education. Accordingly, the strategic model may allow mild disabilities to be discussed in the domain of disability studies. The strategic model of disability also overcomes the theoretical limitation that Morris (1993) pointed out by reflecting the individual experience of restriction on the social model of disability. In this sense, the strategic model of disability may further develop the social model of disability and better understanding of people with disabilities.

6.2. Implications

This section addresses the implications of the study by elucidating significance and transferability of the study. In other words, I aim at further discussing what I suggest the

following research can do and what influence in society I believe the study will make. Therefore, this section is divided into the following two implications including research implications and social implications of the study. This section intends to facilitate the way in which the readers relate their research interests to the findings of the study. In closing, the social significance of the study will be addressed.

6.2.1. Research Implications of the Study

The findings of the study address the following research implications. First, the study addressed the importance of further examination of the younger generation of people with defective color vision with a larger volume of interview samples. Second, the study implied diversifying examples of disabilities to the following research. Third, the findings of the study entailed the significance of disability studies perspective to school health studies. Finally, the fourth implication the study addressed is to disclose academic ableism regarding school color vision testing. Through discussing the four research implications of the study, this part intends to highlight transferability of the study for the following research.

First, the strategic model of color-blindness must be further sophisticated by examining a larger and more socially diverse sample volume of the younger generation.

The life story analysis of people with defective color vision who experienced the optional school color vision testing examined only four samples of life story due to its difficulty of finding research participants. Color vision defects tend to be intentionally invisible and hidden by the people concerned themselves from strangers. Therefore, it is often required for the researcher to establish a certain level of rapport with the people concerned before commencing a life story interview. In addition, the interview and transcription tend to be very time-consuming in the procedure. As a result, it is impossible for a single researcher, such as me, to significantly increase the volume and the representativeness of research sample in this research approach.

Furthermore, studies about even more younger students who experienced the revival of school color vision testing after 2014 were not much available yet in the domain of school health studies. It is perhaps because they may be still too young to share their experience in public. The following research regarding this particular generation may address another insight into the shifting of notions of color-blindness under the optional school color vision testing. Therefore, the life story analysis of the younger generation who experienced the optional school color vision testing requires an increase of following researchers with various perspectives in order to sophisticate the strategic model of color-blindness.

In addition, the younger generation of people with defective color vision who experienced the mandatory school color vision testing between 1973 and 2002 needs to be further investigated with a reasonably larger and a representative sample size. As previously discussed in chapter four, school color vision testing was in transition from the annual testing to the reduced frequency of mandatory testing during this period. Therefore, those who grew up under the reduced frequency of mandatory school color vision testing, especially after the mandatory school color vision testing abolition movement was organized in the late 1980s, may reflect some influence of shifting in the way which bio-power was discursively exercised over their bodies. I was not aware of this particular transition period yet when I began the life story analysis of this study. Therefore, I did not include those who experienced the reduced frequency of mandatory school color vision testing in the analysis of this study. As I wrote this dissertation, however, I gradually noticed that there might be another transition period regarding the notion of color-blindness between the late 1980s and 2002. Further analysis of this period may enrich the discussion about the way in which the notion of color-blindness as self-advocacy of color vision needs was discursively transformed towards the abolition of mandatory school color vision testing in 2003.

Earlier studies in the domain of school health studies lack the lived experience of people who grew up during this possible transition period. To complete the analysis, further life story interviews are required. However, due to the difficulty of data collection, I have only managed to start interviewing two participants for a limited period of time. Consequently, I have not collected enough size and representativeness of research samples yet that reasonably represent the population of people with defective color vision who grew up during this possible transition period. Therefore, neither data collection nor analysis has been sufficiently completed yet. However, based on the limited representativeness, the two interview participants seem to have occasionally self-disclosed their color vision needs in different situations. In light of Foucault's notion of power, their life stories, therefore, seem to reflect the influence of deformed disciplinary power which was exercised over their defective color vision. Further life story analysis of this particular transition period will probably confirm the shift of notion of color-blindness from the annual school color vision testing towards the reduced frequency of testing, which I theoretically discussed in chapter four.

This hypothesis suggests the possibility that the transition of notion of color-blindness from failing the Ishihara test towards self-advocacy of color vision needs might be slowly in progress from the 1980s towards 2002. Due to the lack of sufficient

data, however, it is too early for this study to conclude that yet in the discussion. Therefore, the life story analysis of the younger generation also requires further examination of life stories of people with defective color vision who experienced the reduced frequency of mandatory school color vision testing during this possible transition period. An increase of following researchers, who particularly investigate lived experience of those who took the mandatory testing during the reduced frequency of school color vision testing, will help further develop not only the strategic model of color-blindness but also the social model of color-blindness.

Second, it is important for the strategic model of color-blindness to be ambitiously applied to other examples of disabilities. The strategic model of disability was theoretically developed from the close examination of color vision issues. Although the strategic model of disability implies transferability to other mild disabilities, there is not much existing literature available yet in the domain of disability studies. Therefore, the strategic model of disability should be further examined with more diverse examples of disabilities including mild disabilities. This approach allows not only the strategic model to be improved, but also the disability studies researchers to better understand the social construction of mild disabilities. In this sense, the study implies that more diverse examples of disabilities are necessary for the strategic model to be further developed.

Third, the findings of the study imply that school health studies should facilitate more studies of school health and school health exam in light of a social model of disability. The majority of earlier studies regarding school color vision testing has reflected ophthalmological and medical perspectives of color-blindness. Not only color-blindness, but also mild disabilities remain less discussed in the domain of school health studies. Since the number of schools commencing school color vision testing has risen recently (Hara, 2018 Dec.), it becomes important more than before to further develop understanding of educational influence the school color vision testing makes on students.

In addition, issues of mild disabilities in the classroom may require more attention from researchers. According to Akikaze (2013), “65% of people with a disability certificate can be estimated as mild disabilities” (p. 166). The percentage will rise if the estimate counts the number of people who experience inaccessibility within daily life, but do not have a disability certificate. However, school health studies remain blind and deaf to those students with mild disabilities under the traditional medical definitions of students’ health or educational needs. Medical perspectives and social perspectives of school health are intertwined. In this sense, the findings of the study

suggest that school health studies in light of disability studies perspectives are more facilitated in the domain of school health studies.

Finally, the fourth implication the study addresses is academic ableism regarding school color vision testing in Japan. The findings of the study highlighted the birth of notion of color-blindness as self-advocacy of color vision needs under the optionalized school color vision testing. As discussed in chapter five, however, the self-advocacy notion entailed academic ableism in which the people with defective color vision would be required to self-advocate their needs to the teacher. The people concerned become commonly regarded as the professional or being knowledgeable about how to fulfill their color vision needs. Although the students concerned self-advocate their needs to the teacher per request, many of them may not be even aware of how unique their color recognition is and how to improve color accessibility for themselves. It is because majority of them become aware of their defective color vision within daily life under the optionalized school color vision testing. This entails that there may be significant lack of the individual experience of learning about their defective color vision, and how to improve their color accessibility.

As a result of academic ableism, the students concerned may choose silence in the classroom because they can hide their defects as long as they do not talk about it. In

other words, they strategically choose the way they self-disclose their needs. Accordingly, they tend to be afraid of making a negative impression because they are concerned about their evaluation or grades in the same way as the other non-colorblind students are. In this sense, emphasizing self-advocacy of color vision needs may hide learner needs and makes it more difficult for teachers to assess inaccessibility in the classroom.

One way to counteract the academic ableism is to deconstruct superiority of normal color vision to the abnormal according to Hoshika (2013). In other words, disclosing the construct of ableism allows the study to ask a different question in order to challenge the influence of academic ableism. Chapter five elaborated on the deconstruction of ableism by highlighting that the younger generation of people with defective color vision strategically chose self-disclosure of their needs depending on the circumstances. In this sense, the embodiment of strategic model of color-blindness implies that ableism may be discursively deconstructed under the optionalized school color vision testing.

However, the concern about making a negative impression was also addressed in the life story analysis. The study, therefore, successfully highlighted the ambivalence between strategic disclosure and hesitation in the collected life stories. On the other

hand, the study did not fully deconstruct ableism notion through the life story analysis. As a result, the strategic model of color-blindness may still require the further discussion about ableism notion of color vision in theory. In this regard, the study implies the further discussion about academic ableism regarding school color vision testing to the following research.

6.2.2. Social Implications of the Study

The strategic model of color-blindness the study addressed suggests that the location of students with color vision defects can be flexible between the fourth and second quadrant in reference to Sakakibara's quadrant diagram of treatment (see Figure 2). The current location of students with color vision defects is the fourth quadrant where they tend to face inaccessibility in/outside the classroom. For example, Interviewee E in chapter five experienced inaccessibility to the color-coordinating task at his part-time job. Since no individual support was provided, it was impossible for Interviewee E to complete putting color coordinated stickers on rental videos and magazines.

Interviewee E, therefore, decided to disclose his color vision needs. Interviewee E intended to make it easier for himself to ask colleagues for help with the color-coordinating stickers. As a result, the self-disclosure of color vision needs enabled

him to work smoothly at the inaccessible workplace. In this regard, Interviewee E chose to move from the fourth quadrant to the second quadrant where he could receive better treatment in order to be incorporated at his part-time job. In this sense, under the optionalized school color vision testing, the people concerned seem to strategically and flexibly move from the exclusive circumstance to the inclusive circumstance by effectively using the self-disclosure of their defective color vision.

Sakakibara (2016) argued that disability laws should position people with disabilities in the second quadrant by referring them to the autopoietic definition of disability (see Figure 2). The autopoietic definition of disability allows the laws to approach various types of social exclusion including “gender, race, ethnicity, and family status” (Sakakibara, 2016, p. 382; author’s translation). In consequence, Sakakibara (2016) asserts that not only impairment but also exclusion may play a role in the construction of disability. The strategic model of color-blindness that the study addressed corresponds with the Sakakibara’s argument. The people with defective color vision can be enabled in the second quadrant but disabled in the fourth quadrant.

Foucault’s notion of power does not allow me to predict what happens in the future. However, it allows me to become skeptical about what is the norm in society. Accordingly, Sakakibara asserts that “we cannot talk about how to solve a problem

before the problem is identified" (2016, p. 382; author's translation). Therefore, the study intended to help identify the problem regarding school color vision testing in Japan. The study problematized school color vision testing and identified what might be a problem regarding the current debate of school color vision testing. The findings of the study, therefore, imply that the current discussion regarding school color vision testing does not reflect the way in which the younger generation of people with defective color vision live in society today under the optionalized school color vision testing. In other words, the debate regarding school color vision testing should further discuss what system or policy of school color vision testing may better reflect the strategic notion of color-blindness.

In conclusion, the findings of the study imply that a third discourse, which may be regarded as a strategic discourse of school color vision testing, shall be explored in order to further discuss school color vision testing after the increase of its debate in 2014 in Japan. The third discourse is in-between mandatory and optional school color vision testing discourses. The third discourse is a discourse regarding school color vision testing, which strategically moves over the second and fourth quadrant in Sakakibara's quadrant diagram of treatment (see Figure 2). The third discourse reflects the way in which the younger generation of people with defective color vision has been

resistant to the dichotomous school color vision testing discourse in Japan. There are both the discourse supporting the mandatory school color vision testing and the other discourse supporting the optional one in Japan.

As Fujita (2000) asserted, Foucault's notion of power entails the perspective that "power is considered as strategy" (p. 135; author's translation). Power, on Foucault's account, can be exercised through the people who are ruled by rulers in society. In this sense, the people who are ruled are the subject of resistance. Fujita (2002) also argues, Foucault's notion of power implies that "transformation can be caused by the strategic relationship between people who are the subject of action and who fight, resist, and criticize the status quo" (p. 140; author's translation). Addressing the third discourse, which is underpinned by the strategic model of color-blindness, implies an insight into power relations regarding school color vision testing to society. Therefore, the study of third discourse allows Japanese society to discursively shift from the exclusive circumstances towards the inclusive circumstances for people with defective color vision.

According to Fujita (2000), Foucault claimed that "intellectuals are responsible for providing results of analysis of power to the people concerned as an instrument" (p. 141; author's translation). Therefore, the study of the strategic model of color-blindness

implies a different way of thinking about color-blindness as a strategic tool to not only people with defective color vision but also those who are aware and considerate of the people concerned. In consequence, the study may contribute to shifting notions of color-blindness from inability to see the difference between colors towards human diversity of color vision in society.

As Foucault (1972) indicates, the researcher changes through analyzing and writing their thoughts about discursive formations of notions:

> I now know which voice it was I would have wished for, preceding me, supporting me, inviting me to speak and lodging within my own speech. I know now just what was so awesome about beginning; for it was here, where I speak now, that I listened to that voice, and where its possessor is no longer, to hear me speak. (p. 237)

The study of the way in which power is exercised through discursive formations of notions allows me to engage in the transition of notions of color-blindness. In the same way, the study may also engage those who are aware of the issues regarding color-blindness in the transition of notions of color-blindness. In this sense, the findings of the study help society accommodate people with diverse needs including color-blindness.

To summarize, the findings of the study imply a third discourse of school color vision testing, which reflects the perspectives of the younger generation of people with defective color vision. They are not recognized and listened for under the optional school color vision testing. The further discussion of the third discourse entails raising awareness of color-blindness in society. Correspondingly, the insights into the notion of color-blindness that the study addressed contribute a different view of disability to those who are considerate of color-blindness. In addition, the shifting of notions of color-blindness addresses further discussion regarding color-blindness as one of mild disabilities. Therefore, the study also addresses the following question, what influence Act for Eliminating Discrimination against Persons with Disabilities has on people with defective color vision after 2016. Consequently, the study may help people with defective color vision live better in society. In closing, color-blindness is discursively in transition from the exclusive notion towards one of inclusive notions under the optionalized school color vision testing in Japan.

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APPENDICES

Appendix A

A Life Chronology Sheet for Interview Participants with Color-blindness

Age	Year	Family History	Education / Career	Others	Location to live	Historical Incident	Episode regarding color vision defects
0							
1							
2							
3							
4							
5							
・							
・							
・							

Note. This sheet shows only the beginning part of a complete form of life chronology sheet. Accordingly, this sheet was author's translation from a Japanese format which was actually used in the interviews of the study. I added the category of episode regarding color vision defects to the original format. Adapted from *Raifu stoorii bunseki* (p. 25), by T. Okubo, 2011, Tokyo: Waseda Sociological Society. (author's translation)

Appendix B
Excerpts from Life Story of Interviewee B

Excerpt B1

M: でも、どこで自分で、こう［色覚異常］認識したりって・・・？
B: あぁ、自分で認識したのっすか？
M: うん
B: 俺はたぶん、中学、たぶん２年のころとか、そんぐらいで。で、なんか友達ん家で、ゲームやってたんですね。
M: はい
B: で、ゲームを、サッカーゲームだったんですよ、たぶん。サッカーゲームやったときに、ユニフォームの色を決めるじゃないっすか？
M: うんうんううん
B: で、あっ、ユニフォームの色が決められるんっすよ。そのときに、たぶん赤対緑、みたいに設定で、こう、なって。で、いざやるってなったときに、全然わかんなかったんですよ、たぶん。
M: あっ、こうごっちゃ混ぜになって、プレイヤーが。
B: そうそう。そうです
M: へぇー
B: まぁ、友達普通にわかってるぽいのに、俺なんかわかんなくて。で、どんどん、敵も味方もわかんないから、ぜんぜんあれで。
(Interviewee B, May 18, 2016)

Excerpt B1 (author's translation)

M: However, where did you become aware of it [color vision defect]?
B: You mean when did I become aware of it?
M: Yes.
B: I think I was in junior high school, probably in my second year. I was playing a video game at my friend's house.
M: I see
B: I remember we played a soccer video game together. Usually, we get to choose uniform colors, right?
M: Sure
B: So, we chose uniform colors. Then, red and green uniforms were chosen. Therefore, I totally could not tell the difference between two teams within the game, I guess.

M: You mean, both teams' uniforms were mixed? I mean players.
B: Yes, that is right.
M: I see
B: Although it seemed like my friends could tell the difference no problem, I could not. Then, I could not play the game at all because I could not see the difference between my team's players and the other team's players.
(Interviewee B, May 18, 2016; author's translation)

Excerpt B2

B: そこで、なんかアレ？って思って。まぁ、そこは、普通に、それで終わったんですけど。で、次、たぶん家でテレビとか見てるときに、・・・テレビとか見てるときに、なんか、けっこうテレビ、色が変わっていくみたいなのあるじゃないですか？なんていうんでしょう？マジック・・・なんか、絵の一部変わっていって、みたいな。そういうので、色が変わったやつとかも・・・
M: えっ、どういうやつだろう？クイズみたいな？
B: そう、クイズ番組とか、みたいなので。なんか、どこが違うでしょう？みたいな感じのやつで。
M: あぁ～　右と左の絵の違いとか？
B: そう、そう。で、そういうので、色とかがあって。で、そういうのわかんなんくて、で、親に、なんかわかんねーんだけどって、感じで。まぁ、前のそういうゲームのやつとかもあったから、なんかわかんねーんだよねっつたら、たぶん爺ちゃんが色弱だから、そっちの遺伝あんじゃない？みたいに言われて、そこで初めて、色弱なんだっていうのを、が、わかったみたいな感じっす。
(Interviewee B, May 18, 2016)

Excerpt B2 (author's translation)

B: Then I thought there must be something different between my friends and me. Well, that was it. Some other time, I remember probably I was watching a TV show. The show used different colors time to time. How can I say, it might be similar to magic? They showed me two pictures. One of the pictures was partially different in color and I was supposed to find out the difference between them.
M: What was it like? Was it some kind of quiz show?
B: Yes, it might be one of those quiz shows, asking audience where was the difference between two pictures?
M: I see. … like difference between right and left pictures?

B: Right. Then, some differences were colors. I could not see the difference. Then, I told my parents that I could not tell the difference between colors. I guess I was still wondering what happened at the video game. My parents told me that it might be weak color vision inherited from your grandfather. It was my first time to realize that I was a weak color vision.

(Interviewee B, May 18, 2016; author's translation)

Excerpt B3

B: 就職、うちの、まぁ去年院生いて、で、その人、JR に就職したんすよ。

M: はいはいはい

B: で、うちの研究室、結構 JR 東日本に、就職する人多くて。で、そこで聞いたのが、JR 東日本とかだと、色弱のテストも、あるらしいんですよ。

M: あっ、その先輩がやったんだ。

B: そうっす。

M: それは、あれ、運転職じゃなくて？

B: 運転職とかじゃなくて、普通に JR 東日本に入る時に、多分色弱テストっていうのを、・・・多分やるんすよ。

M: えぇ〜

B: だから、そういうところは受けらんないなとは思いました。

M: あぁ〜思ったんだ〜うふふふふ

B: ふふふ

B: だから、進路でいうと、一番そこが、今困ってますかね。そこ、まぁそこまで困ってはないですけど。就職考えてないから。

M: あっ、行きたかったんですか？JR 東日本に

B: いや、別に行きたくはないけど、やっぱり道、幅広い方が良いじゃないですか？

M: うんうんうん

B: 就職の道として。だから、一本絶たれたなっていう感じ。狭くなっちゃったな、という感じ。

(Interviewee B, May 18, 2016)

Excerpt B3 (author's translation)

B: Regarding job hunting, senior of my seminar found a job in JR.

M: Sure.

B: Many graduates of my seminar found a job in JR East before. They told me that there was a color vision testing in the selection process.

M: You mean, that senior seminar member took the color vision test?
B: Yes, he did.
M: Did he apply for the train driver position?
B: No, he did not. I guess all the applications would take a color vision test in the selection process.
M: Really?
B: Therefore, I thought I would not be able to apply for that job opening.
M: I see. You thought so, hahahah
B: hahahah. So, I guess it may be the most troublesome for me regarding career planning. Well, it is not that serious yet because I have not started to think about it at all.
M: Did you want to work for JR East?
B: Not really, but I think it would be better if I have as many options as possible.
M: Right.
B: So, I felt one of many options was closed for me. I lost one option of my career.
(Interviewee B, May 18, 2016; author's translation)

Excerpt B4
M: どんな時に、言おうかなと思ったとか、あるいはどんな時に、言わなくてもいいかなって。なんかちょっと、思い当たるものって、ありますか？
B: だから、そういうところだと、初対面というか、あんま知らない人とかには、そんな喋ろうとは思わないですね。だからもう結構・・・
M: うん、それはどうして？
B: それは、別にそんなに自分が、自分がそんなに・・・、なんか障害って、そこはもうやっぱり障害は障害だから、
M: うん
B: 初めての人に、そういう自分の障害、話すのは嫌だなっていう部分はあるかもしれないですね。
M: うん
B: だから、もう結構仲良くなって。また、生徒の例で言うと、結構何回も見てて、気が知れてるって言うか。そういう感じの子には、たまに丸つけしてて、わかんないときとか、先生わかんないんだよねー、的な感じで言うこと、言ったことはありますね。
(Interviewee B, October 17, 2016)

Excerpt B4 (author's translation)

M: When did you feel you should tell your color vision, or you should not?

B: Well, considering situation, to students who I meet first time, or I do not know well yet, I would not tell my defective color vision.

M: Why do you think so?

B: It is a disability after all.

M: Sure.

B: It may be because I feel uncomfortable to talk about my impairment.

M: I see.

B: So, those who I felt close to, or students who I taught many times before, who I knew well, I told sometimes that I might get confused between red and black strokes.

(Interviewee B, October 17, 2016; author's translation)

Appendix C

Excerpts from Life Story of Interviewee C

Excerpt C1

M: まず最初に、どんな状況でお気づきになったかを聞きたくて。一番最初の記憶って、どんな感じですか？

C: まぁ、母親が気づいたみたいです、最初。

M: 何歳ぐらいの頃ですか？

C: 多分、そうですねー・・・３、４歳ぐらいだったかと思うんですけど。

M: はい、母親・・・

C: 本、絵本か何かを読み聞かせしてる時に、ちょっと明かりの少ない部屋だと、黄緑とかオレンジとかがわからない。

M: へぇー・・・これは、なんかそのお母さんが読み聞かせしてる時に、色の・・・

C: 色の話をしてて、なんとなく気づいたみたい、ですね

(Interviewee C, August 4, 2018)

Excerpt C1 (author's translation)

M: First of all, I would like to know how you became aware of your unique color vision. Could you tell me about your first memory of defective color vision?

C: Well, I heard that my mother realized it first.

M: How old were you?

C: Well, I guess… three or four years old.

M: I see, your mother …

C: Book, when she read stories to me, she realized that I could not see yellowish green and orange.

M: I see. That was, …. When your mother was reading stories, then colors…

C: Yes, it seems she somehow figured out that.

(Interviewee C, August 4, 2018; author's translation)

Excerpt C2

C: ただ、・・小学校の３年か４年くらい。まぁ、中学年くらいの頃に、一回眼科に行って、

M: うん

C: 本当にその、色の違い、わからないところがあるのかな？みたいなのを・・・

M:へえー

C: 確認したことがあるので、おそらくその時に、・・・
(Interviewee C, August 4, 2018)

Excerpt C2 (author's translation)
C: When I was in third or fourth year of elementary school, I guess in the middle grade, I went to see an ophthalmologist.
M: I see.
C: I guess it was to find out if I really could not see colors.
M: Is that so?
C: Yes, we confirmed that…probably that time.
(Interviewee C, August 4, 2018; author's translation)

Excerpt C3
C: 高校も、ほとんどなかったんですけど。あの、スマホとかが出てきてたじゃないですか？
M: おぉーそっかそっか。そういう時期ですか・・・
C: で、えーと・・・
M: 持ってましたか？
C: 持ってましたね。それで普通に、なんかネットでそういう色の認識の違いがわかる、みたいなテスト・・・
M: あーありますね！
C: あるじゃないですか？なんかああいうのは試して、なんかやっぱ結果が違うねーみたいな話を、友達と一回くらいしたことがありますね
M: あっ、友達と、やったんですか？
C: あっ、友達とやりました。普通に。なんか、俺、色の見え方違うらしいんだけどって言って、
M: へえーー
C: それで、そのスマホのやつとかやって。・・あっ、確かに違う・・・
(Interviewee C, August 4, 2018)

Excerpt C3 (author's translation)
C: In high school, smart phones started to be popular.
M: I see. I remember those years.
C: Then, umm
M: Did you have one?

C: Yes, I did. Then, I found an online color vision test that would tell you your difference in color recognition.
M: I see, yes there are many.
C: Right? I tried one of those, and once I talked with my friends that my color recognition was surely different from them.
M: You mean, you took the test with your friends?
C: Yes, I did. It was quite natural that I told them that it seemed like my color vision would be different from others.
M: I see.
C: Then, I took the test with my smart phone, and they realized how different I saw colors.
(Interviewee C, August 4, 2018; author's translation)

Excerpt C4

C: 見え方が違う、多分オレンジとか、うん、緑とか。暗いところだと、・・ちょっとあんまり違いがわからない、みたいな・・・話を、ふとした雑談の中で、・・・
M: うん、・・友達と？
C: ええ・・・
M: ふとした雑談の中で・・・なんかその、そういう事、結構あるんですか？時々
C: ええ、ええ
M: 自分の見え方ちょっと違うらしい、みたいな話をするタイミングって。
C: そうですねー・・・
M: 割と、この友達は、すごい親しい友達なんですかね？
C: まぁ、高校、高校だったんで。そうですね。
M: ふーん
C: なんか、その（笑）、うちあ、打ち明けたとか、そういうんではなく
M: うんうんうん
C: 普通に、会話の中で、そういう話をしたのは、覚えてますね。
M: 自然に？
C: 自然に。
M: 何か目的があったわけではなくて？
C: 目的は、なかったと思いますね。
M: ただ単に、話題として？
C: 話題として
M: へえー

C: うーん
M: で、なんかこう。その、で、なんか［インターネットで］調べて
C: えぇーみたいな
M: あっ、みんなえぇー？
C: 彼らみんなえーみたいな感じですよ
(Interviewee C, August 4, 2018)

Excerpt C4 (author's translation)

C: My color recognition may be different from others. Orange and green are sometimes indistinguishable for me in the dark. In small talks, I shared my difference and difficulty regarding color recognition.
M: Sure, you mean with your friends?
C: Yes.
M: In small talks…by the way, do you often talk about difference of your color recognition?
C: Yes, I do.
M: Are these friends you shared your color vision needs with close to you?
C: Yes. We were close friends in high school.
M: I see.
C: It was nothing like confessing my secret.
M: Sure.
C: I remember that we talked about my color recognition under a quite natural atmosphere.
M: Natural?
C: Yes.
M: Did you have any intention?
C: I think I did not.
M: So, it was only a topic of conversation?
C: Right, just a conversation topic.
M: I see.
C: ummm
M: Then, you searched for color vision test pictures on the internet?
C: Wow…
M: You mean, they all said wow?
C: Yes, they sounded like surprised.

(Interviewee C, August 4, 2018; author's translation)

Excerpt C5

C: それは、学生団体のパンフレットとか、ポスターとかを作っていたので・・・

M: へぇー

C: その時も多分、そういう色の話とかはしていると思います

M: 結構あれですか、割とそういう作成をする時には、割と、気づいた時に、話すような感じなんですかね？話を聞いてると・・・

C: そうですねー

M: だいたい、その俺色の見え方が違うんだよ、みたいな

C: 一応どっかのタイミングで、いうようにはしてますね

M: へぇー。だいたいいつもおんなじですか？見え方が違うらしいよー

C: あっ、そうですね。色弱？なんか、オレンジとか黄緑とか、の、その暗いところだと見えにくい。とかがあるから、基本的にはセンスがないはずなので、なんか思ったことがあれば、全然気軽に言ってね？みたいな

で、基本的には、センスがない、

M: グフフフ（笑）

C: はずなので、異なることはあっても・・・一応ちょっと書いておきますね

M: その誰かが、人の作ったものには指摘するのは難しいだろうなっていうことから、それがいいやすいようにする、まぁなんかきっかけの一つに、そういうものあげたりとか。

(Interviewee C, August 4, 2018)

Excerpt C5 (author's translation)

C: Well, I used to make brochures and posters for student groups.

M: Sure.

C: I think I also talked about my color recognition with the group members on that occasion.

M: Do you usually talk about your color recognition when you work on design project like that?

C: I think so.

M: Perhaps, you tell them that my recognition may be different?

C: I intend to tell project team members my color recognition when it is appropriate.

M: I see. Do you use the same phrase every time? … for example, I see colors differently.

C: Yes. Weak color vision? I tend to find difficult to see orange and yellowish green in the dark. Therefore, I basically do not have sense of color. Please feel free to tell me if you find anything strange.
M: Basically, no sense…
C: Hahahah
M: Therefore, please feel free to… let me take notes of it now.
C: I believe it must be difficult to point out products that someone else makes. Therefore, I hope that my color vision talk may make it easier for them to point out my error of color use if any.
(Interviewee C, August 4, 2018; author's translation)

Excerpt C6

M: どうですか、大学の時とか、就職されてからとか・・・
C: まぁ、可能性として、色に関わることって、ゼロじゃないんで、じゃないんですよね、ウチの会社って。美術館とかも持っていて、関わる可能性があるので、会社では、そんなに積極的には言わないようにはしてますね。
M: 積極的には言わないっていうのは？
C: まぁ、いろんな、見方をする人が、おそらくいると思うので・・・
うん。会社では・・・いろんな味方・・・じゃ例えば、あんまり、色とかデザインとか、そういうところに関わるような仕事には置かないようにしようとか。そういう判断がされるのは、あまり良くないかなと
(Interviewee C, August 4, 2018)

Excerpt C6 (author's translation)

M: What about university, or office?
C: Well, it is possible for me to be required to properly use color in the company I work for. They have art museums. Considering the possibility, I try not to talk positively about my color vision at my office.
M: What do you mean by that?
C: Well, I think some colleagues may have different opinions about it.
M: I see. Some colleagues may have different opinions about it…
C: There may be a risk that some colleagues may make a negative judgment on me based on my color vision so that they may get critical about me working at office where color design or any task relating to color is part of work.
(Interviewee C, August 4, 2018; author's translation)

Appendix D

Excerpts from Life Story of Interviewee D

Excerpt D1

D: 色覚に関してのことっていうと、どうやら私、２００４年に、小学４年生のころから、色覚検査を受けてたみたいなんですよ。たぶん、わたしが、わたしの世代が、色覚の、なんていうんでしょう、１００％実施じゃなくなった一番最初の年なんですけど、あの、自由になった年。

M: うんうんうん

D: どうやらたぶん、親の意向かなんかで、なんか私は受けてた、みたいです。

M: へぇー、それは

D: 記憶はあるんですよねー

M: 記憶はありますか？

D: はい

M: それは、なんかあのー聞いたんですか？お母さんとか、お父さんとか、ご両親に？

D: 聞いたっていうのは？

M: あの、どうして受けたのー？みたいな・・・

D: いや、特に

M: そうじゃなく、なんとなく、記憶で・・・

D: まったく覚えてないっすね。ただ、保健室で色覚検査を、なんらかの機会でうけたなっているのは、覚えてるんですけど・・・まぁでも、それをわざわざ受けたっていうことは、まぁ親の意向なんだろなっていうこと

(Interviewee D, July 14, 2018)

Excerpt D1 (author's translation)

D: Regarding color vision, it seems like I had a color vision test in 2004 when I was in my fourth year of elementary school. Probably, I am the first generation that color vision testing became optional.

M: Sure.

D: According to my parents, it was their intention for me to take the color vision test.

M: I see.

D: I remember it.

M: You remember that?

D: Yes

M: Did you hear that from your parents?

D: What do you mean by that?
M: I meant that you must have asked your parents why you took the test?
D: Not really.
M: I see. So, it was just your memory.
D: I do not remember anything. I only remember that I took a color vision test at Yogo teacher's office. I thought it must have been my parent's intention because school color vision testing was supposed to be optional by the time.
(Interviewee D, July 14, 2018; author's translation)

Excerpt D2

M: とくに・・・ご両親には・・・ご両親の意向かもって言ってましたけど・・・ご両親にはこの結果とか・・・
D: は、そう、後から聞いた話なんですけど、親はこれでやっぱりその、異常があるっていう風な結果を聞いたって言ってました。
M: あ、そうですか
D: はい
M: これ、ちなみに後からって言ってましたけど、いつぐらいにお聞きしました？
D: ２０１７年、１６、１６年か
M: ２０１６年に聞いたと、ということはそれまで全然、この結果とか・・・
D: そうですね、まず全く・・・
M: あ、そうですか
D: ２０１６年に就職活動の時に、検査をしたんですけど
M: あ、そうですか！？へぇーちょっと、それは就職活動、会社の入社の時ですか？
D: あ、そうですね
M: ２０１６年、え、えと学校でやったんですか？
D: いや、えーと就職試験で、鉄道会社か、鉄道会社の就職試験で、結果を教えてもらえなかったんで、ただちょっと思わしくなさそうな反応だったんで、
M: え、へぇー
D: で、自分で、再検査、再検査というか病院に行って、やってもらったと・・・
M: あっ、そうなんですか
D: はい
M: そのあとに？
D: はい
(Interviewee D, July 14, 2018)

Excerpt D2 (author's translation)

M: You mentioned that you had a color vision test because of your parents' intention. Did they know your result?

D: Yes. Although it was much later, I heard from my parents that they were told that I had defective color vision after the test.

M: I see.

D: Yes.

M: By the way, when did you hear about the test result?

D: It must be 2017 or 2016…

M: It means you never heard of your test result until recently.

D: Yes, I never did.

M: I see.

D: In 2016, I had a color vision test during my job hunting.

M: Really? Was it required for job application? Or you did it at the time of hiring?

D: Yes.

M: In 2016, where did you take the test? Perhaps, school?

D: No, it was at job interview of a railway company. Although my test result seemed not good enough, they did not tell me the result.

M: I see.

D: So, I went to see an ophthalmologist for follow-up or retaking color vision test.

M: Is that so?

D: Yes

M: After the interview?

D: Yes

(Interviewee D, July 14, 2018; author's translation)

Excerpt D3

D: まぁ、結局あの、覚えてなかったんで、私の場合、［学校色覚検査］あったとしても、なかったとしても、あんま関係なかったんですよね、多分。

M: うんうんうん

D: まぁ、これは完全に親の問題ですけど、

M: うんうん

D: で、その結果を伝えるでもなかったので、多分親は知っていたのに

M: うんうんうん

D: うん、なので、私としては、・・・私はあんまり、個人的には関係なかったってことですけど・・・

M: うんうんうん

D: まぁ・・・ある程度、は、は、早いうちにわかってるなら、わかっといた方がいいだろうなとは、思いましたけどね・・・

M: それは、どうしてですか？

D: うーん、やっぱちょっと、就職、就活の時に、やっぱ、初めて知っちゃうってなると、やっぱ、その時、ものすっごい忙しくて、やっぱ面接とか、ものすっごい詰まってて・・・ちょっとテンパるって言ったらいいか

(Interviewee D, July 14, 2018)

Excerpt D3 (author's translation)

D: So, in my case, it [school color vision testing] was not much to do with my career planning.

M: Sure.

D: However, I thought it might be better to know my defective color vision as early as possible if it is possible.

M: What makes you think so?

D: Well, I guess it might be too much to deal with if you know it in the middle of your job hunting because you are very busy with job interviews, and other things.

M: Right.

D: How can I say, it might be disappointing if you had many job interviews, but you did not get any offer because of color vision requirements. In my case, I was seeking for a regular full-time position, but what if train driver or blue-collar work?

M: Sure.

D: I might have to change my career planning, right?

M: I see.

D: If that was the case, it would be troublesome.

(Interviewee D, July 14, 2018; author's translation)

Excerpt D4

D: まぁ、その部署の人には、ここの時には、やっぱ、あっ、ちょっと私、あんまりちょっと色見分けつかない、色覚異常を持っているみたいなんで、みたいなことは・・・

M: あっ、言ったんですか？

D: はい

M: へぇー

D: もしかしたら、そういうので、ちょっと区別つきずらくなってるかもしれないですーって。

(Interviewee D, July 14, 2018)

Excerpt D4 (author's translation)

D: Well, to only the colleagues, I told that I may not see difference in certain colors because of my defective color vision.

M: Is that so?

D: Yes.

M: I see.

D: I said it might be my defective color vision to make certain colors indistinguishable for me.

(Interviewee D, July 14, 2018; author's translation)

Appendix E
Excerpts from Life Story of Interviewee E

Excerpt E1

M: まずそうだな。なんでもいいんですけど、色覚異常に関して、自分がこう、まぁ時系列の方がいいと思うので、自分が一番最初に気づいた時って、覚えています？

E: 気づいた時？今覚えている範囲だと、前話した感じで、青い電車の模型みたいなやつを、電気消して暗くしたところだと、緑色に見えるみたいな。

M: ははは、なん歳ぐらいとか覚えてる？

E: それでも結構ちっちゃかったんで。４、５、くらいだと思います。４歳、５歳くらい。

M: へぇー電車の模型か、電車の青い模型。電気消すと緑か。

E: で、それを親に。そういう時って、何かあると、すぐ報告したがるじゃないですか？

M: あっ、緑みたいな？

E: これすごいよっ！みたいな感じで。

M: ははは（笑）

E: それで、緑に見えるよって、教えてあげたら、・・えぇそうかなーみたいな［親の反応］、微妙な反応が返ってきたのを覚えてますね。

M: あっ、そうなんだ。へぇー、その時何か言われたことはないの？お母さんに

E: そうかなーみたいな。ははは（笑）、あんま親は同意してる感じはしなかったですね。

M: はぁー

M: え、じゃあ、実際に自分が、そうだな色の違いが、他の人と違って見えるって、気づいたのは？

E: それは、もうちょっとあとで、・・妹がいるんですけど、

M:うんうん

E: 妹、５歳差なんですけど、妹も多分、３歳ぐらいの時かな。自分は、たぶん小学生に上がってた時なんですけど

M: ８歳ぐらい、うん

E: なんか、なんだっけ。妹が色ぬりをしてて、色鉛筆で。で、なんか多分ピンクとか使ってたんですけど、それは、あんま具体的には覚えてないっすけど、その色は違うよみたいな、自分が言ったらしくて。

M: えぇー

E: で、多分グレーだか、グレーかピンクか、緑とか、例のあの、わかりにくい色のあれだと思うんですけど。

M: うんうん

E: それを、なんか妹に注意みたいな感じでしたら、妹は多分普通なんで、あのーなんか、妹からしたら、どっちが正しいのかわかんなくなったみたいな。

M: あぁぁー

E: そういう話を、前聞きましたね。なんか、・・兄は、兄はあれが、例えばグレーって言ってるけど、それピンクじゃないのかなって、すごい困ったみたいな。

M: あぁ、妹が？

E: はい

M: へぇー。

E: で、自分も、なんか家族、他の父とか、母からも、なんか、あんま同意を得られなかったんで、あれっ？みたいな

M: あっ、その色ぬりの？

E: そうですそうですね

M: へぇー。じゃあ、結構家族の間で議論になったような？

E: なんか、浮いたような感じが・・・

(Interviewee E, June 14, 2017)

Excerpt E1 (author's translation)

M: Let us begin now. Although you can pick what you like or do not like to talk about, I guess it might be easier for us to follow the timeline. Do you remember when you realized your color vision first time?

E: When I realized? As far as I remember, as I told you last time, a bluish train model looked like green in the dark.

M: Sure. Do you remember how old were you at that time?

E: I was still small. I guess I was only four or five. Four or five years old.

M: I see. A train model, a bluish train model. It looked like green in the dark. [Typing keyboard to write field note]

E: Then, I told that to my parents. Children usually like to report anything to their parents, right?

M: You mean, turned to green?

E: Yes, like this is amazing! Look, mother!

M: Hahahah

E: So, I let them know that the bluish train model looks green. However, my mom's response was like, really? I do not see it. I remember that she replied to me in a strange way.

M: I see. What did she tell you at that time?

E: Really? She said. Hahaha. I did not feel that my mother agreed with me on this.
M: Sure.
M: So, when did you realize that your color vision was different from others?
E: That was later. I have a sister.
M: Sure.
E: My sister, five years between us, was probably three. I just started elementary school.
M: Eight, perhaps?
E: Well, my sister was coloring a picture with color pencils. Then, she was perhaps using pink, I do not remember exactly which color she used, and I said the color was not right according to my parents.
M: I see.
E: I guess, it must be gray, pink, green, …one of those confusing colors.
M: Sure.
E: I pointed out her use of color. Since my sister has normal color vision, she got confused which was right.
M: I see.
E: I heard that story before. Well, my brother said it was gray, but I thought it was pink. I was confused.
M: Your sister said so?
E: Yes.
M: I see.
E: Then, I felt uncomfortable because my family, father and mother, did not seem to agree with me.
M: You mean, that coloring picture?
E: Yes.
M: I see. Did your family have some discussions about it?
E: Well, I felt set apart from my family.
(Interviewee E, June 14, 2017; author's translation)

Excerpt E2

E: あとは、ネットとかに、例の数字のやつ［石原色盲検査表］あるじゃないですか？あれは、まぁ見たことはあるんですけど。
M: あっ、本当に？
E: はい、あれはもともと。
M: それは、なんか自分で気づいてから・・

E: んーなんかそうですね。母親が、これはどう？みたいな、感じで
M: 母親が？
E: こういうのもあるよ、みたいな。あの、昔自分は、色覚の、あれがあったから。検査が、学校であったから。
M: あぁその話の時ですか
E: だから、それでおぼえてたんだと思いますね
M: なんか言ってましたよね、お母さんが昔は
E: そう、昔は普通にあったよって、言ってて。でも、自分は受けたことなかったんで。
M: あぁ、それでお母さんが見せてくれた・・・
E: なんか、見せてもらった気がしますね。こういうのもあるよ、みたいな
M: こういうのもある・・・ちなみにそれ、読めました？
E: それで、もう完全に間違えてたんで、あぁーみたいな
M: はははは（笑）
E: 反応をしてた覚えが。すごいねー
M: すごいねー？はははは（笑）すごいねーって言われたの？
E: すごいねーみたいなこと言ってました
M: はははは（笑）。それはどういう意味なんだろう？
E: あぁ、本当にわかんないんだっ、みたいな、ことだと思いますけど
(Interviewee E, June 28, 2017)

Excerpt E2 (author's translation)
E: In addition, on the internet, there are some color vision test on which we are supposed to see numbers, right? I have seen it before.
M: Really?
E: Yes, I have.
M: Did you see it after you became aware of your color vision?
E: I guess so. My mother showed it to me like, what about this test?
M: Your mother?
E: Yes, she did. She showed it to me. She told me that she used to take school color vision testing.
M: Sure. She took a school color vision test then.
E: Yes, I think that was why she remembered.
M: Didn't you mention before that your mother used to …
E: Yes, she said school color vision testing used to be quite common before. However, I never took it.

M: I see, therefore she showed it to you.
E: Yes, I remember that she showed a color vision test on the internet to me.
M: She showed it to you… by the way, could you read numbers on the test pictures?
E: No, not at all. I totally failed. I remember my mother said, Gee you cannot read really read them.
M: Hahahah
E: I also remember that she said something like amazing!
M: Amazing? Hahahah, did she really say amazing?
E: Yes, I remember so.
M: Hahahah, what was it supposed to mean?
E: I guess she meant that I cannot really see colors.
M: I see, … I cannot really see colors.
(Interviewee E, June 28, 2017; author's translation)

Excerpt E3

M: へぇー。友達に話したことある？
E: あー全然ありますよ、なんか。あのー自覚してからは、結構、こうーわかんない時あるんだよねーみたいな
M: へぇー
E: そんくらい言ったりしますね
M: 例えば、どんな時に言うの？なんかー、ふ、なんかー
E: 例えば・・・美術とかで絵を描くじゃないですか？
M: あぁあぁー
E: そういうときとか。まぁ、話のネタじゃないですけど・・・
M: はぁー
E: なんだろう？あとは・・・
M: もう小学校ぐらいから？
E: たぶん、言い出したのは中学くらいかな？
M: 中学校くらいから？話のネタみたいに？
E: 話のネタにしてましたね
M: 美術の時間に？
E: そうですね
M: スッゲーな
E: あんまり気にしたことないんですよ、そんなに・・・
M: うんうんううん

E: デメリットじゃないですけど、弱い点とか思ったことなくて・・・
M: うんうんううん・・・色わかんないんだよねーって、言ったの？
E: うん、なんか（笑）あと、なんか予め知っておいてもらった方が。いちいち、これ何色とか聞かれるの、面倒臭いんで。なんか、なんだろう。わかんなかったとき用の保険じゃないですけど・・・
M: はぁー
E: もともと言っておけば、そういうミスというか、こいつミスったなーとかいうの防げるかなと思って。それで、自分から言ってたのは、ちょっとありますね。
M: けっ、結構クラス全体に言ってた感じ？それとも・・・
E: まぁ、仲良い人だけですね。わざわざ別に、
M: うんうん
E: 仲悪い、あんま良くない人に話すことでもないんで・・・
M: うん、うんと、ミスした時の保険？
E: そうですねーなんか
M: ふぅーん。ちなみに反応どんな感じだった？友達・・
E: え、なんか、そうなのっ？みたいな感じで、みんな盛り上がってくれますね。
M: 盛り上がる？どういうことどういうこと？
E: だから、それ言ったあと、これ何色？とか
M: あーそっかそっか
E: それ何色とか、そういう風に聞いてきて。わかんないとか言うと、
M: うんうん
E: おぉーみたいな
(Interviewee E, June 14, 2017)

Excerpt E3 (author's translation)
M: Have you told your friends about your color vision?
E: Yes, I have. After I became aware of my defective color vision, I have often told my friends that I cannot see some colors.
M: Is that so?
E: Yes, I do that.
M: For example, in what situation do you tell them?
E: For example, when we draw a painting in art class.
M: Sure.
E: That may be one case. Well, I talk about my color vision as a conversation topic.
M: I see.

E: Well, let me think about other situations…
M: Did you start talking about your color vision in elementary school?
E: No, perhaps when I was in junior high school, I started.
M: Junior high school, already? As a conversation topic?
E: Yes, my defective color vision was already a conversation topic.
M: In art class?
E: Yes, it was.
M: Surprising.
E: I have not seriously concerned about it yet.
M: Sure.
E: I have never considered my defective color vision as disadvantage.
M: Right. Did you also say, I would not see colors?
E: That is right. In addition, I want friends to know about my defective color vision in advance. It bothers me if they keep asking me about color recognition. Well, I guess it can be an insurance.
M: Right.
E: If they know my color vision already, I think it may become easier to prevent any mistake regarding color.
M: Did you let almost everybody know about your color vision?
E: Not really, only close friends.
M: Sure.
E: It is not something I like those people who are not close to me to know about.
M: I understand. It was an insurance…
E: Yes, it was.
M: I see. By the way, how did your friends react to it?
E: Well, they were like really? The conversation usually came alive.
M: Came alive? What do you mean by that?
E: After I told them my color vision, they started asking me questions like what color do you think this is?
M: I see.
E: When they asked me about certain colors, I said I do not know
M: Sure.
E: They were surprised like, WOW!
(Interviewee E, June 14, 2017; author's translation)

Excerpt E4

E: あのー、ベストセラー、人気ランキングでランクインしてるのは［レンタルビデオ］、ここことか。そう言う風に、シールで色分けしてるんすけど、

M: あぁーそうなんだ

E: それの、緑とオレンジが、違いが全然わかんなくて・・

M: へぇー

E: なんか、たまに漫画がいっぱい入荷してきたときとかは、レンタル用に、自分でこう加工したりするんっすけど、その作業やっているときに、棚番のシールだけわかんないんで、他の人にやってもらったりとか。

M:へぇー

(Interviewee E, June 14, 2017)

Excerpt E4 (author's translation)

E: [Rental videos are] color coordinated with different colors. For example, best-sellers and ranking-in titles are put different color stickers.

M: I see.

E: Among the stickers, I cannot tell the difference between green and orange.

M: Sure.

E: Sometimes, we have many new arrivals of comic books. Then, I have to put stickers on them. Since I cannot tell the difference between colors they use, I have to ask my colleagues to tell me which color stickers are for which titles.

M: I see.

(Interviewee E, June 14, 2017; author's translation)

Excerpt E5

E: なんか、別に色に限らず、自分はなになになんで、なになにができないですって言ってくる人って、あんま印象よくなくないっすか？しょうがない事ですけど、自分がもし雇ったボスだとして、あの、初めに言っておくんですけど、自分これなになになんで、こういうことできないんですよ、とか先にバンバン言うと。こいつを雇ったのは失敗かなとか、思うかもしれないんで。あんま仕事とかに支障が出ないといいなという風には、考えてます。

M: うーん。言う予定ですか？いままで通り・・

E: うーん。先には言わないですね。もし知られないんなら、まぁそれが一番と言うか。

(Interviewee E, June 14, 2017)

Excerpt E5

E: I often think about negative impression I may make by letting people know about what I cannot do in advance. If I start working full-time, colleagues may see me as useless.

M: May be so.

E: Well, it is not only color vision, but don't you think those who tell you what they cannot do in advance make negative impression in general? I sometimes cannot help it, but my boss may regret hiring me if I just tell him/her what I cannot do in advance. I have been thinking that I like to talk about my color vision needs in a way not to cause negative impact to my work as much as possible.

M: I see. Would you say your color vision to your colleagues if you start working full-time as you did before?

E: I think not. If they do not have to know about it, I think it must be the best for me not to let anyone know about it.

(Interviewee E, June 14, 2017; author's translation)