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Autism Spectrum: The Impact of Colors and Symbols Have on Students Outcome

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Capstone Project: An Action Research Project

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Abstract

The purpose of this action research paper was to explore the effects of educational interventions using colors and symbols on orchestra members with Autism Spectrum Disorder. A fifth week action study was conducted using visual support for effective musical expression in an orchestra composed of members with autism and intellectual disabilities. The red glasses marked on the sheet music of the members should see the conductor and play according to conductor's hand signals, and the number of times they could not play according to the conductor's hand signals was checked every week for 5 weeks to collect and analyze data. The educational intervention using colors and symbols was effective for all members, but the difference in intervention effect was large for member with autism. Positive responses from parents and team members to educational interventions using colors and symbols in structured surveys suggest more use of visual aids. Future research will investigate the effect of educational interventions using various colors and symbols on the performance of orchestra members, and whether the use of visual tools is helpful for orchestra operation.

Keywords: autism spectrum disorder, intellectual disability, color, symbol, orchestra, music

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Autism Spectrum: The Impact Colors and Symbols Have on Student Outcomes

Autism Spectrum Disorder (ASD) is one of a group of neurodevelopmental disorders known as pervasive developmental disorders and exhibits three main characteristics: communication difficulties, social interaction difficulties, and restricted, repetitive, and stereotypical patterns of behavior interests (Faras et al., 2010). Students with ASD do not develop functional language, their linguistic characteristics show the form of copying the language of others, and it is difficult to use language for the purpose of interaction.

Due to impairment in social communication, students with ASD are unable to communicate their intentions and thoughts through proper communication, and sometimes express their intentions in undesirable ways. One of the cognitive features of ASD is a deficit in the theory of mind, meaning the inability to recognize that one's own and others hold different beliefs, people with ASD have difficulty interpreting the intentions of others because of this feature, and some people with ASD may experience great anger as a result (Edwards & Higham, 2020). Specifically, in the case of students with ASD who cannot express themselves through spoken language, they have difficulty in understanding their communication partner compared to students with ASD who express themselves through spoken language, and this situation sometimes exacerbates problem behaviors in students with ASD. Moreover, the use of visual support can increase understanding, reduce anxiety, encourage engagement, support communication, and increase independence in students with autism, thereby reducing the risk of challenging behavior (Baxter et al., 2015).

The problem is that in the general environment classroom, most of the information related to education and school activities, such as the sound of bells signaling the start and end of classes, delivery of academic instructions and learning contents, communication with peers, and assignments, is presented as instantaneous auditory information. However, the auditory clues provided momentarily to students with ASD who have strengths in visual information processing enough to be called 'strong visual learners'

make it difficult for them to participate in educational activities and act as a hindering factor (Rao & Gagie, 2006). This is because by the time students with autistic disorder are ready to focus on auditory cues and understand and process educational activities, that process has already passed, and they miss most of the information provided.

Among the strengths of memorization skills, preference for repetitive routines, and visual information processing ability, which are the strengths of students with ASD, various teaching methods and educational tools have been studied to help them participate in educational activities and school life. Visual aids are among the most widely used tools in education for students with ASD today. Visual support can support expressive communication and provide alternatives or complements to words, signals, gestures or actions (Rutherford et al., 2020). Artifacts constructed in this way can represent elements of basic communication, sometimes using images or tangible objects, in these cases, just as sign language can be a visual representation of language for people with hearing impairments, visual supports are used to enhance communication in people with autism (Hayes, 2010). In this context, the use of visual tools can be effectively applied to the education of students with ASD.

Much previous research, including Hedge's research, found that the use of visual tools had a positive effect on learning (Hedges et al., 2018), in addition, Naidoo, and Singha showed successful implementation of communication using communication boards with ASD in their studies (Naidoo & Singh, 2020). Therefore, in this research, based on visual cues that have been proven effective in previous studies, I will research the effect of instructions marked with colors and symbols on the learning of students with ASD. The purpose of this research is to explore the effect of providing consistent educational support to the learning of students with ASD, just as consistency was provided by applying visual support to communication. Moreover, by comparing and analyzing the learning acquisition speed indicated by writing and the learning acquisition speed indicated by color and symbol, the purpose of the study is to find out which methods are more effective for learning in students with ASD. This paper

examines the use of visual aids in education and based on the various research of visual aids, discuss the impact of these aids on the learning of students with autism.

Materials for this behavioral study were collected from the DeWitt Library at Northwestern College in Orange City, Iowa, and from libraries around the world. Materials collected from libraries around the world were used by request with online permission, and research considered for inclusion are recent studies published in peer-reviewed journals within the last 10 years. I reviewed research on the characteristics, communication, visual support, and music education for ASD. Ultimately, 20 materials were selected for relevance and support for this study, and the studies were used to understand the characteristics of children with autism and to identify the effects of the use of color and symbols in education.

Review of the Literature

Students with special needs face a variety of challenges in many settings, including daily life, school, and learning. They come to school with special needs every day in the way they are accustomed to: riding their parents' car to school, riding the school bus, or taking public transportation. However, it is challenging for students with special needs to move from class to class, study numerous subjects, and achieve academic accomplishment in order to succeed in school. To address these challenges, schools and teachers need to think and research what they can do to help students. Advancing technology, the changing educational environment, and the ongoing efforts of parents in our neighborhoods are driving educators and researchers to advance new technologies and educational strategies to better serve students (Herold, 2018). This researcher has experienced that visual explanation is effective for students with disabilities. Based on this experience, this researcher conducted research to help students with autism spectrum disorders study by providing consistent education using colors and symbols, just as the way students are accustomed to coming to school every day.

Autism Spectrum Disorder Education

Inclusive education, which began in the United States in the late 20th century, sparked by the rights movement of students with disabilities and advocacy efforts by parent and professional groups, has mediated access to and participation in general education classrooms for students with disabilities (Waitoller & Artiles, 2013). "For children with disabilities, receiving instruction that aims so low would be tantamount to 'sitting idly…awaiting the time they were old enough to drop out'. The IDEA demands more" (Endrew F. v. Douglas County School District, 2017, p.14). "To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are not disabled" (IDEA, 20 U.S.C. § 1412(a)(5)(A)). Inclusive education aims to provide an education that meets the needs of students with and without disabilities interacting with each other (Avramidis et al., 2000).

Inclusive education is when students with special needs are placed and educated in a general classroom with their peers who do not have disabilities. In the study of Guralnick & Bruder (2016), the current state of inclusive education in the United States was studied, over a 30-year period, approximately 700 projects have demonstrated the effectiveness of US-funded inclusive education for students with special needs and those without disabilities. The research states that in an inclusive classroom, various social interactions can influence one another, but it is still challenging for educational curriculum (Guralnick & Bruder, 2016). The success and inclusion of students with a wide range of disabilities in an inclusive educational environment depends on the attitudes and commitment of teachers towards children. Teachers with positive attitudes about inclusion can deliver effective instruction when teaching students with special needs, but teachers with negative attitudes about inclusion and teaching students with special needs tend to this leads to lower expectations, which in turn can lead to reduced learning opportunities and achievements for students with special needs within an inclusive classroom (Rakap et al., 2017).

Dotger and Coughlin (2018) analyzed the behaviors and decisions made by school teachers and officials toward students with ASD and noted general classroom cultures and structures that often exclude students with disabilities when classroom circumstances are challenging. Contrary to the intent of these classroom cultures and structures, they ultimately had negative consequences for students with ASD. Therefore, classroom management and knowledge of about special education and students with disabilities is vital and must permeate and include all decision-making (Dotger & Coughlin, 2018). While educators' positive attitudes towards understanding and supporting students with autism can be positive for inclusive classrooms, despite these positive prospects, there remains a lack of adequate conditions, support, knowledge and training for students with ASD. It is not the students that need to change, but the schools and education systems, highlighting the need for prepared classrooms for children with disabilities, and the importance of creating environments that are as tailored to the needs of students as possible (Hersh & Elley, 2019).

Schools and related special education services face the ever-growing needs of students with ASD and can face many challenges when supporting them. Difficulties in communication and social interaction, repetitive thoughts and behaviors that are symptoms of ASD can limit students' functioning in school. Schools address the overall symptoms of ASD and provide a combination of communication, social and behavioral services, and life skill training to help students with ASD succeed in their academic performance (Wei et al., 2014). It is clear that academic performance is influenced by factors other than IQ. In other words, many individuals with ASD may have various levels that are well above or below those predicted by their IQ, falling outside of age standards in a variety of academic domains. Factors that influence students' academic performance may relate to specific child characteristics or environmental factors, including educational programs (Keen et al., 2016).

Character of Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a disorder caused by differences in the brain, people with

ASD have genetic differences, and other causes have not yet been identified. Diagnosis of autism

spectrum disorder can be difficult because a diagnosis of autism spectrum disorder is not based on a

medical test, and doctors make a diagnosis for a child after looking at the child's developmental history

and behavior (Centers for Disease Control and Prevention, 2017). Autism Spectrum Disorder appears

before age 3 and may persist throughout life, although symptoms may improve over time. ASD can

sometimes be detected within a year, and some children may have difficulty acquiring new skills or lose

skills once acquired after acquiring new skills and meeting developmental milestones between 18 and 24

months. However, many children are delayed until they are older, and this delay means that students with

ASD may not get the early help they need. Early detection of disabilities is important so that children can

receive services and supports tailored to their needs (Centers for Disease Control and Prevention, 2017).

Over the past few decades, the number of children diagnosed with autistic disorder has increased

dramatically, and is generally more common among boys than girls. Despite public concern and interest

in these phenomena, the causes of ASD remain controversial. Although the exact cause of ASD has not

been identified, it is presumed to be caused by a combination of genetic and environmental factors, and

no effective treatment has been developed yet (Natascia et al., 2015). Autistic Disorder is considered to be

on the spectrum, from mild to severe, and is present regardless of cultural, ethnic, racial or socioeconomic

group. Autism Spectrum Disorder is characterized by two key domains: social communication, and

restricted, and repetitive sensory-motor behavior (Lord et al., 2018).

Autism Spectrum Disorder is a condition with other difficulties, and usually requires

consideration of developmental delay, intellectual disability, or speech impairment (Lord et al., 2018).

Delayed language skills, delayed cognitive or learning skills, abnormal moods and emotional reactions,

anxiety, stress, lack of fear or excessive fear are characteristics that most people with ASD have people

(Centers for Disease Control and Prevention, 2017). Methods for measuring autism disorder are limited,

and difficulties in observing the classification and extent of autism symptoms in the office can make

caregiver observations an important data for judgment. Difficulties in interacting with peers, which may

not be observed in a brief meeting at the office, are often judged through the caregiver's observation diary (Frazier et al., 2014).

Anxiety and depression are more likely to be observed in individuals with ASD who are fluent in language, they are more aggressive than students with other disabilities and show aggressive tendencies in various forms such as verbal attacks and physical attacks (Lord et al., 2018). The abilities of people with ASD can be highly individual, and they may act, communicate, interact, and learn in ways that differ from most other. Having a typical thinking, moving in patterns, difficulty interacting, and sensory processing are other features associated with ASD (Simpson, 2018), they have difficulty forming interpersonal relationships and assimilating into society. Students with ASD can struggle with school and academic accomplishment because of challenges to making friends, adjusting to the classroom environment, and language and concentration challenges (Anglim et al., 2018).

ASD is known to cause neurodevelopment, and they tend to process social information differently than other people, as shown in their brain activity (Luckhardt et al., 2018). There is evidence that social skills training through group activities and cognitive-behavioral therapy interventions improve ASD symptoms (Gates et al., 2017). People with ASD express difficulty adapting to diverse social contexts and accurately interpreting facial expressions, which can lead to inconsistent nonverbal communication behaviors. When diagnosing autism spectrum disorder, identified differences in social communication skills, but social skills can develop over time. People with ASD who have language difficulties may need explicit support for text comprehension (Finnegan & Accardo, 2018).

Autism Spectrum Disorder Communication

Communication difficulties are common among children on the ASD, as lack of social communication is one of the main features of autism (American Psychiatric Association, 2023). Difficulties in communication with others include difficulties in understanding each other socially and emotionally, as well as abnormal social approaches, challenges in continuing exchange of conversations, and exchanging interests with each other. It can act as a factor that hinders the development of a person's

social dialogue and relationships (Koegel et al., 2016). In an interview with 18 adults with autism, Müller et al. (2008) reported their social difficulties and feelings of isolation. Difficulties in understanding abstract language and social difficulties due to communication problems are factors that make them feel isolated (Müller et al., 2008). In particular, empathy has long been considered difficult for people with ASD, and these symptoms may worsen over time (Koegel et al., 2016).

Empathy is broadly defined and complex, but usually involves an emotional response consistent with another person's feelings. Comprised of the cognitive component of understanding what the other person is saying and the emotional component of being aware of what the other person is feeling, empathy is considered a communication skill for interpersonal relationships and can be positively developed. (Koegel et al., 2016). Seltzer et al. (2004) research has shown that individuals with ASD can improve social communication and behavioral skills, but few individuals move these abilities into the average range, they report feeling frustrated in social relationships and having a desire to learn to interact appropriately with others (Seltzer et al., 2004).

A study by Koegel et al. (2016) suggests that people diagnosed with autism spectrum disorder have difficulty recognizing and empathizing with the emotions of others, and may face challenges with verbal expression in their communication (Koegel et al., 2016). These social communication difficulties can hinder people with ASD from socializing, often leading to low self-esteem and self-confidence, along with reduced self-esteem, peer friendships (Byers et al. 2013). Challenges to social communication and expression in people with ASD can persist throughout life, and in the absence of intervention, these challenges can affect an individual's social functioning. This suggests that intervening verbal empathic communication skills in individuals with ASD may be effective in improving their social functioning (Koegel et al., 2016).

Communication is vital skill that develops in early childhood and is linked to academic achievement and social success. However, some children, such as those with ASD, have difficulty

developing adequate and sufficient social communication skills and may need speech therapy and support from school districts and educators to achieve academic and social success (Douglas, & Gerde, 2019). The increasing variety of supports for children with disabilities has resulted in students with ASD receiving language services and supports for social communication development, providing voice services alone is insufficient to satisfy their social communication needs (Katz et al, 2010). Communication is the exchange of information with the other person to perceive and understand what the other person is saying, and interaction with peers and other people represents importance to support the development of social communication skills in students with ASD. Speech therapists, the community, school districts, and educators must work together to provide opportunities for students with ASD to communicate with a wide range of people and to support their communication development (Douglas, McNaughton & Light, 2014).

Visual Support for Autism Spectrum Disorder

Students with ASD are said to be visual or graphic learners who respond more positively to information presented in visual form, such as pictures or graphics, than to information presented in auditory form. For this reason, using pictorial or graphic presentation learning methods can help students with ASD reduce their reliance on communication. The positive results of visual processing in students with ASD have led many professionals and educators to accept that the provision of visuals can be used as an important tool for their improvement. Visuals, such as pictures and graphics, are used as aids to facilitate and strengthen communication in people with ASD. These visual aids can all facilitate expressive language using gestures, facial expressions, drawings, symbols and charts (Ganz, 2007).

Hedges et al. (2018) investigated how high school students with autism spectrum disorder use technology as a supportive approach. The study was conducted at 60 schools in three states with 472 high school students with ASD. A custom questionnaire design method was used, and the questionnaire was delivered to three survey experts who provided feedback. The majority (98%) of survey respondents reported using technology in school to complete daily tasks, and students report that using technology in

school is beneficial in many ways. Based on expert feedback, we developed a revised version of the questionnaire that reduced the number of questions, included some visual elements, and increased font size to increase engagement with a wider range of students for students who needed additional support.

Next, a pilot test of the questionnaire was conducted with six high school students with ASD to ascertain the clarity and relevance of individual questions. The revised version was more simplified and added more visual elements based on the pilot tester's difficulty in completing more abstract questions. The majority (98%) of survey respondents answered they use technology in school, and while students find that technology use is sometimes distracting, but students acknowledge that using technology in school makes learning easier (87%) and more fun (85%) (Hedges et al., 2018).

Naidoo and Singh (2020) researched and developed a visual communication tool, such as a communication board, to facilitate a smooth communication process between patients with ASD and oral care professionals. The research was initiated after written informed consent was obtained from dental therapists registered with the association of health professionals of South Africa Council and parents of 20 children with ASD attending dental training clinics. The first stage of the study used a quantitative survey questionnaire, and the second stage used a combination of quantitative and qualitative questionnaires. The most frequently selected symbols were displayed on a color-coded background to distinguish the different categories on the dental communication board. The communication board made patients with ASD feel comfortable, which made noncooperative patients comfortable with dental treatment. In addition, it has been proven that effective expression is beneficial for health management by improving the ability to express themselves. However, the fact that patients still do not understand some terms is a weakness of this communication board and it seems that these terms need to be reviewed. Demonstrating the successful implementation of the communication board, the study highlighted the training issues, terminology and expression needed for children with ASD. This research anticipates the integration of the dental communication board as a visual mode using graphical symbols for the

reinforcement of expressive language and communication in oral care settings for children with autism spectrum disorders (Naidoo & Singh, 2020).

"Educational treatments are given in a classroom setting. One type of educational approach is the Treatment and Education of Autistic and Related Communication-Handicapped Children (TEACCH) approach" (Centers for Disease Control and Prevention, 2017). This pedagogical approach builds on the fact that students with ASD grow through consistent instruction through visual learning, and provides educators with ways to improve student outcomes, including through classroom structure changes and academics" (Centers for Disease Control and Prevention, 2017). Advancing technology can be used to engage and assist students with ASD across school and classroom settings in a variety of problem-solving opportunities. Educators can use visual support in everyday and school life to teach students with ASD a problem-solving process, and ongoing support can have a positive impact on students with ASD to build self-confidence (Cote et al., 2014).

Accelerating diagnosis of autism spectrum disorder highlights the need for effective intervention and treatment. An active intervention research literature provides the source for identifying interventions and treatments that generate positive outcomes for children and youth with ASD and their families (Wong, et al. 2015). When discussing the difficulties students with ASD, we noted that they may struggle especially when routines are absent or unpredictable. Children with ASD tend to require strict adherence to routine or environmental coherence. Therefore, in this research, the visual signals that have been proven effective in previous studies are displayed in colors and symbols by applying consistency, and the effect of these instructions on the academic ability of children with autism is intended to be researched.

Methods

Research Question

Orchestral performance is when dozens of individuals who play instruments come together to create a single piece of music. Orchestral music is born at the end of the process of playing musical instruments

while looking at the sheet music, and at the same time looking at the conductor's hands and having to breathe musically according to the signature. In an orchestra of 20 people with developmental disabilities, it was a challenge to bring one breath together without intervention. In this situation, the need for intervention for musical breathing was raised, and various opinions were presented within the orchestra. Since 2019, this organization has been posting the timetables of the members using color, and this method was efficient in timetable management. Based on this, the researcher decided to conduct a practical study to see if using colors and symbols would help performance. Thus, this action study answers the following questions:

- For students with special needs, specifically autism spectrum, were there any differences observed when using the visual support and when not using the support?

- Has visual support for members with special needs, specifically those with autism helped improve orchestra performance?

Participants and Setting

The action research was conducted at the Seocho Hanwoori Orchestra in Seoul, South Korea. It is a wind orchestra composed of 20 musicians, and all members are employed by the company and are active as professional musicians. They are all developmental disabilities and have intellectual disabilities and autism spectrum disorder. All orchestra members are Korean and there are no students from other cultures. Of the 20 members, 7 are female and 13 are male. In addition, autistic disorder accounted for 45% of the total, 9 members, and intellectual disability, 55%, 11 members. One in 20 members (0.05%) is in a low socioeconomic status. Members are all adults after school age and range from 20 to 34 years old. All members have no difficulty in distinguishing colors and can identify which color they are.

All members belong to companies, receive salaries and work as professional musicians, and go to the rehearsal place for orchestra practice. Orchestra members have to work 20 hours a week, and work includes orchestra, and ensemble rehearsal hours for performances and work hours at home. They work on-site for three hours four times a week on Mondays, Tuesdays, Thursdays, and Fridays, and eight hours

of telecommuting from home is private practice for orchestra performances. Out of the 12 hours of field work, 2 hours are practiced every day for the entire orchestra, and 1 hour is for ensemble by instrument. A conductor (the researcher), assistant conductor, and two assistant teachers guide the entire orchestra rehearsal, and four instrument teachers guide the ensemble. For this action study, the assistant conductor and four ensemble teachers, including this researcher, share the educational method using colors and symbols, and apply the same educational method not only to the orchestra but also to the ensemble.

Intervention and Timeline

After pretesting students with disabilities and collecting data, interventions are conducted for action research. At intervals once a week, data is collected a total of 4 times and Protest results are derived. The action research period from Pretest to Protest takes 5 weeks, and an educational method using colors and symbols is used in the research. For a week after the pretest and before the start of the action research in the week 1, the researcher explained the use of colors and symbols to the orchestra members, and checked whether they remembered the colors and symbols through a short-answer quiz during orchestra practice every day. From week 1, the researcher investigates whether the members remember the meaning of colors and symbols, reflect them in actual practice, and play them well, and whether this visual utilization helps students with ASD learn. These interventions are also shared with parents for consistent education at home.

Variables

In the education method dictated by colors and symbols, the results of the research may vary depending on the student's memory. In detail, the research result can be different depending on whether members remember this instruction well when they are taught to play purple and marked with a color on the sheet music. Similarly, when symbols are marked, the results of the study may vary depending on how well members remember the symbols and how quickly they learn the content. Second, the results of action research may vary depending on the involvement of private teachers and parents. In order to play

an instrument, personal practice is essential. Although the educational contents instructed by the orchestra instructors are also transmitted to the parents, there may be a difference between when parents actively intervene and practice the contents repeatedly when the members practice at home, and when they do not.

Measurement Tool(s)

Quantitative data in the research uses monitoring situations during orchestra rehearsal time. The Dependent T test method is used, and data is collected over a total of 5 times at weekly intervals. After checking the hand signal breathing of the orchestra members and the conductor in a situation without intervention through the pretest, the meaning of colors and symbols is educated, and each member is marked on the score. After that, at weekly intervals, data is collected to see if the members understand the symbols and colors well and play accordingly. In the part where you have to watch the conduct while playing, the glasses mark is drawn in red, and if the conductor stops conducting at that part, the members must stop playing as well. In this part, the member making the sound of the instrument lacks understanding of the meaning of the symbols and colors, or it is thought that more practice is needed to acquire it, and the learning progress is monitored for 4 weeks. For each member, identify the members playing the instrument at the point where the conductor stops, and check and record how many times the breathing is out of sync while practicing the 4 songs. The conductor, assistant conductor, and two assistant teachers who participate together during the orchestra rehearsal create a tally sheet and save it in an Excel file. There is an orchestra practice at the disabled welfare center, and the practice place is always recorded. The parents of the members are aware of this fact, and the researchers who participated in the action study can replay the recorded video if necessary.

In addition, a survey is conducted on parents and members. It will be collected in a quantitative way by asking whether the educational method using colors and symbols was satisfactory and effective for the members. The parent survey (see Appendix A) consists of strongly agree, agree, disagree, and strongly disagree, and the member survey (see Appendix B) provides two options and selects one. Data is

collected using graphic stickers with facial expressions instead of written questionnaires for members with disabilities.

Anticipated Statistical Analysis

The Dependent T test is conducted to collect quantitative data for 5 weeks from pretest to protest. The data collected for each member shows the effectiveness of the teaching method using colors and symbols. Teachers record the progress of members' action research on a tally sheet during orchestra practice, and if the checked number is larger or similar, it is determined that this intervention method was not effective for members with autism disorders and another teaching method should be considered. However, the smaller number shown in the tally sheet, the more effective the teaching method was for members with ASD, and it can be applied to other music.

The survey allows parent and orchestra member responses to action research and can be applied to future educational interventions. When the members practice at home, the parents directly help them, and parents recognize the situation and effect of the members' adaptation to the visual teaching method as much as the orchestra teacher. For this reason, parents' thoughts and opinions on this educational method are very. In addition, Members are the ones who directly learn and practice this educational method, and the educator needs to know the preferences of the members for this method. By examining the preference and efficiency of the visual support educational method of parents and members, the direction of future educational intervention can be reflected.

IRB

"Research, conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods" (Protection of Human Subjects, 45 C.F.R. § 46.104, 2018). My research is to help members practice and

play orchestra through visual support. The study poses minimal risk to the participants, and I believe the likelihood of harm or discomfort is very low. There is no cost to the members for the experiment, and the method of the visual supports will be taught during working hours at the orchestra practice center. Therefore, I think that it is possible to exempt according to Federal Regulations to study the effectiveness of individual members' practice contents and practice efficiency using colors and symbols for effective professional activities of members.

Data Collection

Quantitative data were collected for this action research. The first quantitative data includes the results of the pretest before intervention, and tally sheets of guidance teachers who participated in orchestra rehearsals were used. Prior to conducting action research on the orchestra members, they were instructed on the meaning of colors and symbols and repeatedly trained for a week. Every day before the orchestra practice, during the rehearsal, and before the end, the instructor asked about how to play in colors or symbols, and members answered the meaning of the color and symbol were prepared for intervention. Four instructors who observed the practice of 20 orchestra members prepared a tally sheet every day, recorded and checked the actions of the five members in charge. The action research was conducted using colors and symbols in four songs for orchestra performance, which requires the conductor to play according to the conductor's hand signals according to the changes in musical flow and tempo. As for the score, the red color was chosen because it has black notes on white paper, which makes it conspicuous and has an important meaning, and the shape of glasses was drawn on the score of all members in each part where the conductor must see. And for the action research, the conductor stopped conducting at the point where the glasses mark appeared, and it was checked and recorded whether the members continued playing the instrument or stopped playing the instrument after seeing the conductor's hand signal.

The second quantitative data is a structured survey of orchestra members who directly participated in the action research and parents who indirectly participated. The survey is taken immediately after the action research and runs over one day. Members participate in the survey directly after going to work, and the parents' survey sends two documented questionnaires via messenger to receive answers. The survey for parents provided multiple ratings of responses, with responses ordered from one end to the other, and respondents were asked to select responses representing their opinions, thoughts on the questions presented. Surveys that provide midpoints tend to have respondents choose the middle category, so in this survey no middle category was provided and respondents were asked to choose one response. In the survey of orchestra members, face graphics were used instead of written surveys, and only two choices representing like and dislike were provided. Surveys were used as this data collection method because they can collect on the effectiveness of educational interventions and responses to action research and make educational decisions based on the thoughts and beliefs of the educational interventionists as well as their stakeholders.

Data Analysis

In order to execute action research on whether visual support using colors and symbols is effective for orchestra members with ASD, 20 orchestra members with developmental disabilities participated in the action research. It consists of 11 members with intellectual disabilities (55%) and 9 members with autism (45%). For this action research, orchestra instructors drew red glasses symbols on the orchestra members' sheet music (see Figure 1), and when the symbols appeared, the members received an educational intervention in which they stopped playing while looking at the conductor. For comparison before and after the action study, the researcher decided on four songs for this study, and the part where the members had to see the conductor and follow the hand signals was shared only by the instructors, and the members' performances were tested in advance. The data was collected on the same day of the week, at the same time, and at weekly intervals. And each individual's training effect was analyzed by post-testing in the fifth week.

Figure 1

Sheet Music for a Member with Red Glasses Mark
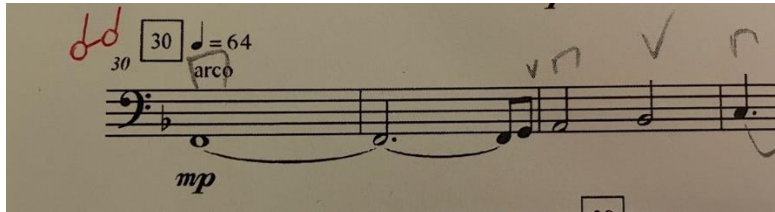
Data was collected while the members played four songs during working hours, and during orchestra rehearsals, all parts that needed to see the conductor were drawn with red glasses on the sheet music. There were twenty parts where the glasses were drawn, and the tempo changed at that part, so the 20 members had to play while watching the conductor to produce one sound. In the Pretest before the educational intervention using colors and symbols, the average frequency of the members playing without looking at the conductor's hand signal was 8.4, and the average frequency of the Protest after the intervention was 3.75. In the results of the five-week experiment, educational interventions using colors and symbols were effective (see Figure 2). However, this result shows the educational intervention results of 20 members with autism and intellectual disabilities, and it is necessary to see them separately for the researcher's action study. Therefore, the effect of the intervention was investigated by examining the data of nine members with autism and analyzing the results.

Figure 2

Graph of Change in Pretest and Protest Values of 20 Members Including ASD and Intellectual
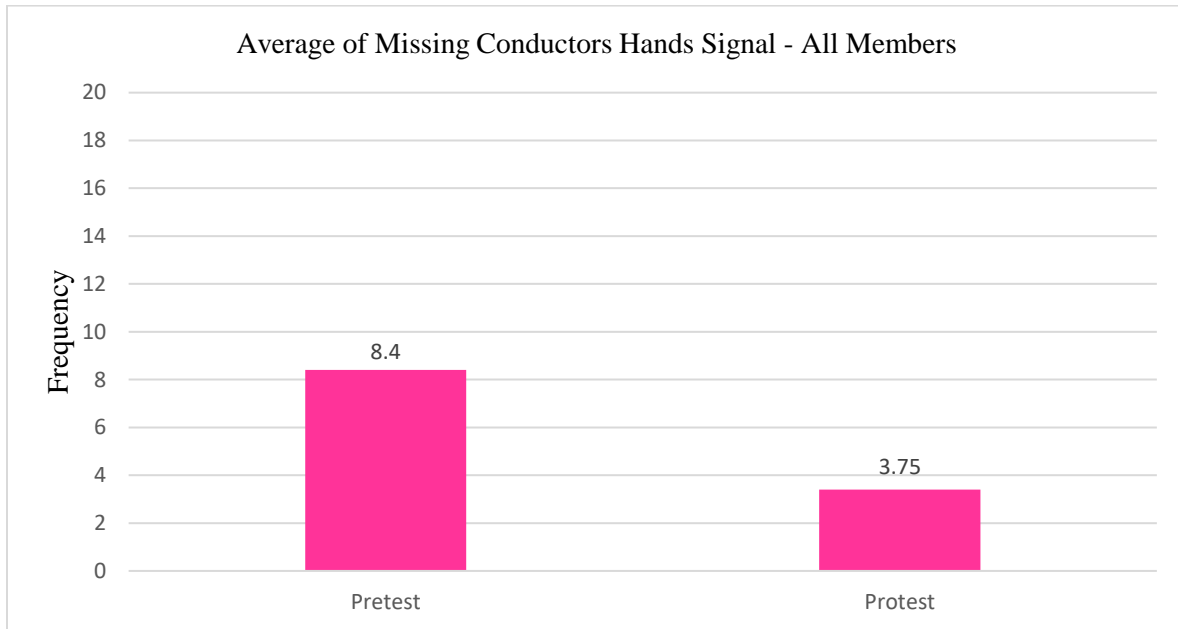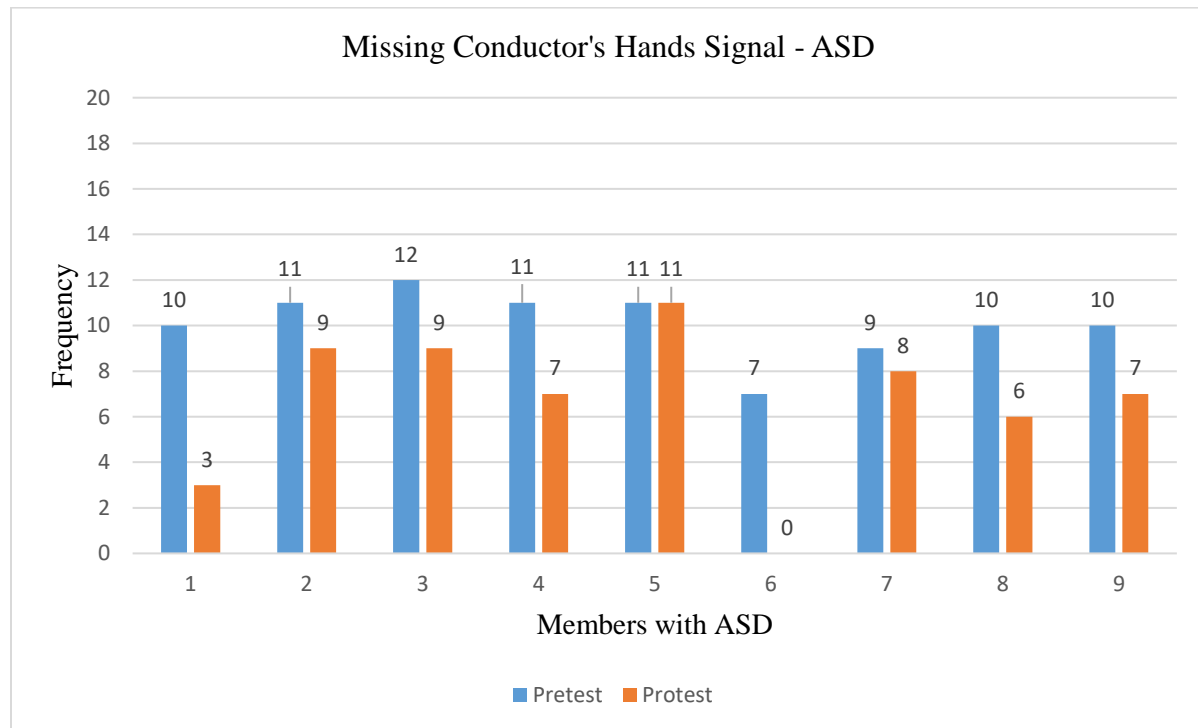
Disabilities

Figure 3, below, shows the data values before and after the visual intervention of the members with autism. According to the data, visual support for orchestra members with autism was found to be effective in most cases, but the intervention effect varied greatly among individuals. one out of nine members are showing the result of stopping playing while watching the conductor's hand signal from all the glasses display in protest. Data were collected from members with ASD and students with intellectual disabilities who participated in the same action research to analyze the effects of visual educational interventions.

Figure 3

The Number of Times the Performance of Members with ASD did not Match the Conductor's Hand

Signals

Missing Conductor's Hands Signal - ASD

According to the data, it can be seen that the 11 members with intellectual disabilities showed a

large difference before and after the intervention of visual support. This shows the effect of educational

intervention using colors and symbols, and about three members (27%) of eleven members recorded a

frequency value of 0 in the last action study, proving its effectiveness. The frequency value of 0 means

that the members look at the conductor's hand signals and play music according to them in all the glasses

marked on the score. Therefore, it can be confirmed that visual educational intervention using colors and

symbols helps the performance of members with autism and intellectual disabilities (see Figure 4).

Figure 4

The Number of Times the Performance of Members with Intellectual Disabilities did not Match the

Conductor's Hand Signals
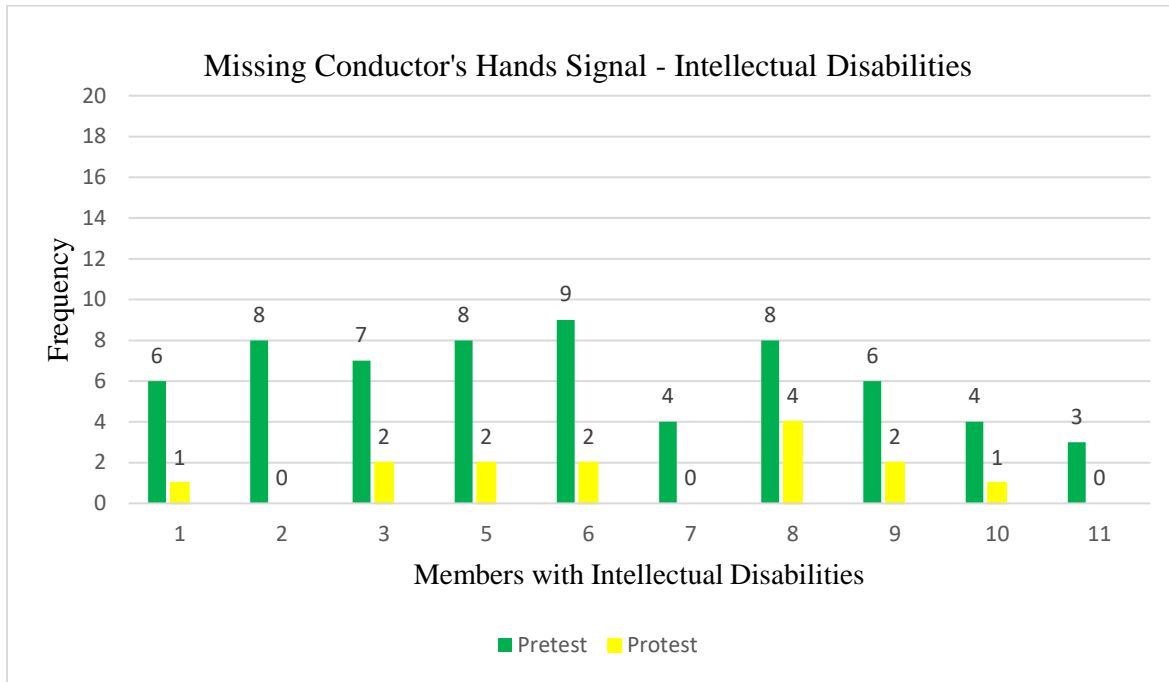
For another data collection of action research, a structured survey was conducted with 20 parents and members. The researcher asked two questions through a messenger to parents, and members participated in the survey directly after coming to work. The first question was a survey on satisfaction with visual support for improving their children's playing ability, and 11 parents were very satisfied, 5 were satisfied, 2 were dissatisfied, and 2 did not respond (see Figure 5).

Figure 5

Satisfaction with Visual Support

Response Choices					
	Strongly Satisfied	Satisfied	Dissatisfied	Strongly Dissatisfied	No Answer
Number of Respondents	11	5	2	0	2

The second question was a preference survey on the use of visual tools for educational support and overall orchestra operation. 13 parents were strongly like, 3 like, 1 dislike, and 3 did not respond (see Figure 6). In a survey targeting parents, 80% of the respondents answered positively to the two questions about using visual support for their children's playing ability and group management, but it was difficult to collect various opinions due to the quantitative survey.

Figure 6

Preference for More Use of Visual Supports

Response Choices					
	Strongly Like	Like	Dislike	Strongly Dislike	No Answer
Number of Respondents	13	3	1	0	3

In the survey using face graphics, 19 members answered like and 1 dislike (see Figure 7). This action research was an educational intervention using colors and symbols instead of spoken language and writing, and a questionnaire survey also used facial graphics instead of writing to express concise and clear opinions to members with autism and intellectual disabilities. Through the survey, it was possible to know about the reaction of parents and members to the visual support, and the members, like the parents, all responded positively to this educational intervention.

Figure 7

Preference of Use of Color and Symbols in Orchestra Performance

Preference of use of Color and Symbols in orchestra performance

5%

95%

■ Like   ■ Dislike
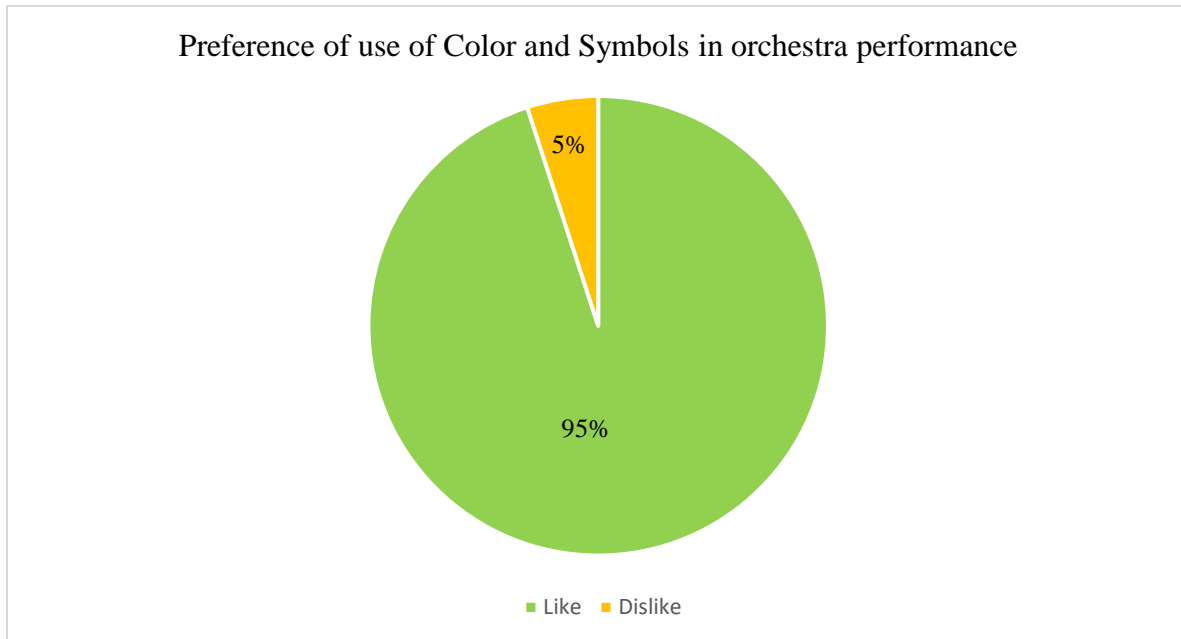
Orchestra performance is a process in which dozens of members gather to create one balanced sound. This researcher conducted an educational intervention using colors and symbols to find a more effective and efficient instruction method in the rehearsal and practice of the members while conducting an orchestra composed of people with developmental disabilities. For orchestra members with autism and intellectual disabilities, this method shows effective results. When comparing the pretest and the test conducted after 5 weeks of intervention for both members with autism and intellectual disabilities, the data showed that the frequency of not following the conductor's hand signal without seeing the command decreased. In addition, the high preference of parents and members for concise and clearly marked visual educational interventions confirmed through the survey suggests a positive direction for this and future research.

Discussion

Summary of Major Findings

Results of the action research indicate that most of the members who received the visual instruction method for five weeks decreased the number of times they played without seeing the conductor. This means that visual support in education using colors and symbols was effective for orchestra members with developmental disabilities. However, there is no regularity in the frequency of times, and each member shows a big difference in educational intervention. When playing four pieces, action research was conducted on whether the symbols indicated on the score were accurately followed, and all members watched the conductor at the beginning and end of the piece to prepare or conclude the performance.

On the other hand, there were many individual differences in accurately recognizing and keeping the signs in the middle of the song. Although there was an effect of visual support in education for both autism and intellectual disability, it was found that there was a large variance depending on the individual, not the type of disability. Because the members were seeing the conducting at both the beginning and end of the song, they were able to follow the conductor's instructions eight times when playing four pieces. Based on this, the researcher found that not only the type of disability but also other factors may come into play. Various external factors, such as individual performance experience, learning memory, and parental intervention, can affect members' visual education intervention, and more detailed evidence will need to be identified in future research.

Impact on Teaching and/or Learning

The conductor, assistant conductor, and orchestra instructors shared teaching methods marked with colors and symbols and provided consistent instruction, which was helpful to the operation of the orchestra. The process of having many teachers explaining and understanding a single instruction to the members with different words and phrases consumed a lot of time. However, by providing consistent

education with symbols, all instructors have shortened the training time for the content and made it possible to conduct efficient rehearsals. Before doing the action research, the average of the members' pretest was 8.4 times, and after the educational intervention using colors and symbols, the average of the protest was 3.75. In the case of the members with ASD, the average of the pretest was 10.11 times and the average of the protest was 6.66, which is higher than the overall average including members with intellectual disabilities, but the decrease in the frequency after the educational intervention suggests that training through visual aids had a positive effect on the orchestra performance of the members.

Alignment to Research

To students with ASD who have strengths in visual information processing enough to be called 'strong visual learners', the auditory education method that delivers verbally makes their learning difficult (Rao & Gagie, 2006). Based on their preference for repetitive routines and their ability to process visual information, educational visual aids are widely used (Rutherford et al., 2020). Just as sign language can be a visual representation of language for people with hearing impairments (Hayes, 2010), visual aids can be effectively applied in teaching for students with ASD. Specifically, the research by Naidoo, and Singha successfully demonstrated the implementation of communication with people with ASD using a communication board (Naidoo & Singha, 2020). Therefore, in this study, the researcher studied an educational intervention using colors and symbols for instrument players with ASD based on visual support, which has been proven effective in previous studies, and proved its effectiveness.

Limitations of the Study

In action research, two limitations were found. First, in the action research performed once a week, there was a difference between the members who remembered the content well and the members who did not remember the content well during the week. There was a difference between the members who understood and practiced the contents of the educational intervention for a week and those who did not, and this served as a variable that the results of action research differed depending on individual

learning other than orchestra rehearsal. Second, the simple subject is limitation of the research. In this research using one color and symbol, it did not take long for members with smooth communication or quick educational understanding to accept and apply it to actual performance. In addition, the limitations of this research were that all members had different performance experiences, and that the understanding and acquisition speed of visual support differed according to the degree of experience.

Secondly, there were limitations in structured surveys. Structured surveys can help research by increasing response rates, getting answers quickly, displaying data visually and reflecting the numerical consequences of selected answers. However, since the survey was conducted by the company that employed the members, it is possible that the parents chose the positive answer. As soon as the data collected in this way is added up, it is displayed only as numbers that cannot be judged as true, and inaccurate answers may be included in the data. In addition, since open-ended responses were not used, it is difficult for the researcher to know the reasons for the negative responses in the survey, so it is difficult to identify areas of the study that were not satisfactory or areas that need improvement.

Future Research

When playing music, many musical expressions are needed besides reading the name of the note and keeping the beat. Examples include making loud or soft sounds, playing short notes, or playing softly. In this action research, an educational intervention using the shape of red glasses was conducted for all members to match the correct performance timing when performing an orchestra, and the intervention was effective. However, as described in the limitations of the study, the scope of the action study that explored the effect of educational intervention using the red glasses symbol was narrow and simple. The learning memory and performance experience of the members served as variables in this research. Therefore, it is necessary to make an educational board that shows different kinds musical expressions, set various musical terms and playing methods in colors and symbols, and further research on the effect and efficiency of applying them to action research.

Furthermore, based on the proven effects of colors and symbols in education, it is necessary to apply them to real life and study their effects. The orchestra practice venue is always the same, but the order in which the members come to the place of work changes depending on external factors such as the season and weather. In winter, members have to take off their coat and hang it on a hanger, and when it rains, put their umbrella in a box. In addition, since musical instruments are greatly affected by the weather, it is necessary to do more careful tuning before playing. Since this changed pattern of daily life can be confusing to members with developmental disabilities, an action study can be conducted to see if it is helpful for members' daily lives using a visual scheduling tool. This means that visual support can be helpful not only in the education and daily life of a member with ASD, but also in the operation of an orchestra.

Conclusion

Education is our future. Teaching is providing students with the best opportunities to learn and grow, and teachers must formulate and apply instructional strategies that benefit learners. The goal of this action research was to find a more effective and efficient teaching method in an orchestra composed of members with intellectual disabilities and autism. Therefore, in order for the members to clearly and concisely convey the instructions to be followed in the orchestra performance, the contents to be followed in the orchestra performance were marked with colors and symbols to educate them. Data were collected at the practice sites of the members for five weeks, and changes over the five weeks could be found through the quantitative data collected by the researcher. After the educational intervention using colors and symbols, the members followed the conductor's instructions better, which improved the orchestra's performance.

The results of this study indicate that visual support was effective for members with autism. Additionally, the positive response from parents and members to the use of visual aids in teaching motivates further use of this method. The data obtained from this action research suggests a direction for

guiding various musical expressions using colors and symbols in the future, and furthermore, it can be applied to orchestra operation. With the development of science and technology, teachers can obtain information from various sources through the Internet, and information from the other side of the world is also readily available. Teachers have to obtain a lot of information for effective education of learners who require special help in the field of education, and apply various education methods and curriculum to provide education suitable for them.

Appendix A

Parents Survey

Dear Parents/ Guardians,

Thank you for your permission and cooperation for your child to participate in my action research for the Northwestern College Department of Special Education Graduate Graduation Paper. I applied the method of using colors and symbols to the training to improve the performance of the members, and this intervention had beneficial results for the orchestra performance. I would like to hear parents'/ guardians' opinions on this visual support method through two simple surveys. Please indicate your opinion below.

	Strongly Satisfied	Satisfied	Dissatisfied	Strongly Dissatisfied
Are you satisfied with the visual support method using colors and symbols to improve your child's performance?				

Figure A1. Survey requested to parents

	Strongly Satisfied	Satisfied	Dissatisfied	Strongly Dissatisfied
Do you prefer to use visual tools in the future for both the training of your child and the overall orchestra operation?				

Figure A2. Survey requested to parents

Appendix B

Orchestra Member Survey

Express your thoughts on the method of teaching using colors and symbols. If you like it, put a

blue smiley sticker on it, if you don't like it, put a red sticker on it.

Like	Dislike

Figure B. Survey requested to orchestra members

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