A Training System that Analyzes the Behavioral Factors of Children with Autism

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Abstract: Teachers of autistic students must observe the overt behaviors of these students and acquire the necessary skills to analyze the causes of these behaviors. Teachers can build a low-stress environment by considering the characteristics of each student, which can be revealed by analyzing their behavioral factors. However, it is not easy for less-experienced teachers to perform such analysis. Therefore, we are developing a training package that aims to help less-experienced teachers acquire the observation and analytical skills necessary to accurately identify the behavioral factors of each student with autism. We carried out our preliminary experiment by using a prototype system based on the hypothesis that it is possible for even an less-experienced teacher to make correct assumptions about behavioral factors such as stress. The results of our preliminary experiment support this hypothesis.

Keywords: autistic person, stress, training package, behavioral factors, behavioral analysis

Introduction

This study focuses on children who have been diagnosed with low-functioning autism spectrum disorder (ASD). ASD is a neural development disorder characterized by impaired social interaction and communication; those characteristics are listed on the diagnostic criteria of the *DSM-IV* [1]. Problem behaviors, such as self-injury, include actions that injure the self or others, such as picking at the skin, hand biting, and head banging; these behaviors are almost always caused by ASD's communication difficulties [2]. The manifestation of problem behaviors is sometimes compared to an iceberg, with the tip representing the overt behaviors (i.e., the results) and the submerged portion representing the underlying differences and impairments (i.e., the factors that create the results) [3]. Therefore, teachers must observe the behaviors of autistic students and analyze the factors that cause those behaviors (hereafter referred to as "behavioral factors"). Problem behavior, which is seen at least occasionally in each person with autism, is caused by behavioral factors in many cases, such as minor changes of environment and surrounding circumstances. To build a low-stress environment, the teacher must take into account the characteristics of each student with autism and must guess at the behavioral factors that influence these characteristics as accurately as possible. However, it is difficult for less-experienced teachers in special-support schools to acquire the skills to accurately guess behavioral factors that are not presented.

Thus, we are developing a system to accompany a training package that will help less-experienced teachers to acquire the necessary skills for observing the behavior of students with autism and to analyze the behavioral factors of those students. Although many behavior-analysis training packages help users to obtain knowledge and to acquire analytical skills, they require users to undergo multiple rounds of self-study or training; as a

result, these other packages are not necessarily efficient. Therefore, establishing the framework for an efficient training package is enormously significant.

We have developed a case conference support system equipped with a balloon-type video-annotation function (hereafter referred to as "video annotation") [4]. It has been suggested that it is possible for viewers to obtain awareness of certain behavioral factors by reading video annotations, inserted by experienced teachers, that express the likely intentions of people with autism, and by comparing these annotations with those inserted by other teachers. However, although this technique is effective in terms of observing certain behaviors, it is difficult to analyze the behavioral factors solely through inserting individual video annotations. In discussions between less-experienced teachers, the topic of behavioral factors also appeared; however, the contents of those discussions were scattered and did not deepen. It was observed that less-experienced teachers tended to gain awareness of behavioral factors only from referring to the annotations from expert and experienced teachers. Whereas it is effective for teachers to share information among themselves regarding their awareness of the behaviors of specific autistic students and to reflect this knowledge in their lessons, this concept cannot be applied to the field of knowledge acquisition or obtaining teaching skills because the characteristics of each autistic person are different. Thus, although it is necessary to carry out training intended to give teachers experience in guessing behavioral factors, it is difficult to accomplish this using only methods outlined by previous studies.

Therefore, we conducted a survey to discover why less-experienced teachers cannot correctly infer behavioral factors from the overt behaviors of students. As a result, it was discovered that students training to be teachers tend to be unable to identify a correspondence between problem behaviors and stress; also, student teachers interpret behavioral factors based on their own experimental rules. Hence, we believe that the less-experienced teachers had made superficial judgments. We also theorize that less-experienced teachers can infer behavioral factors through by learning to identify potential stress in their students and analyzing student behavior with a view toward stress.

1. Compendium of the Training Package

We propose a training package based on the hypothesis that even an less-experienced teacher can make correct assumptions about behavioral factors such as stress. Steps 1 and 5 of this package use methods established in previous study [4].

Step 1: Participants express their interpretation of the intention of the target child in the video by using balloon-type video annotation. It is expected that less-experienced teachers can become aware of behavioral factors through the activity of expressing their interpretation of these intentions.

Step 2: Participants analyze the scene containing these annotations, with a view toward stress. Through this work, participants are expected to be able to focus on the stress level of the target child.

Step 3: Participants analyze behavioral factors with a view toward stress. The system gives a visual representation of the stress analyzed in Step 2 in the form of a graph; participants describe the common points between high-stress and low-stress scenes.

Step 4: Participants observe the differences between the expert teacher's stress graph and their own. Then, participants describe the common points among the high-stress and low-stress scenes that were pointed out by the expert teacher. It is expected that participants can reflect on the differences between their methods of analysis and those of the expert teacher.

Step 5: Participants refer to the expert teacher's video annotations.

The training package is composed of a worksheet and a training system. Herein, we describe the prototype system and the procedures of this training package in detail. The prototype system is a client-server system. The client side can be operated in Windows VISTA/7. Figure 1 shows the prototype system interface.

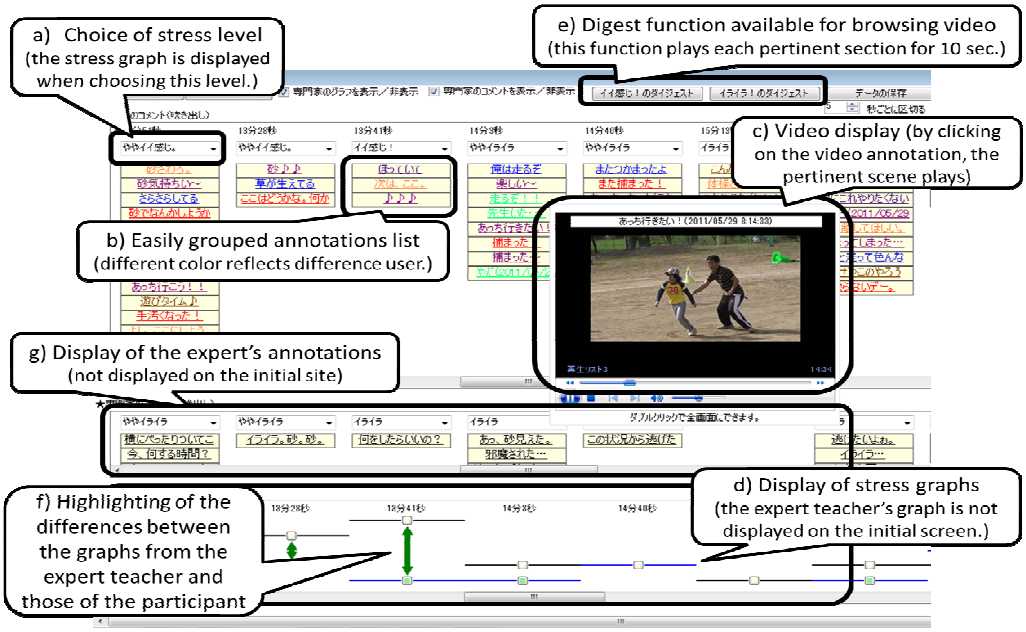

Fig. 1 Prototype system

1.1 Procedures for use of the training package

We developed the training package based on the mode of two-hour exercises using videos of approximately 15 minutes each and a one-hour commentary by an expert. The procedure for this exercise was as follows:

1. Participants insert the annotations in the video. (40 min)
2. The system groups the annotations (which participants have inserted on an hourly basis); participants refer to the video, which is linked by its annotation groups. Then, participants select a stress level. (15 min)
3. Participants describe the differences in their worksheets among their own annotations and the common points among the high-stress scenes and low-stress scenes. (25 min)
4. Participants draw a comparison between their own stress graphs and that of the expert teacher; they describe their burgeoning awareness in the worksheet. (15 min)
5. Participants browse the video digest of the common points chosen by expert teachers between the high-stress/low-stress scenes, and describe the common points in their worksheets. (10 min)
6. The system displays the expert teacher's annotations; the users describe their growing awareness in their worksheets. (15 min)

2. Experimental Methods

2.1 Target video

The target child was a 10-year-old boy who had been diagnosed with ASD and was enrolled in a special-support school. His vocabulary was limited; his method of communication was to use non-verbal instrumental gestures. Many video scenes showed him running around or not participating in class. We video-recorded the target child during one day of school. The

edited video was 13 minutes long and was composed of a morning assembly, an arithmetic lesson, and a physical-education lesson during which the target child exhibited problem behavior frequently.

2.2 Participants

Participant A and participant B were graduate-school students who had applied for jobs as special-support-school teachers and had experience teaching in elementary school or junior high school. However, these individuals had not gained practical experience in a special-support school.

2.3 Procedure

We conducted a preliminary experiment to investigate whether less-experienced teachers can correctly interpret behavioral factors in terms of stress. The survey was administered individually. First, we worked with the training package, which was set up according to the prototype system and used the methods we described in section one. However, we did not work on the content of the expert teacher's lecture. Next, we carried out non-structured interviews and the questionnaire survey.

3. Results and Discussion

3.1 Selecting a stress level

First, Participant A focused on the scene in which the target child touched the sand repeatedly; this participant commented, in her worksheet, "Does he really like to touch sand? I think…probably not." Then, participant A stated, regarding non-structured interviews, "When I watched the video the first time, I recognized his behavior of touching the sand repeatedly as a fun activity. However, through use of the training system, I began to question my own interpretation of his behavioral factors." Therefore, it was suggested that participant A can adjust her interpretation by choosing a stress level appropriate to the target child in the video. Similarly, participant B can analyze behavioral factors in terms of stress by observing the differences between his own annotations and those of other teachers. Therefore, the work of selecting a stress level may be effective with a view toward pointing out areas of stress. In addition, it was suggested that participants can acquire awareness of behavioral factors.

3.2 Describing the common points among high-stress and low-stress scenes

In her worksheet, Participant A describes the common points among the high-stress scenes as being "the scene of touching the sand" and "the scene of running around." In her non-structured interview, she stated, "When this child touches the sand or runs around, he is under stress. Therefore, he overcomes the temptation to get angry." She was aware of the behavioral factor when she selected the stress level and arrived at her conviction by referring the relevant scene when she described the common point between the high-stress scenes. In her non-structured interviews, she stated, "If the child likes to touch sand, he should continue to touch it" and "I thought that he should figure out the instructions when he has an understanding of what to do next." Participant B also described the common point concretely. Therefore, it was suggested that the content of the discussion in which participants choose the stress level of the target child leads them to analyze the behavioral

factor by describing the common point between high-stress scenes. However, neither participant described behavioral factors by referencing the common point between the low-stress scenes.

3.3 Awareness gained by reference to the stress graph created by an expert teacher

Participant A referred to the expert teacher's stress graph and compared it with her own. However, she has not acquired the necessary awareness to make statements such as "It was unexpected" and "I think that he practices gymnastics in a straightforward manner." Similarly, although participant B strove to gain awareness, as indicated by statements such as "I can understand that touching the sand is not a pleasant sensation for him." this participant did not acquire the same level of awareness as he had in his other description. Nevertheless, both participants strove to acquire awareness by referring to the video digest containing a graph of the high-stress situations and a graph of the low-stress situations (both created by expert teachers) and by describing the common points among the high-stress and low-stress graphs. For example, participant A pointed out behavioral characteristics such as "He jerks away from the teacher in the high-stress scene" and "He looks into the distance in the high-stress scene." She clarified her awareness regarding behavioral factors in statements such as "The high-stress factor is that the teacher allowed the child to exercise forcibly," which specify the common point among high-stress situations. Further, participant A acquires awareness of the common points among low-stress situations: "It is in low-stress scenes that the teacher faces the child and the teacher can hold his interest" and "It is in low-stress scenes that the teacher takes a positive approach toward him and praises his behavior." Similarly, participant B gained awareness, as he can appreciate awareness of the importance of analyzing behavioral factors objectively by observing the child's actions before and after the behavior highlighted in the video. Therefore, participants are unable to understand the true meaning of experts and not able to gain awareness by only comparing the stress graph However, this result suggests that participants can gain awareness and a new point of view by referring to the video digest of high-stress and low-stress scenes.

4. Summary

In this article, we report the results of our preliminary experiment using a prototype system. This system was developed based on the hypothesis that less-experienced teachers learn to accurately infer behavioral factors in terms of stress by being given a framework of stress analysis to help them learn to spot stress occurrence in people with autism. Although our experiment is preliminary, participants were able to gain a great deal of awareness." In future work, we will improve this system based on the results of the preliminary experiment and on its use in actual training sessions.

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