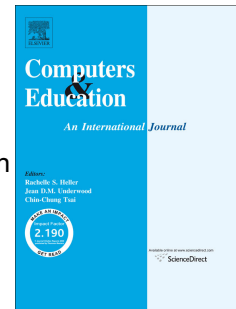


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**Using Multimedia to Reveal the Hidden Code of Everyday
Behaviour to Children with Autistic Spectrum Disorders
(ASDs)**

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Using Multimedia to Reveal the Hidden Code of Everyday Behaviour to Children with Autistic Spectrum Disorders (ASDs)

Abstract

This paper describes a framework which was developed for carers (teachers and parents) to help them create personalised social stories for children with autistic spectrum disorders (ASDs). It explores the social challenges experienced by individuals with ASDs and outlines an intervention aimed at revealing the hidden code that underpins social interactions to them. It focuses on how technology can facilitate the implementation of this intervention by utilising multimedia-authoring tools. Findings from a case study, involving seven carers over a five-month period, are encouraging revealing that the participants quickly learned the basics of the intervention and either adapted or created social stories. They found the framework easy to use and sufficiently flexible to cater for children with social interaction, communication and behaviour problems.

Keywords: authoring tools and methods, media in education, teaching/learning strategies.

1 Introduction

Due to their social-cognitive learning disabilities individuals with ASDs are unable to develop social skills and interpret the social nuances of those around them. The foregoing brings deep and lifelong challenges that impact their lives in multiple ways. For instance, when these children are not able to read social cues, their personal safety and decision making can be at risk (Smith Myles et al, 2004). Consequently, children with ASDs need to be taught particular skill sets to survive in ways that cater for their learning difficulties and perception of the world (Jordan & Powell, 1995).

Rather than merely diagnosing the condition by identifying clusters of behaviours (Smith, 2003), current approaches attempt to understand the thinking and emotional processes that underlie the way in which children with autism perceive the world and behave. Several prominent models of autism such as: triad of impairments (an absence of social interaction, communication and development of imagination) (Wing & Gould, 1979); theory of mind (Happé & Frith, 1994; Baron-Cohen, 2000); central coherence (Frith, 1989); executive function (Ozonoff et al, 2005); joint attention (Bigelow et al, 2004; Dawson et al, 2004; Mundy & Burnette, 2005); and personal autobiographical memory (Jordan & Powell, 1995) underpin the conceptual framework of the present research.

An intervention to teach social skills to children with ASDs should recognise individual differences and be informed on sound principles. Thus, unlike existing commercial social skills packages (Smith, 2003), social skills tools should be flexible and adaptable to cater for the idiosyncratic and individual nature of each child's difficulties. For instance, children with ASDs generally have a visual learning style (Kuttler et al, 1998; Grandin, 2006) and display good visuo-spatial skills that do not involve language (Wing, 2002). Furthermore, a wide range of intellectual ability among children on the autistic spectrum exists. According to Baron-Cohen (2008) up to twenty-five per cent of

1 children with autism present with additional learning difficulties while many children at
2 the higher-functioning end of the spectrum have an IQ above average. Evidence also
3 suggests that children with ASDs have a short attention span (Frith, 2003) and display
4 heightened sensory sensitivity (Grandin, 2006; Attwood, 2007).

5 Children younger than eight and those with a verbal IQ below average can benefit more
6 from strategies that utilise pictures, physical prompts and direct modelling rather than
7 widespread approaches that rely primarily on verbal explanation (Baker, 2003).
8 Nonetheless, they may initially require the structure provided by interventions such as
9 the discrete trial methodology aimed at enabling them to learn the basic vocabulary
10 required to respond to verbal instructions and questions. Despite the method adopted, it
11 is paramount that children with ASDs are not just taught a list of rules and regulations,
12 or expected to memorise scripts, but rather that they are provided the opportunity to
13 acquire social understanding which will help them to generalise and cope with difficult
14 situations they will meet throughout their lives. To this end, approaches and techniques
15 used to facilitate the development of social reasoning and problem-solving have proven
16 effective (Bellini, 2008).
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21 *1.1 Social Stories™ Approach*

22 The Social Stories™ intervention (Gray, 1995) was developed in response to the
23 growing awareness of difficulties children with ASDs confront in relation to developing
24 an understanding of social situations (Howley & Arnold, 2005). It offers a set of
25 guidelines, based on the experience of special needs educators who had implemented
26 this approach, aimed at assisting people to create their own effective stories (Table 1).
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31 [Table 1]

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34 The aim of this intervention is to reveal the ‘hidden curriculum’ (the dos and don’ts of
35 everyday behaviour) to children with ASDs so they are no longer excluded from normal
36 social interaction (Smith Myles & Simpson, 2001). These stories should be adapted to
37 suit the requirements of children in an individual situation (Smith, 2003). For instance,
38 those who present with the triad of impairments (Wing & Gould, 1979) can be assisted
39 by using simple precise language; perspective sentences can be employed to indicate to
40 children how people in the story are feeling so that they can learn to empathise with
41 those around them (Baron-Cohen et al, 2005); confusion can be avoided for those with
42 weak central coherence (Frith, 2003) by leaving out irrelevant details and focusing their
43 attention on essential points in the story; Supportive materials, such as step-by-step
44 instructions, can be incorporated in stories for children learning to cope with executive
45 dysfunction (Hanbury, 2005; Ozonoff et al, 2005); role play can be used to develop
46 joint attention and pretend play (Bigelow et al, 2004; Dawson et al, 2004; Mundy &
47 Burnette, 2005). In addition, a good social story can help a child with limited personal
48 autobiographical memory (Jordan & Powell, 1995) to revisit a particular social situation
49 to remind him of his own personal role in it (Smith, 2003).
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55 The Social Stories™ approach is underpinned by some of the key psychological
56 theories that seek to address the social challenges facing these children. This approach
57 has been examined by researchers and found to be effective in improving social
58 understanding and social behaviour in children diagnosed with ASDs (Attwood, 2007).
59 Studies on the effects of the Social Stories™ intervention reveal promising results
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regarding increases or reductions in targeted behaviours (Crozier & Tincani, 2005; Delano & Snell, 2006; Sansosti & Powell-Smith, 2006).

This intervention has grown in popularity as it provides visual structure and sequencing to teach social skills and reduce problem behaviour in a nonintrusive way (Olley, 2005). Gray (1995) maintains that the challenge for carers is that they are working from an equally valid but different perspective from children with ASDs. Thus, they need techniques which will help them understand a child's perception of a given situation. At the same time children need guidance in identifying what is important and why, and assistance in 'reading' social situations and determining what is expected of them (Gray, 2000).

There is often the mistaken belief that Social Stories are easy to write (Howley & Arnold, 2005). However writing individualised Social Stories can be a difficult and a time-consuming exercise (Rowe, 1999; Smith, 2001). Before a Social StoryTM can be created one is advised to gather information on where and when the situation occurs, who is involved, how events are sequenced, what is occurring, and why. In addition, one must interview all of the key people that form part of the child's life including siblings and carers to find out specific details on his/her developmental age, learning style, reading ability, attention span, and special interests (Gray, 2000).

1.2 Technical enhancements to teach social skills

Howley & Arnold (2005) suggest the way in which a Social StoryTM is presented may be critical to the success of the intervention. They argue that the use of technology to support the Social StoryTM approach may have several benefits including the use of visual information to enhance meaning as many children with autism are visual learners (Grandin, 2006). A social story should not be limited to words on paper but rather Gray (1995) suggests a variety of materials and instructional methods may be used to accommodate the child's cognitive style (Baron-Cohen, 2008). It is now believed that clever use of illustrations, which takes the age level and personal learning characteristics of the child with ASD into account, is beneficial to social understanding (Gray, 2004b).

ICT can support parents and professionals who wish to implement the Social StoriesTM intervention to create successful social stories which will help to teach children with ASDs social understanding with social skills. Technology offers carers the possibility of personalising stories by facilitating the use of graphic images, animated characters, digital pictures, video clips and sound files which suit the individual's developmental age, learning style, reading ability, attention span and special interests. Some researchers have used multimedia (Hagiwara & Smith Myles, 1999), visual cues (Thiemann & Goldstein, 2001; Lorimer et al, 2002; Delano & Snell, 2006; Soenksen & Alper, 2006), verbal cues (Thiemann & Goldstein, 2001; Soenksen & Alper, 2006), music (Brownell, 2002), and personal photographs (Agosta et al, 2004; Ivey et al, 2004) to illustrate social stories and found that it helped children to understand the meaning behind the text.

2 Design of Reach & Teach Framework

Children diagnosed with ASDs are complex and enigmatic (Frith, 2003) so it is important that carers, who are best placed to know the children's special needs, can implement the Social StoriesTM intervention with minimal training in their own home or

work environment (Smith, 2001). It is essential that more people are trained as early intervention may be critical in preventing a cascade of effects that result from early deficits in joint attention, gaze and eye contact, and early emerging social interest and routine, as these could have important implications for emerging skills in other areas (Volkmar et al, 2005).

With this objective in mind a framework was designed to scaffold carers through the steps of creating personalised social stories to help children to cope with the particular social interaction difficulties they experience. The aim was to support carers while they teach children what to expect in different situations (Baron-Cohen, 2008) and help children develop their social understanding so that they can determine appropriate responses in social situations (Howley & Arnold, 2005).

The framework for carers entitled 'Reach & Teach: a framework for Exceptional Children' comprises a number of elements: tutorials, sample multimedia activities, a template activity, a bank of images and sound files, a suite of authoring tools, a discussion forum to encourage collaboration with the development of social stories, and feedback facilities for data collection purposes (Fig. 1). The forty-nine sample social story activities provided were divided under six thematic areas: around the house, personal care, at school, social skills, going places, and things to avoid.

[Figure 1]

2.1 Tutorials

Two tutorials are provided to facilitate the actual story creation. The first introduces the potential of the Social Stories™ intervention and the basic guidelines for social story creation. The second outlines the capabilities of the authoring tools which allow carers to: a) adapt interactive social story activities by transforming activity types such as text-based, association, memory game, word search or puzzle; b) add personal images and sound files to chosen phrases to develop a story to suit a particular context (Figs. 2 & 3).

[Figure 2]

[Figure 3]

2.2 Sample Activities

The activities (Appendix) were chosen to provide carers with examples of how to create a good learning experience for children with ASDs, by taking their distinct characteristics into account and by following Gray's ten defining criteria (Gray, 2004b). Permission was sought from authors (Gray, 2000; Gray & Leigh White, 2002; Smith, 2003; Howley & Arnold, 2005; Flemington-Raritan Autism Program, 2005) to include in the activities text from social stories which had been successfully tried and tested by teachers.

The sample social story activities demonstrate how stories should be written in simple (Smith, 2003) and factually correct (Gray, 2004b) language to address the needs of

children with the triad of impairments (Wing & Gould, 1979). Perspective sentences are included to describe thoughts, emotions, beliefs, opinions, motivation and knowledge in order to improve theory of mind abilities (Attwood, 2007) and joint attention deficits (Bigelow et al, 2004; Dawson et al, 2004; Mundy & Burnette, 2005). For example, animation is used in the **Social Skills** stories to grab children's attention so that they learn by watching the interaction of different characters in a variety of social situations. Similarly, role play is used **At School**. Also, in **What should I do when my teacher is talking?** (Fig. 4) children are shown how to behave so that it is not necessary for them to decipher the hidden code in the classroom by themselves.

[Figure 4]

Sample activities deal with a single situation at a time and only include relevant facts to avoid confusion for children with weak central coherence. Visual cues (Kuttler et al, 1998; Grandin, 2006) and sound effects (Grandin, 2006; Attwood, 2007) are used to highlight important details as for instance in the activity **Calling 9-9-9**. Step-by-step instructions are enhanced using animated characters as for example in the social story entitled **Washing my hair**. Furthermore, sample activities demonstrate how to share a child's world by joining in a chosen activity (Gray, 2000) and how to encourage flexible thinking (Hanbury, 2005) by adapting puzzles, complex and simple associations, and memory games.

2.3 *Template Activity*

In order to provide scaffolding for carers who need to create stories for children with very different needs, a 'template' activity is provided together with details of the process of composing a personalised story according to Gray's guidelines (Gray, 2004b). Examples of story titles and sentences, with popup or dropdown menus, are included to encourage carers to adapt them to suit particular children's needs (Fig. 5).

[Figure 5]

A bank of colourful images, animated characters and sound files is supplied to make the stories more interesting for the children and help to keep their attention. Searching for appropriate multimedia materials can be a time-consuming exercise for carers so supplying a library means they can dedicate more time to preparing the actual stories (Fig. 6).

[Figure 6]

3 **Methodology**

Case studies in evaluation research describe an intervention and its real-life context (Yin, 2009). Given the research questions guiding this research: a) How can a multimedia learning tool assist carers to implement the Social Stories™ intervention?;

b) in which ways can this technology enhanced intervention enable carers to generate personalised social stories which would help them to reveal the hidden social code to children with ASDs?; a case study approach was adopted.

According to Creswell (2005) qualitative inquirers triangulate among different data sources in order to enhance the accuracy of a study. In this investigation social stories created and/or modified by carers, three online questionnaires (preliminary profile, at the mid-point of the study and at the end of the five-week period), semi-structured interviews, telephone conversations, journal logs, field notes and postings on a discussion board were used to find evidence that could be corroborated. By using a variety of collection methods the researchers could obtain valuable insight into the experiences of a small cohort of subjects and were able to develop a report that was both accurate and credible (Cresswell, 2005).

The layout and structure of the questionnaires were planned in order to assist data entry for computer reading and analysis (Cohen et al, 2000). Analytic techniques were applied where appropriate and information obtained in the study was ordered so results would not be biased (Tellis, 1997). The data obtained was coded and themed to establish whether patterns could be observed and if an understanding of the concerns of the case could be built up (Creswell, 2005).

3.1 *Implementation*

Seven carers, six parents and a special needs teacher, took part in this case study. Fourteen children with the consent of their parents were also involved in the study. The children had all been assessed by psychologists and diagnosed with ASDs and/or learning and language difficulties. Six are at the higher functioning end of the autistic spectrum and five attend mainstream schools. Of the remaining children who attend special needs schools, six have mild learning difficulties while two are considered severely challenged.

The case study was conducted over a five-month period to give the carers an opportunity to work through the social stories activities with the children and to observe changes in behaviour over time. Participants were asked to initially concentrate on a small number of sample activities. After completing the two tutorials, carers were asked to either modify some of the samples or use some of the resources supplied to write new stories to meet the children's individual requirements.

3.2 *Procedure*

The following steps were followed when carers implemented the multimedia Social Stories intervention (Table 2):

[Table 2]

4 **Findings**

A comprehensive analysis of the data obtained from social stories created and/or modified by carers, questionnaires, semi-structured interviews, telephone conversations, journal logs, field notes and discussion board was carried out. The principle themes emerging from the data concerned the use of the framework to individualise social

stories to teach social skills with social understanding to children who had been diagnosed with ASDs, and scaffolding of carers during this process.

4.1 Individualisation of social stories

An analysis of responses to the questionnaires revealed that this framework assisted carers to personalise social stories by giving them the means to work with or develop social stories which suit the developmental age, learning style, reading ability, attention span and special interests of children with ASDs. Unlike '*traditional pen and paper methods*' and educational software in the marketplace, this tool helped carers to create an individualised learning experience for children since it allowed carers '*to get across the message at different levels*' (Parent 6) in an age appropriate manner by adapting the templates provided using suitable language and a variety of media (Fig. 7).

[Figure 7]

Parent 6 modified one of the sample activities entitled **Time for a Haircut** to help Child 8, at the lower functioning end, to prepare for a visit to a hair salon. This story sets the scene and describes in simple language the steps that the child would follow when she is getting her hair cut. Parent 6 translated the existing storyline in the activity using words that her daughter would understand the meaning of. The framework allowed carers to tailor material to suit children's needs regardless of their developmental stage. A 'one size fits all' approach would not work with these cases. The framework was specifically designed so that carers could adapt or write social stories to help children cope with their current difficulties and also meet their needs in an age appropriate manner as their condition and circumstances may change over time. Responding to Question 6 (Questionnaire 2) the majority of carers indicated that the multimedia intervention was easy to adapt to the needs of children with ASDs (Fig. 8).

[Figure 8]

Interviews with carers revealed how the flexibility of the framework enabled parents to deal with the same concept at different levels by allowing them to alter the images and text according to individual requirements. For example, both Parent 6 and Parent 1 had to educate their children on the dangers of talking to strangers. Parent 6 was able to use the existing social skills activities to reinforce the message for her daughter who is '*too friendly*' that '*you only speak to people that you know.*' Parent 1 developed this theme following Gray's guidelines (Gray, 2004b) but used a more advanced cognitive and linguistic approach appropriate for her son, an adolescent with Asperger's Syndrome (at the higher functioning end of the spectrum).

The literature and data indicate children with ASDs are predominantly visual learners (Kuttler et al, 1998; Grandin, 2006) and ICT can support the Social StoryTM approach by including visual information to enhance meaning. An analysis of interviews and responses suggested that four out of seven carers believed social stories incorporating animation were best suited to the learning style of the children as the interactive features of animated characters could hold a child's attention and were '*attractive and interesting*' (Parent 6). Data from Questionnaire II further supports this with carers reporting that animation was the feature that best suited the learning style of 64% of their children. Teacher 1 noted that '*images and animations certainly assist this child*

(Child 11) in his quest to answer a picture paints...' and he also suggested that 'having simple text matched with strong clear images or animations seemed to elicit more active responses from Child 13.' Results from the same survey showed that carers believed that bright, colourful images used to illustrate sample social story activities helped to convey the meaning of text to children (29%) and assisted children to retain the material covered in stories (Fig. 9).

Current research suggests that children with ASDs are unable to concentrate for long periods on text-based social stories; however, this deficit is compensated for by their visuo-spatial skills and their dexterity at games, which helps to reinforce the message of the story (Wing, 2002). This is borne out within the group as most carers considered word searches, memory games, and associations (pairing images or images and text) to be the most effective activities to help children remain on task and encourage them to complete their social skills training (Fig. 10). Parent 2 noted that her son '*is extremely visual in how he learns and seems to enjoy this sort of challenge – he loved the matching in pairs games*'. Parent 4 also observed that her son '*hates reading and dislikes anything with text involved. He has an excellent memory and loves puzzles*'.

[Figure 9]

[Figure 10]

Interview data evidences that carers believed it was important to incorporate children's interests into social story activities as the individualisation of content encouraged them to become involved in the social story process. For instance, Parent 1 included a reference to her son's favourite bands, *My Chemical Romance* and *Fall Out Boy*, in one of the stories she wrote. There was also evidence in the data collected to suggest one should integrate graphics and '*fun*' elements such as memory games into the learning experience to keep children motivated (Parent 1). As children gain in confidence activities can be made more challenging by introducing time limits and fading out help information but consideration must always be given to the children's capabilities so that the targets set are attainable and they continue to enjoy a sense of achievement (Fig. 11).

[Figure 11]

4.2 Scaffolding for Carers

Data from interviews reveals the design of this framework facilitated carers by allowing them to select resources in a way that best suited particular children and their own level of computer literacy. Several carers were able to find appropriate activities from among the themes provided. Teacher 1 observed that Child 9 '*responded to the social story tool in a positive fashion, was more open, contributed, reacted and expressed himself with natural flowing language to me and the group.*' By incorporating literal accurate language, visual cues, sound effects and avoiding non-essential details these examples demonstrated to carers how the activities could cater for the unique characteristics of children with ASDs: triad of impairments, theory of mind, weak central coherence, executive dysfunction, poor joint attention and partial personal autobiographical memory. Teacher 1 remarked that '*the difficult work needed to bring and maintain simplicity in the social story format is well rewarded in the responses of the children.*' Inspired by these activities some carers applied the multimedia-authoring tools to

modify existing or create new social story activities when concepts needed to be simplified or expanded upon for individual children.

Data analysis also reveals the structure of this tool provided carers with a focus to start discussions on important topics to help children develop social skills with social understanding. Carers do not have to ‘*dream up things*’ or work from a blank canvas. Parent 6 needed to explain the rules of the road to her child and found the story entitled **How can I walk to school safely** ideal as a starting point. Teacher 1 confirmed that the material gave children ‘*the chance to express ideas about what had happened to them in their lives*’ which reinforced the importance and relevance of personalised learning.

Parent 6: ‘Just the fact that you have the setup there. There is a structure to work from. There is a thought process behind and I just adapt that to suit my need with Child 8. Or somebody else could use the same story and make it suit their child.’

Parent 1: ‘I read through those samples and ...modified it really to suit what I was trying to get across to him [Child 1].’

It was apparent from interviews that this framework allowed carers to select the most appropriate activity types and content to suit their child’s particular learning objectives. For instance, Teacher 1 worked through sixteen sample activities: text-based with dropdown menus, word searches, associations and memory games to teach children life skills: going places and emergency situations. Similarly Parent 4 picked text-based activities which would help her three sons to improve their reading and spelling skills. Having familiarised themselves with sample activities carers were encouraged to study the content of the tutorials provided as part of the learning tool so that they might advance to the next stage by creating their own social story activities. In her interview Parent 1 remarked she found the templates were versatile and easy to use and in a short time, without any programming skills, she was able to create a word search for her son incorporating suitable graphics, sounds and content (Fig. 12).

[Figure 12]

In addition to the benefits experienced by the children data from interviews revealed this tool helped carers to become more sensitive to the experience of children with ASDs as they progressed through the social story process, leading to positive outcomes. For instance, Parent 1 explained how she began to think about what her son was thinking, as she wrote a social story to help him. Parent 6 mentioned how she had to be conscious of her daughter’s ‘*way of being and her way of carrying on and learning*’ when she taught her child social skills.

There are encouraging signs from data analysis that suggest the use of this framework has an effect on targeted behaviour. Some children are already gaining in confidence and learning how to interact more successfully with their peers. In particular an analysis of responses from Questionnaire III indicates that improvement in targeted behaviour was observed by carers over the five-month period (Fig. 13).

[Figure 13]

The most dramatic improvement in behaviour during this study was witnessed in the special needs school. Since enrolling as a pupil in the school seven months before Child 10, an elective mute, had not spoken in class. The introduction of this multimedia intervention gave him the opportunity he needed to interact with other students and he

1 responded by reading and speaking for the first time. While there may also have been
2 some other factors involved it seems reasonable to suggest this framework contributed
3 in no small way by creating the atmosphere where all the children in the group, Child 10
4 included, felt they could tell their own unique stories and that they would be listened to.

5
6 **Teacher 1:** ‘Now I am not au fait totally with the reasons why he is as he is but my objective was to try
7 and see could he talk with us, would he talk, and did he feel threatened in the circumstances and the
8 situation he found himself in with the other children. And I have to say it worked. I just said “You’re
9 next” and off he went...’

10 11 12 13 4.3 Limitations

14 In analysing interviews and responses to questionnaires it also emerged that although a
15 number of carers have good technical skills many would require further training to
16 enable them to use the framework to its full potential. Some carers admitted to finding
17 the authoring tools ‘*a bit complicated*’ or ‘*confusing*’ initially and this possibly
18 underlines the importance of attendance at face-to-face tutorials to learn how to use the
19 different resources provided.
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24 **Parent 1:** ‘I found it anyway fairly user-friendly once I sat down with you [the researcher] and you
25 showed me basically how to get the templates up.’

26 **Parent 6:** ‘You know I needed you [the researcher] to explain to me how to use it and get into it and
27 show me the potential of what it could do and once I could see what it could do then I could play around
28 with it and make it my own.’
29
30

31 Carers suggested that the words used in social stories should be consistent with the
32 developmental age of the child. For instance, Child 5 and Child 7 have just started
33 school and their vocabulary was limited and parent 6 had to simplify the language in
34 sample activities to enable her daughter [Child 8] to read and comprehend certain
35 words. It is evident that several words used in sample activities were too difficult for
36 some children to understand without assistance.
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40 Responses also indicate that sample social story activities should be categorised by
41 learning ability rather than age to help carers select the most appropriate activities for
42 the children in their care. Parent 6 explained how important it was to choose a social
43 story that suited the ability of a particular child as she believed that ‘*chronological age*
44 *never ties in with the actual ability.*’ She used the learning tool to break down
45 information into “*small chunks*” for her seventeen-year-old daughter to ensure that she
46 had a clear understanding of particular concepts.
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50 5 Conclusion

51 The results presented suggest carers were able to personalise social stories by using the
52 Reach & Teach technology enhanced intervention either by: a) using sample social story
53 activities supplied; b) adapting these examples; or c) creating new stories using the
54 multimedia-authoring tools provided. The importance of selecting social story activities
55 to suit the developmental age, learning style, reading ability, attention span and special
56 interests of the children concerned was underlined in the findings.
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Findings also indicate combining appropriate language and visual cues with suitable activity types could cater for the unique characteristics of children with ASDs: triad of impairments, theory of mind, weak central coherence, executive dysfunction, poor joint attention and partial personal autobiographical memory. For instance, use of animation and bright colourful images in activities enhanced the learning experience for the children by highlighting the message of the stories and the use of word searches, memory games and associations helped to motivate children and encourage flexible thinking.

Interestingly, this framework helped to heighten the awareness of carers to the needs of children with ASDs and this in turn seemed to elicit an improved response from them. It is hoped that with continued exposure to this multimedia intervention the social understanding of individuals on both sides of the social equation will increase. There are some early indications that targeted behaviour, either increased or decreased as appropriate, after children have been exposed to the multimedia intervention for only a short time. This is in line with previous research which concluded that when social story interventions are effective results are usually apparent within the first week. Previous studies have also shown that while the intervention can produce immediate results it is most effective the longer it is used (Bledsoe et al, 2003).

There have been several promising approaches to the area of social skills training but, unfortunately, no definitive strategy has been found as yet that produces long-lasting generalizations. However, as strategies become more refined and as research improves it is hoped that significant developments will be seen in the not too distant future (Mitchell, 2008). The current research does not attempt to provide any answers or definitive claims. It merely adds one more piece to the puzzle of remediating social skills with this group of children by providing parents and professionals with a framework that will help them to create social stories to meet their individualised needs.

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[Table 3]

ACCEPTED MANUSCRIPT

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The teacher, parents and children who agreed to participate in this project and who shared their experiences so readily and honestly with us are gratefully acknowledged. The authors who allowed their Social Stories to be used in this study are also kindly acknowledged.

ACCEPTED MANUSCRIPT

No	Gray's Criteria for Social Story Writing
1	The story meaningfully shares social information with an overall patient and reassuring quality. (If this is a story teaching a new concept or skill, another is developed to praise a child's positive qualities, behaviours or achievements.)
2	The story has: an introduction clearly identifying the topic; a body adding detail; and a conclusion reinforcing and summarising the information.
3	The story provides the answers to 'wh' questions - describing the setting or context (WHERE), time-related information (WHEN), relevant people (WHO), important cues (WHAT), basic activities, behaviours or statements (HOW), and the reasons or rationale behind them (WHY).
4	The story is written from the first-person perspective as though the child is describing the event. For a more advanced child, adolescent or adult the third-perspective may be used eg like a newspaper article.
5	The story uses positive language, omitting descriptions or references to challenging behaviours in favour of identifying positive responses.
6	The story is comprised of descriptive sentences (objective, often observable, statements of fact), with an option of any one or more of the following sentence types: (a) perspective sentences - that describe the thoughts, feelings and/or beliefs of other people (b) cooperative sentences - to explain what others will do in support of the child (c) directive sentences - that identify suggested responses or choices of responses to a given situation (d) affirmative sentences - that enhance the meaning of surrounding statements (e) control sentences - that have been developed by the individual to help him or her recall and apply information in the story
7	The story follows the Social Story formula: DESCRIBE - descriptive + perspective + cooperative + affirmative (partial or complete sentences) 2-5 <hr style="width: 50%; margin-left: 0;"/> DIRECT - directive and control (partial or complete sentences) 0-1
8	The story matches the ability and interests of the audience and is literally accurate.
9	If appropriate, the story uses carefully selected illustrations that are meaningful for the child and enhance the meaning of the text.
10	The title of the story meets all applicable Social Story criteria.

Step 1	Forty-nine sample activities to work with were provided. Carers were asked to: a) work with the most relevant samples for their children and to find out which activity types the children enjoyed working with most; b) work on their own projects by first gathering information on difficulties their own children were experiencing from a variety of perspectives.
Step 2	Carers discussed aspects of a social story with their children to discover how much meaning they had comprehended by asking 'wh' questions such as who, what, where, why and when.
Step 3	Carers attended group or one-to-one tutorials to learn how to use the multimedia-authoring tools.
Step 4	Carers were introduced to the Discussion Board where they could share ideas with other parents in the group, and find solutions to problems when devising their own social stories.
Step 5	Carers got access to 'Reach & Teach' which provided central and quick access to the resources: tutorials, sample activities, discussion board, template, and background information. Carers completed the process by writing the actual social stories.
<i>Steps 1 to 5 (School Setting)</i>	The six steps were adapted by the special needs teacher to suit the particular requirements of six students in his school. The multimedia Social Stories intervention was used to spark off a discussion about events which had happened to them personally and so improve their communication and interpersonal skills. The creation of social stories was not the objective here but rather teaching children some essential life skills. Emphasis was placed on the <i>process</i> rather than the <i>product</i> (Gray, 2000). The pupils had seven forty-minute classes, which covered sixteen activities under two topic headings: going places and things to avoid. Each pupil was asked in turn to read sentences in the stories and then, together as a class, they discussed the contents and worked through the memory games and word searches.

Type of Activity	Theme	Area Covered	Resources
text.FillinBlanks	Around the House	Getting Ready for the Day	Images & dropdown lists
		Who knows about time?	Images and animation
		Time to Eat	Images & dropdown lists
		What are unexpected noises?	Images and sounds
	Personal Care	Why do people wash their hands?	Animation
		Time for a bath	Animation
	At School	Things that I do well	Images
		Why children have pencils in my school	Images and animation
		What should I do when teacher is talking?	Images and animation
		Listen to Teacher when Maths get hard	Images
		When the Fire Alarm goes off	Images and sounds
		Will my things be there when I get back	Images and popup messages
	Social Skills	What is Lying?	Images
	Going Places	How may I help?	Clip art
Things to Avoid	When the wind blows?	Images and sounds	
	Emptying the Rubbish Bins	Images and animation	
text.Complete	Around the House	Getting Dressed	Images and animation
	At School	How can I walk to School safely?	Images and sounds
puzzles.DoublePuzzle	Around the House	Time	Images and animation
associations.Simple Association	Around the House	Matching Sounds	Images and Sounds
	Going Places	Simple Association	Images
	Things to Avoid	Simple Association	Images
text.Grid.WordSearch	Around the House	At Home	Reinforcement
	At School	Word Search	Reinforcement
	Social Skills	Word Search	Reinforcement
	Going Places	Word Search	Reinforcement
	Things to Avoid	Word Search	Reinforcement
memory.Memory Game	Around the House	Memory Game	Images
	Personal Care	Memory Game	Images
	Going Places	Memory Game	Images
	Things to Avoid	Memory Game	Images
text.Identify	Personal Care	When do people brush their teeth?	Animation
	Personal Care	Time for a haircut	Animation
	Personal Care	Time to take my medicine	Animation
	At School	How can I walk to School safely?	Images
	Social Skills	How to greet someone	Animation
	Social Skills	How to give a hug	Animation
	Social Skills	Playing outside	Images
	Going Places	What is a Grocery Store?	Images
	Going Places	Riding in a Car	
	Things to Avoid	Emergency	Images
Things to Avoid	Fire	Images and animation	
text.Order	Personal Care	Washing my hair	Word game
	Social Skills	How do Children share Video Games?	Images
	Going Places	Eating out	Animation
	Things to Avoid	Strangers	Clip Art

List of Captions or Tables – Reach & Teach

Table 1	Gray's Criteria for Social Story Writing (2004b)
Table 2	Case Study Procedures
Table 3	Sample Activities - Activity Types (Appendix)

Reach & Teach

A Framework for Exceptional Children

[View Background Document Download with Additional Information](#)



Figure 1a grayscale

[Click here to download high resolution image](#)

Reach & Teach

A Framework for Exceptional Children

How Background Processes Disrupt and Enhance Cognitive Performance





Resources

Here you will find all the information and references that you will need to commence creating personal social stories for children with ASDs.

Tutorials

- [Guidelines](#) on how to use the Virtual Training Studio
- [Social Stories Tutorial](#)
- [JCLic Tutorial](#)

Sample Activities

- [Around the Home](#)
- [Personal Care](#)
- [At School](#)
- [Social Skills](#)
- [Going Places](#)
- [Things to Avoid](#)

Before you start your own projects you must [download](#) some applications:

- [JCLic Player](#) - application used to review activities
- [JCLic Author](#) - application used to create and modify activities
- [JCLic Reports](#) - application used to extract reports in a network environment

You may also be interested in learning some more about the [Virtual Training Studio](#)

Resources

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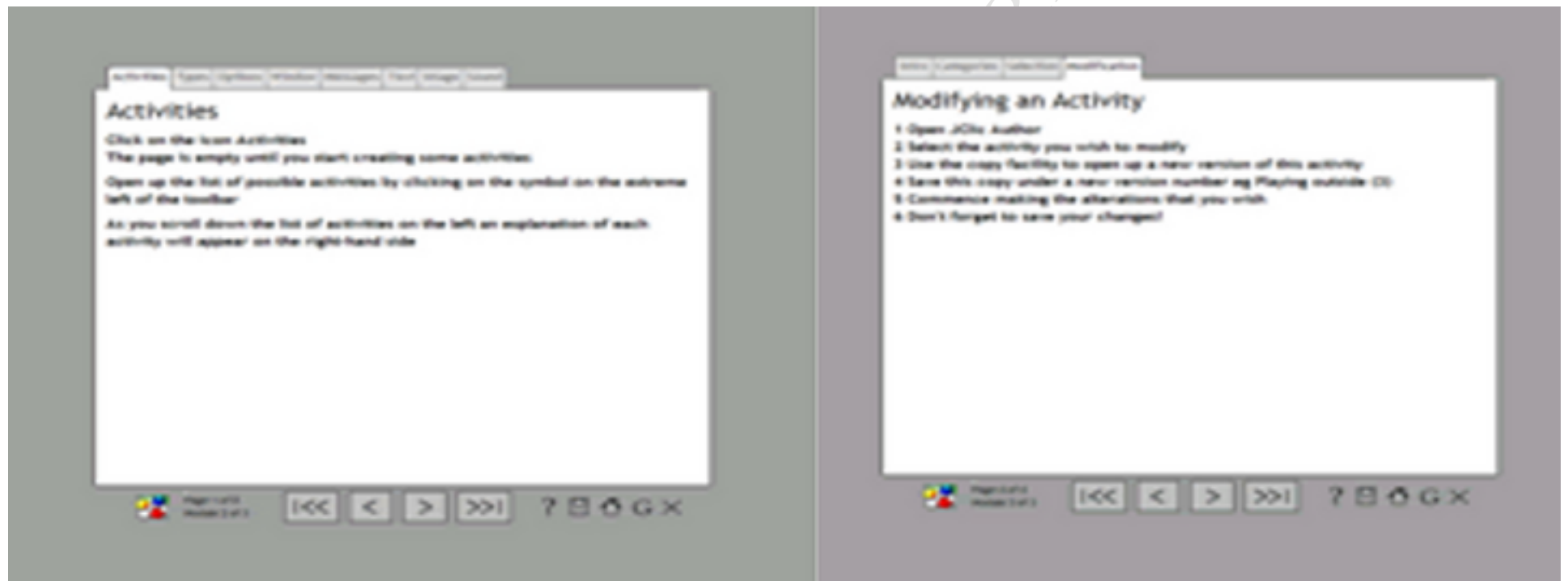




Figure 4 rgb

[Click here to download high resolution image](#)


The screenshot shows a web browser window with the address bar displaying 'at_school'. The page content is as follows:

What should I do when My Teacher is talking?

I go to school almost every 


There are many other children at my school. In my classroom, the children usually sit at their desks.

When the teacher is talking to the class, the are quiet. When someone wants to say something, they usually raise their hand and wait for

the teacher to call on them. 

When the teacher is talking to the class, I will try to be quiet and listen.

When I want to say something or answer a question, I will try to remember to raise my and wait to see if the teacher calls on me.



When I am in class

At the bottom of the browser window, the status bar shows 'Activity running' and a refresh icon.

Figure 4 grayscale
[Click here to download high resolution image](#)



Figure 5 rgb
[Click here to download high resolution image](#)

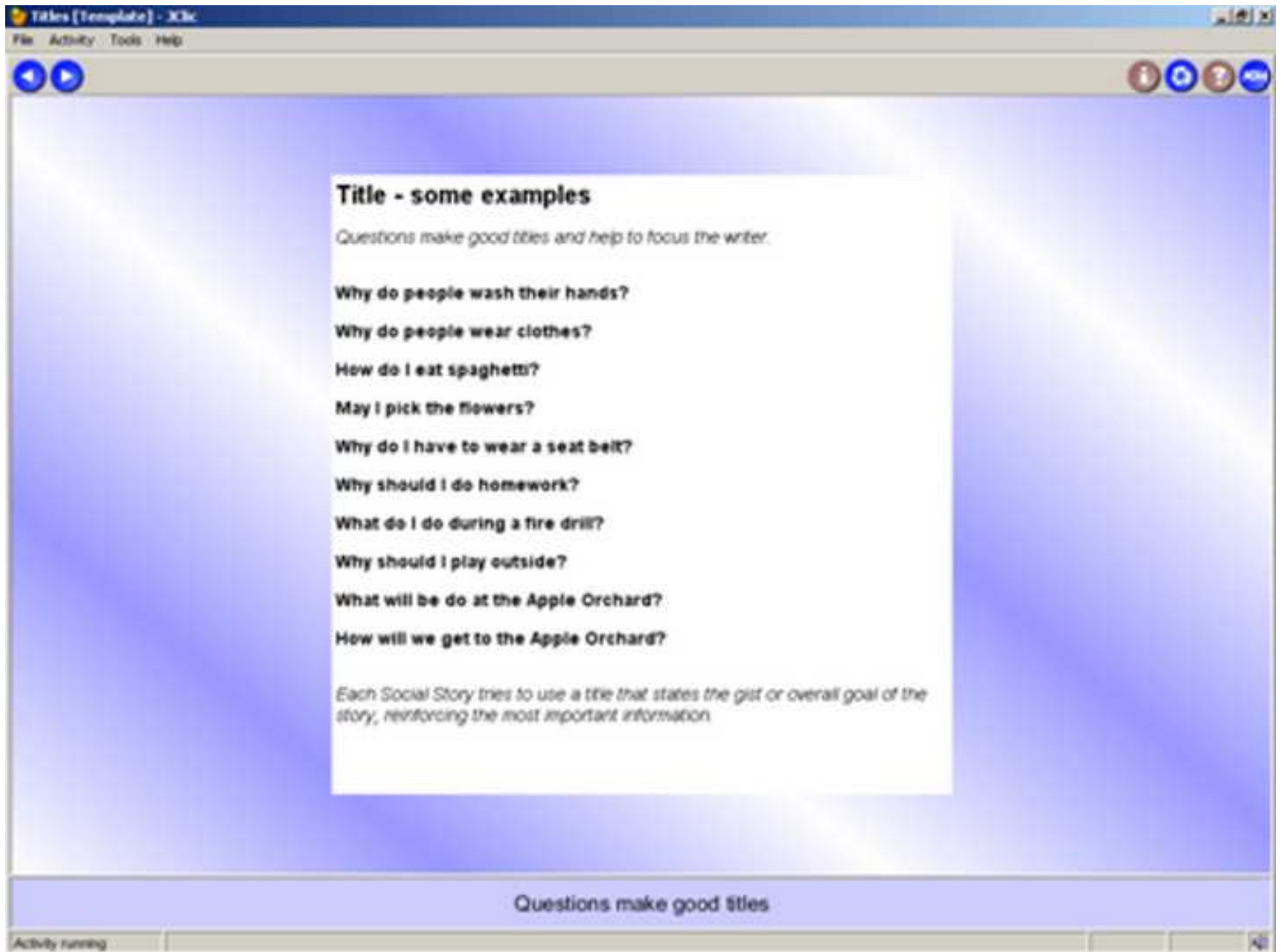
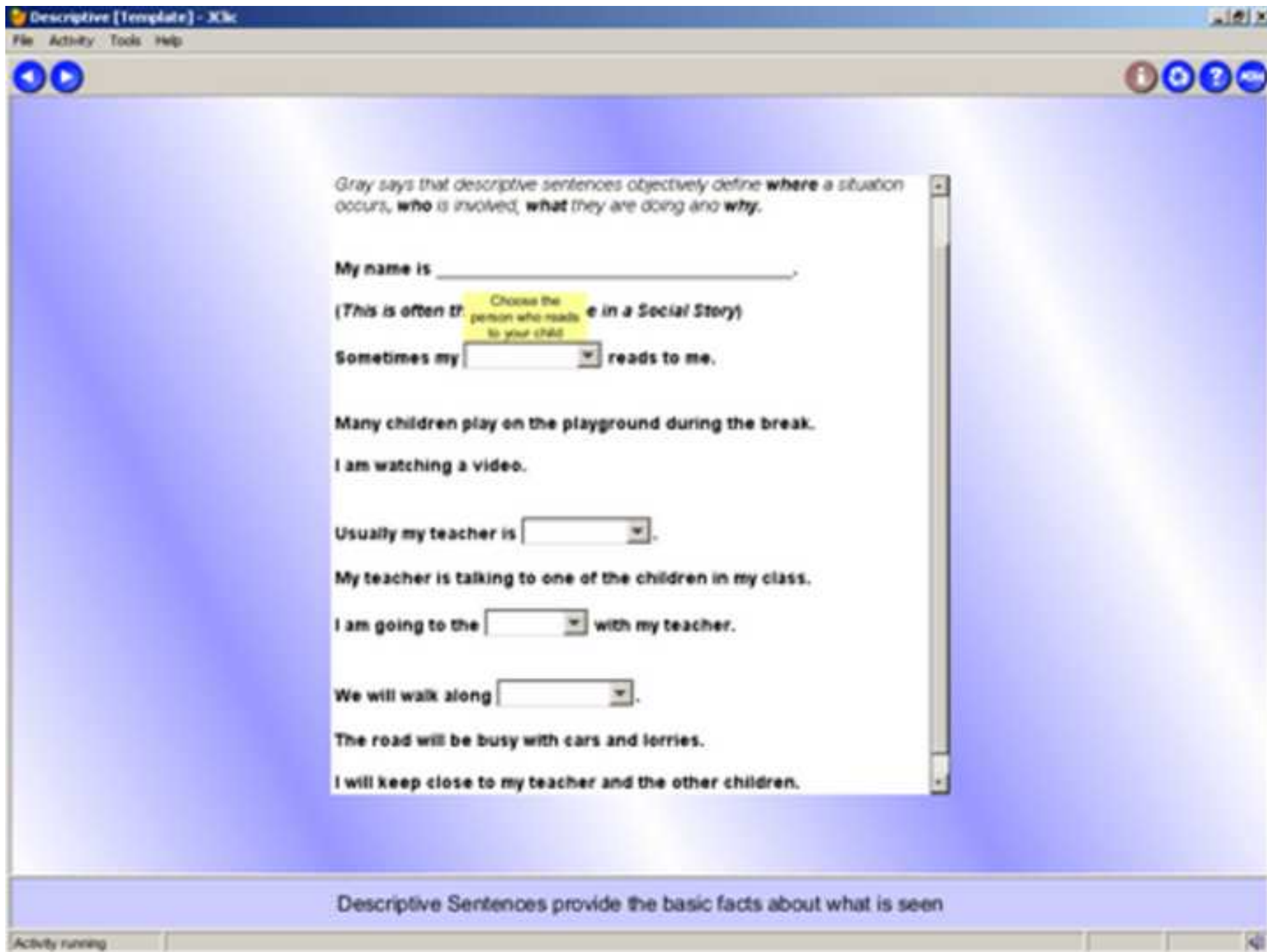
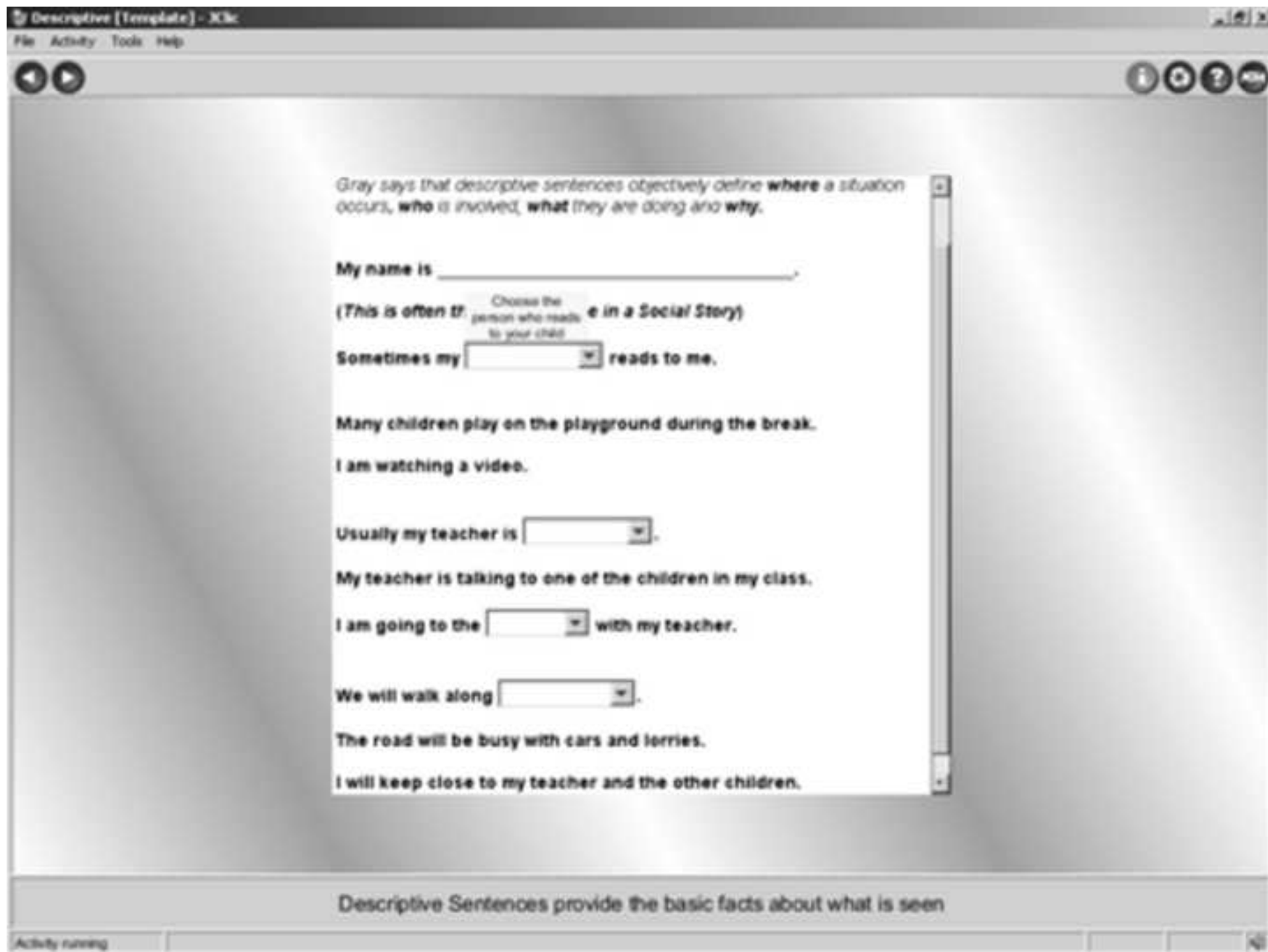


Figure 5 grayscale
[Click here to download high resolution image](#)







Now its my turn

First the girl gets towel



She puts the towel around me

Then she gets the scissors



I can see myself in the mirror

I can see the girl in the mirror

Chip chop chip chop

Now its my turn

First the girl gets towel



She puts the towel around me

Then she gets the scissors

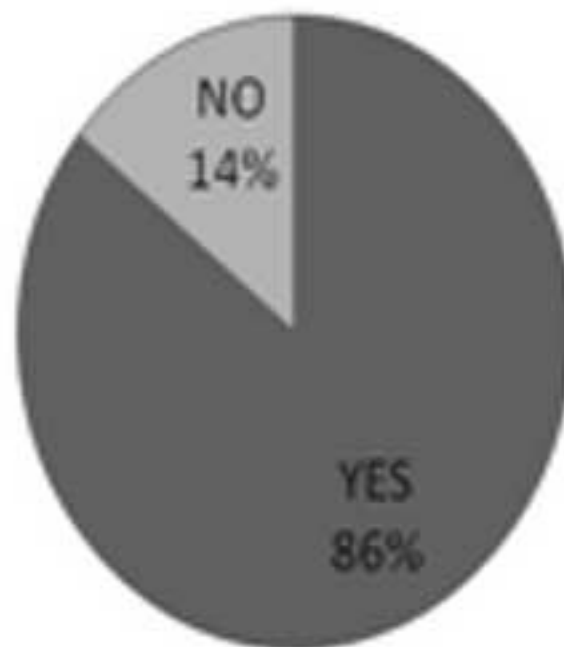


I can see myself in the mirror

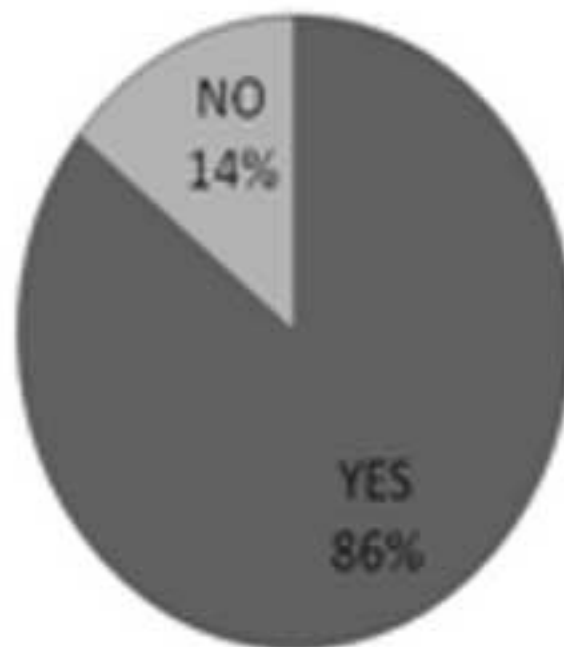
I can see the girl in the mirror

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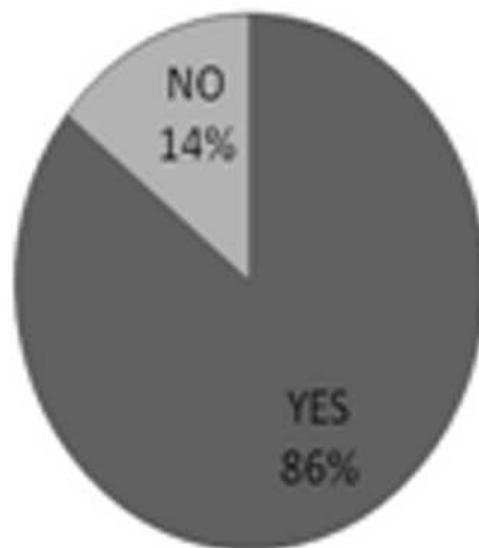
Multimedia Intervention Easy to Adapt to Needs of Children with ASDs

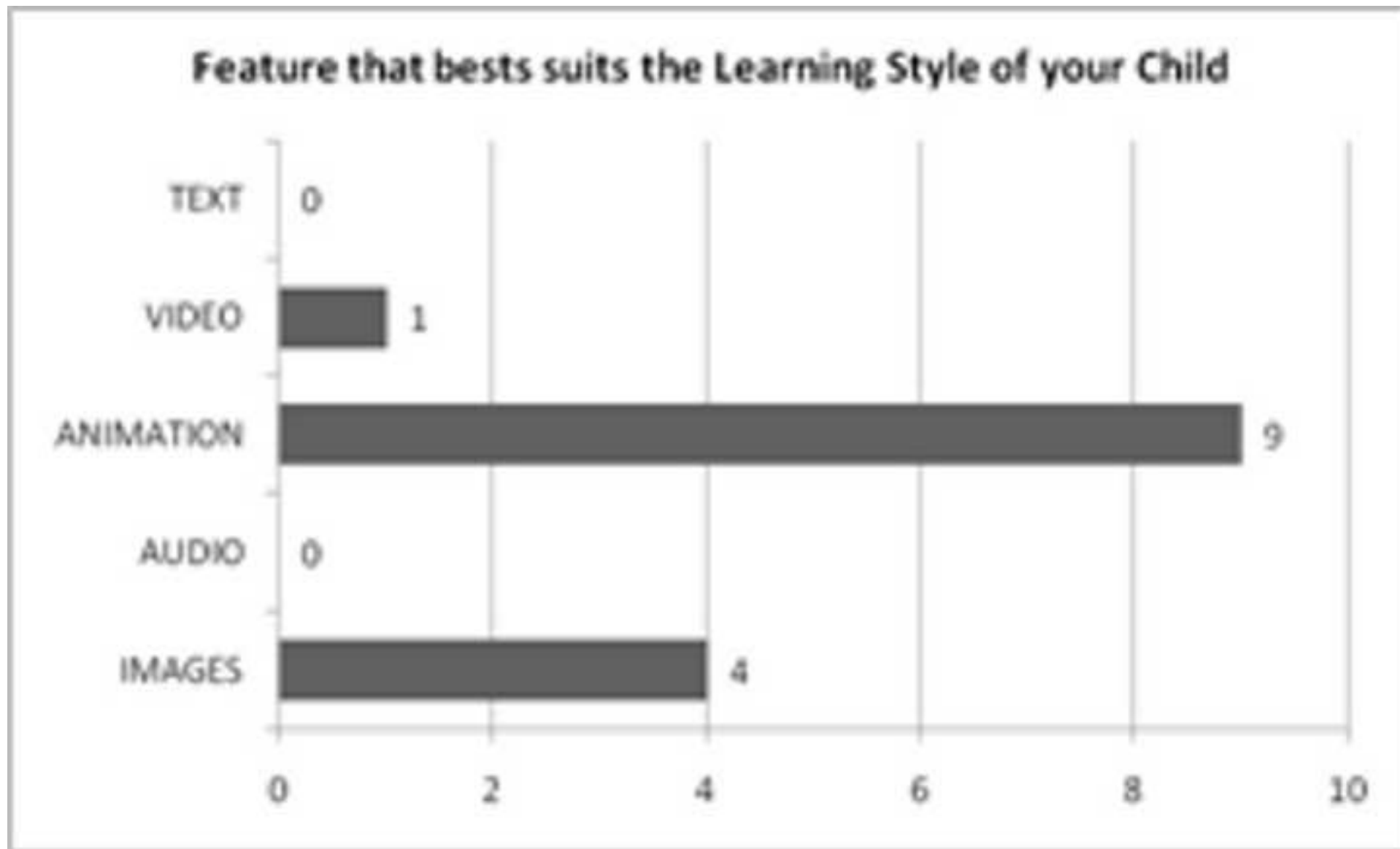


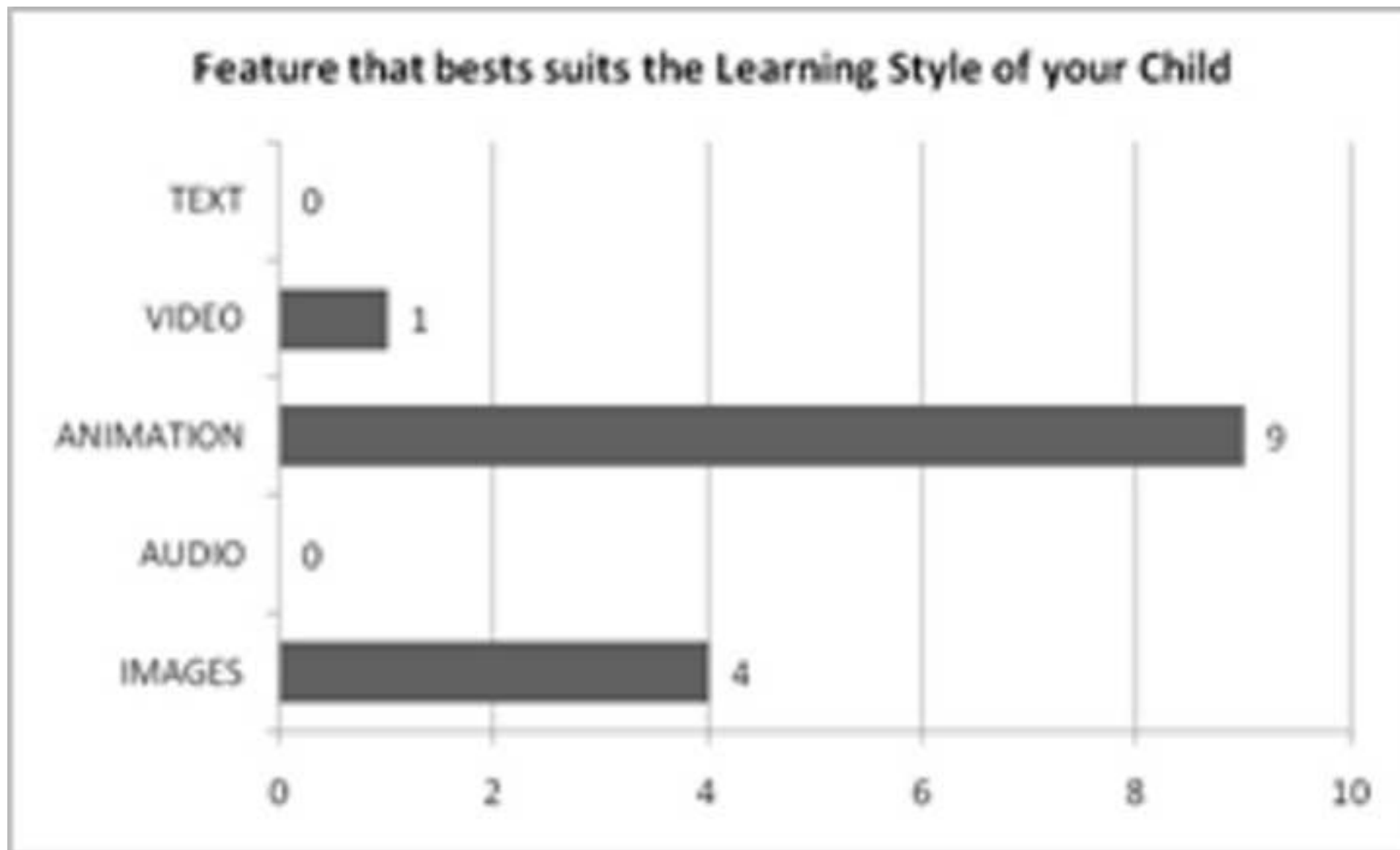
Multimedia Intervention Easy to Adapt to Needs of Children with ASDs

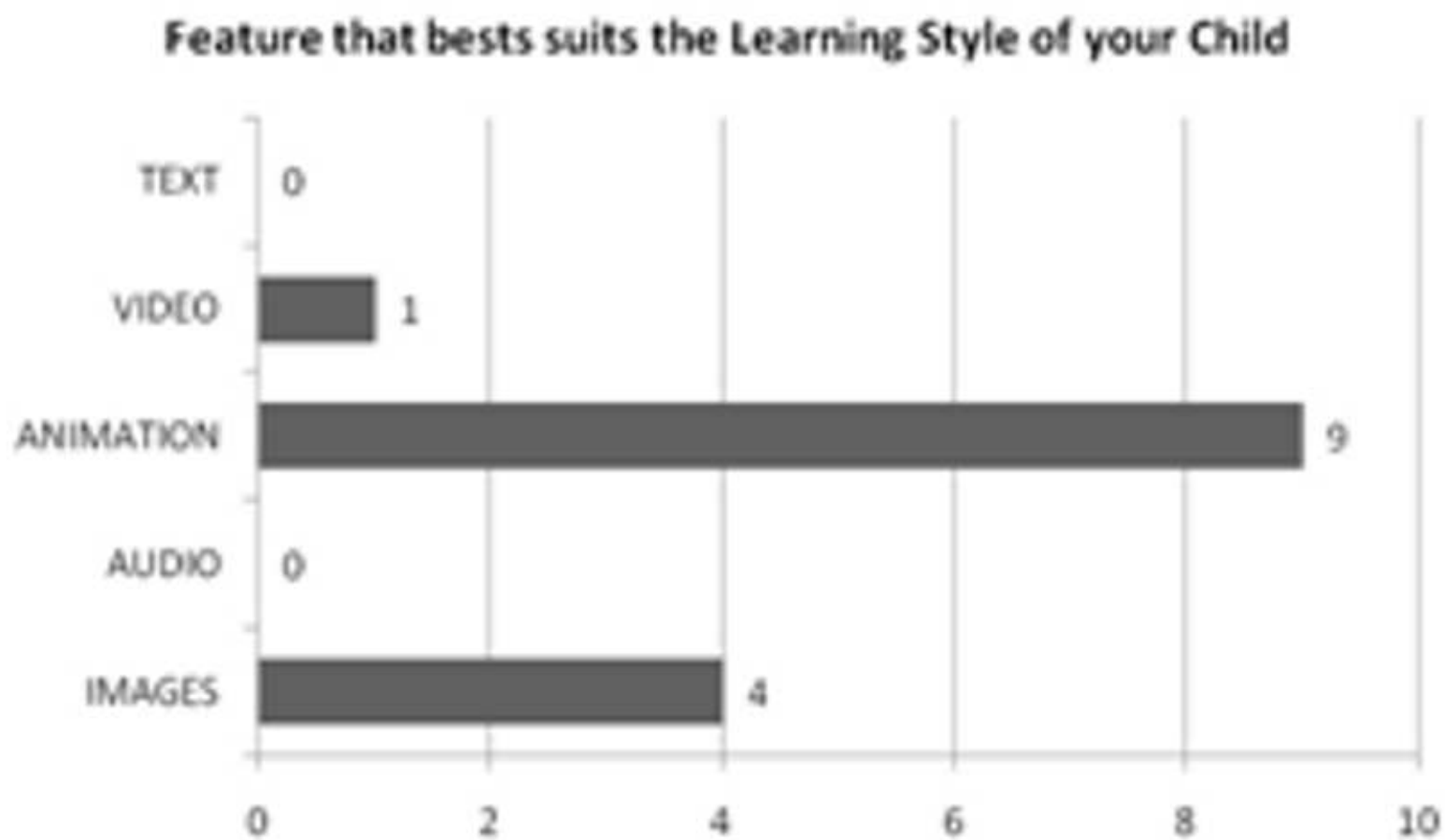


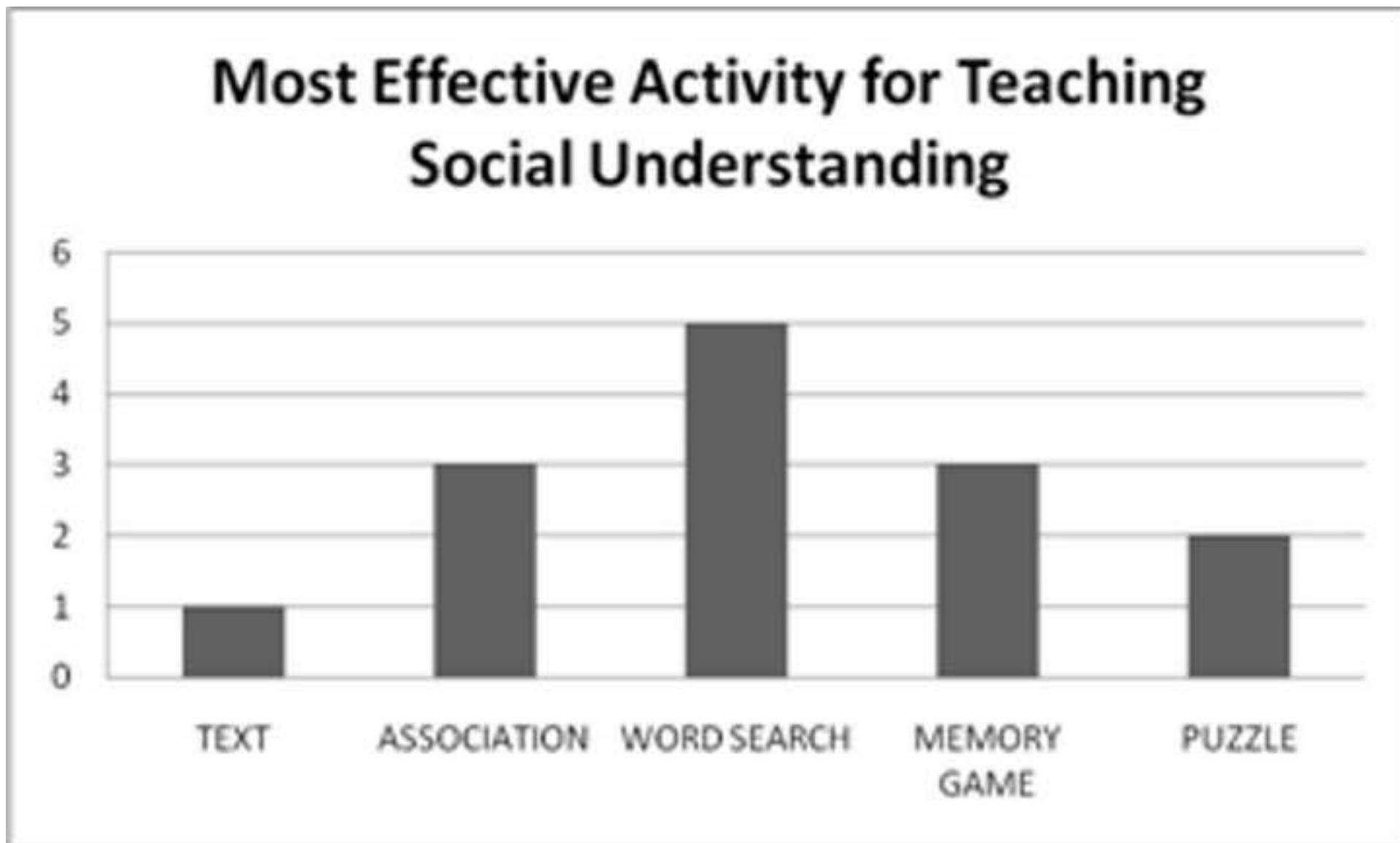
Multimedia Intervention Easy to Adapt to Needs of Children with ASDs



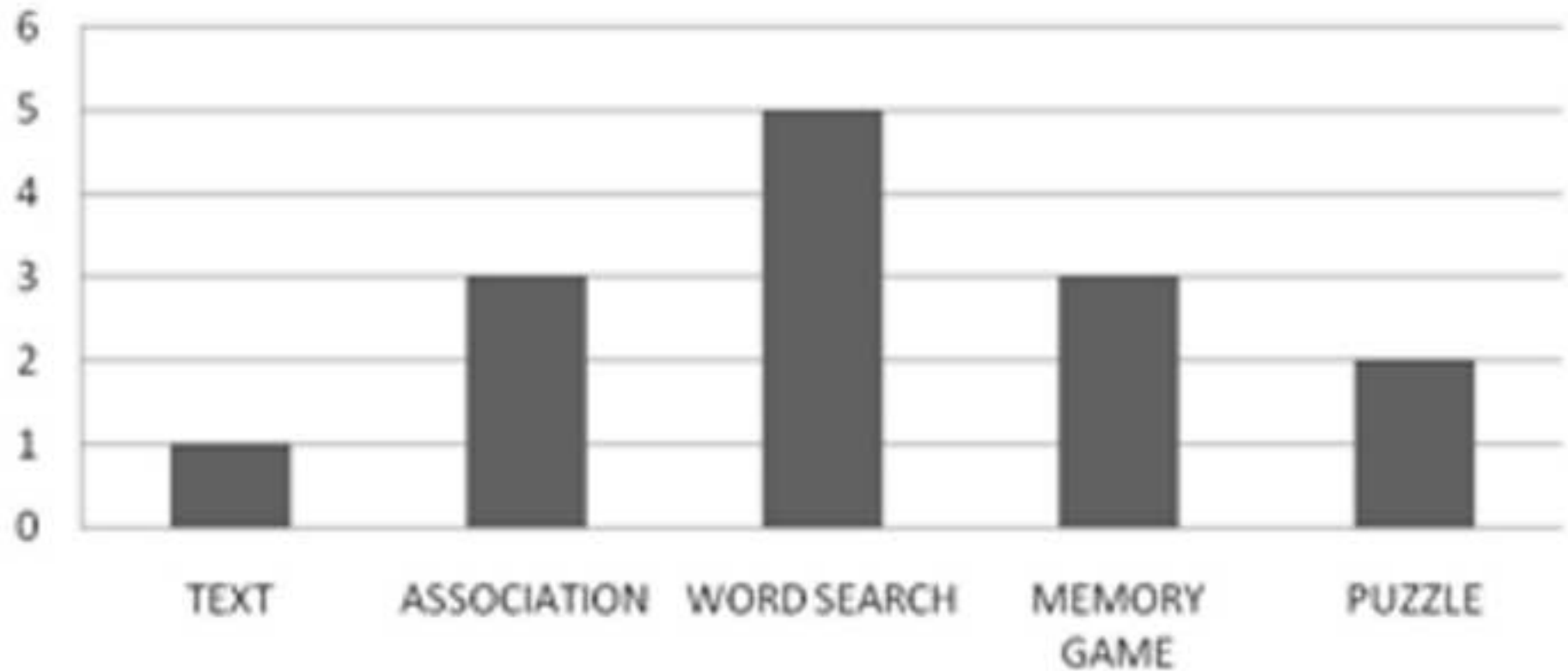
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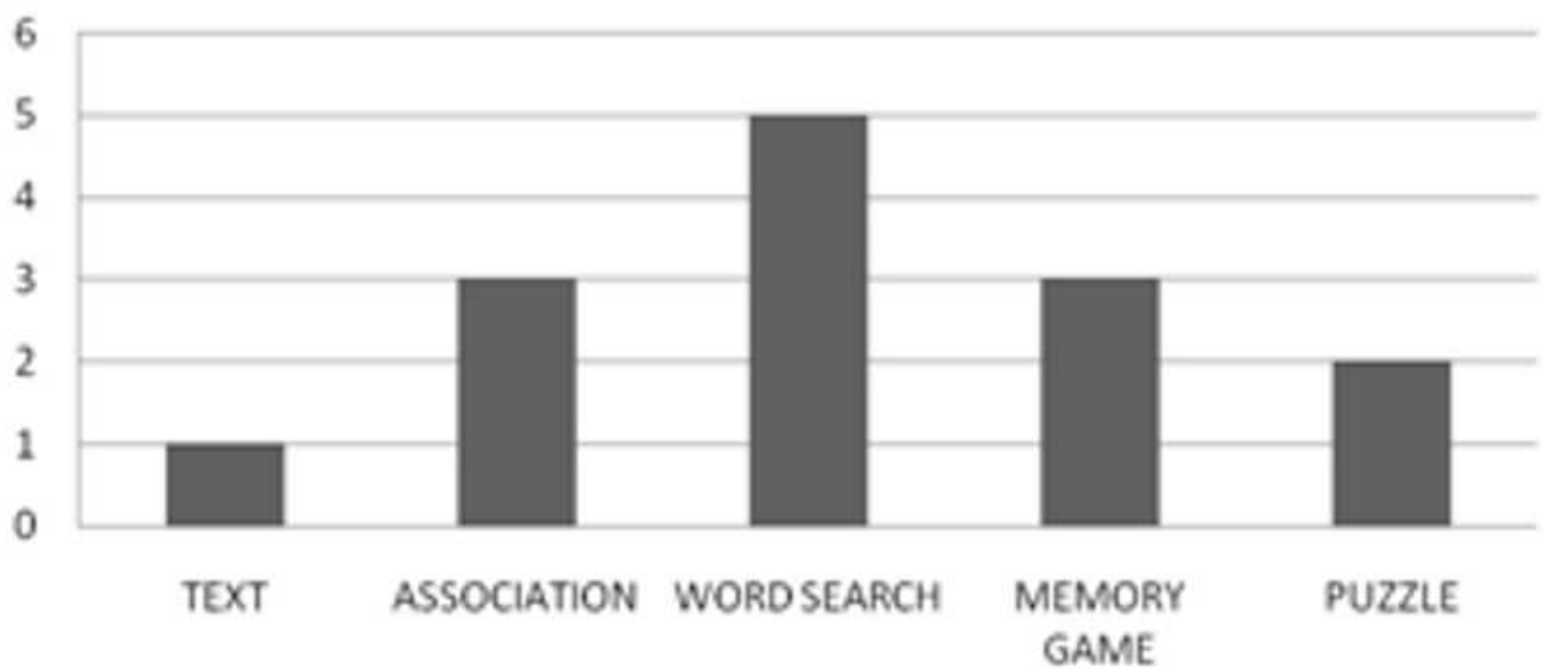




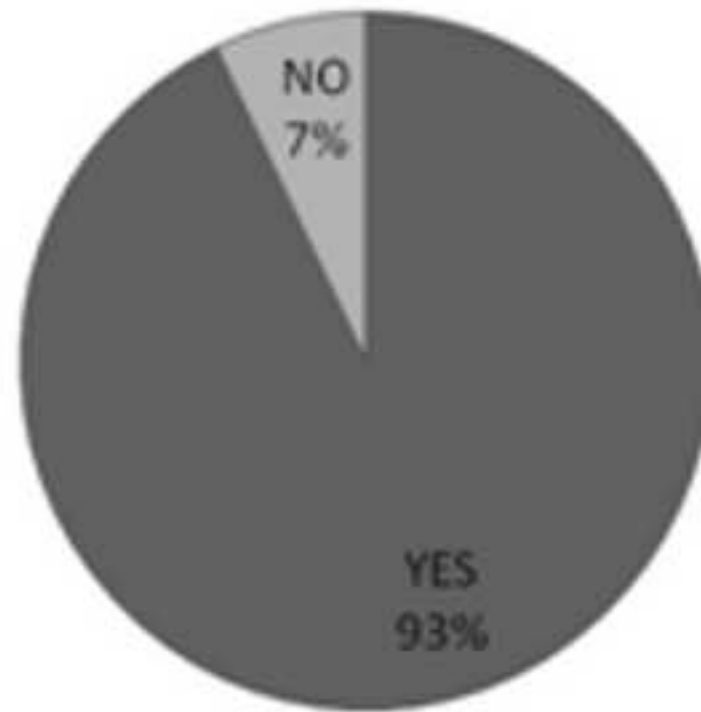
Most Effective Activity for Teaching Social Understanding



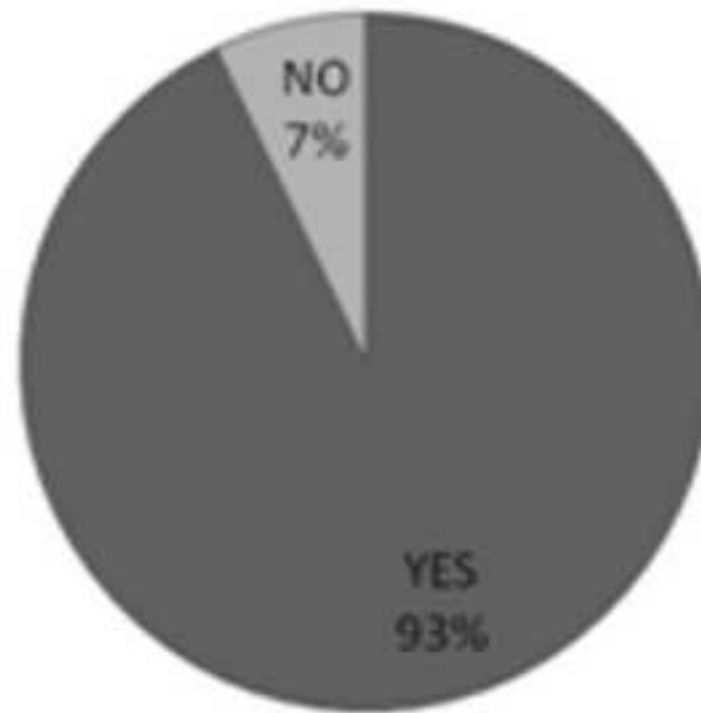
Most Effective Activity for Teaching Social Understanding



Improvement in Children's Particular Situation after working with Multimedia Intervention



Improvement in Children's Particular Situation after working with Multimedia Intervention



**Improvement in Children's Particular Situation
after working with Multimedia Intervention**

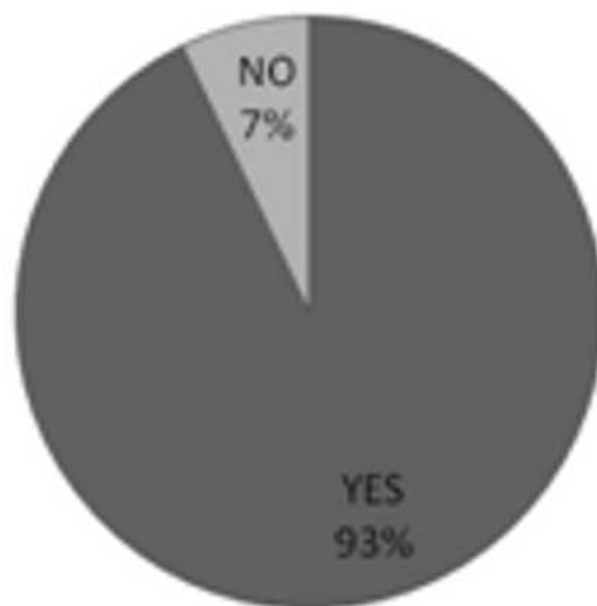


Figure 12 rgb
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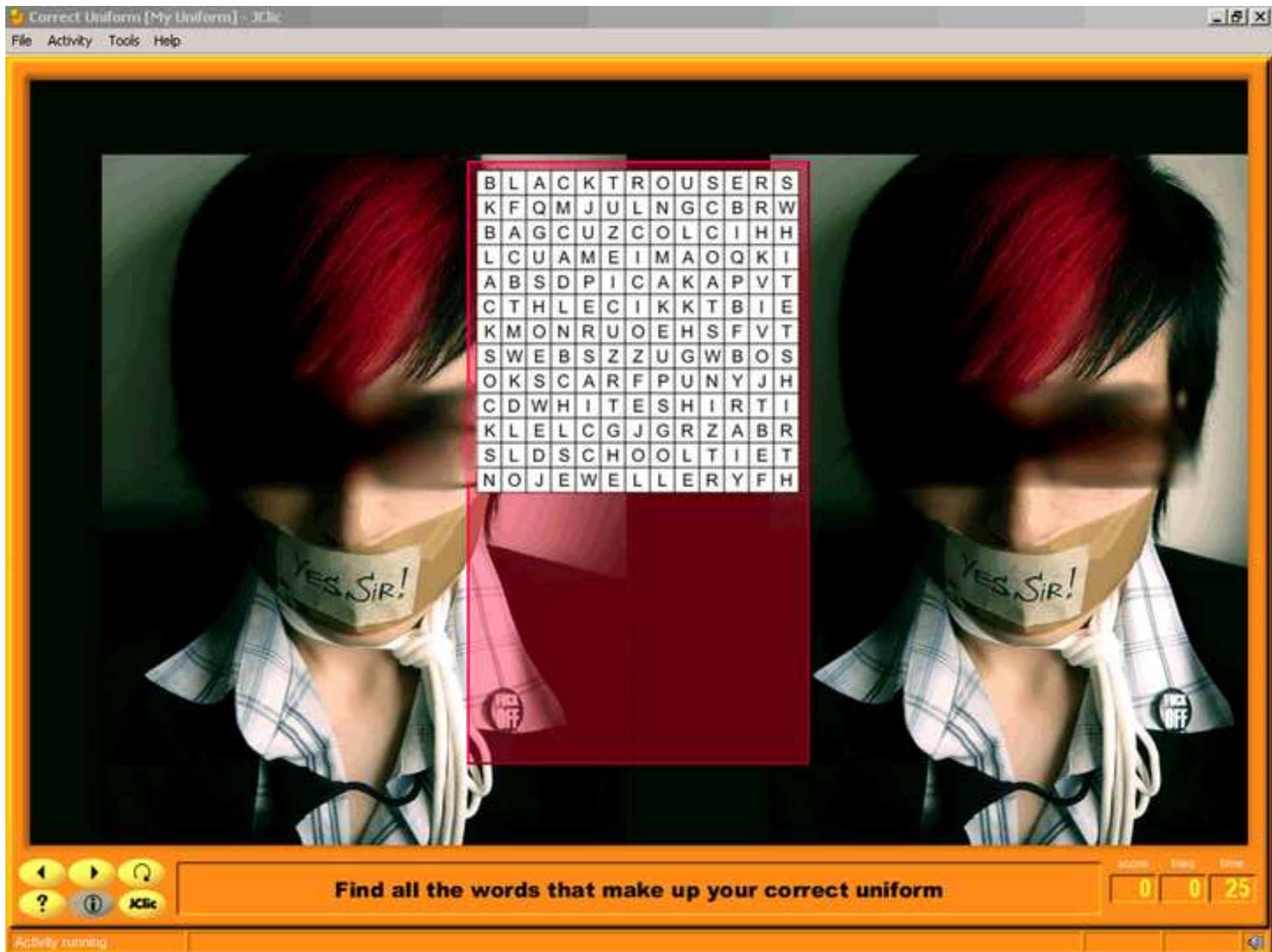
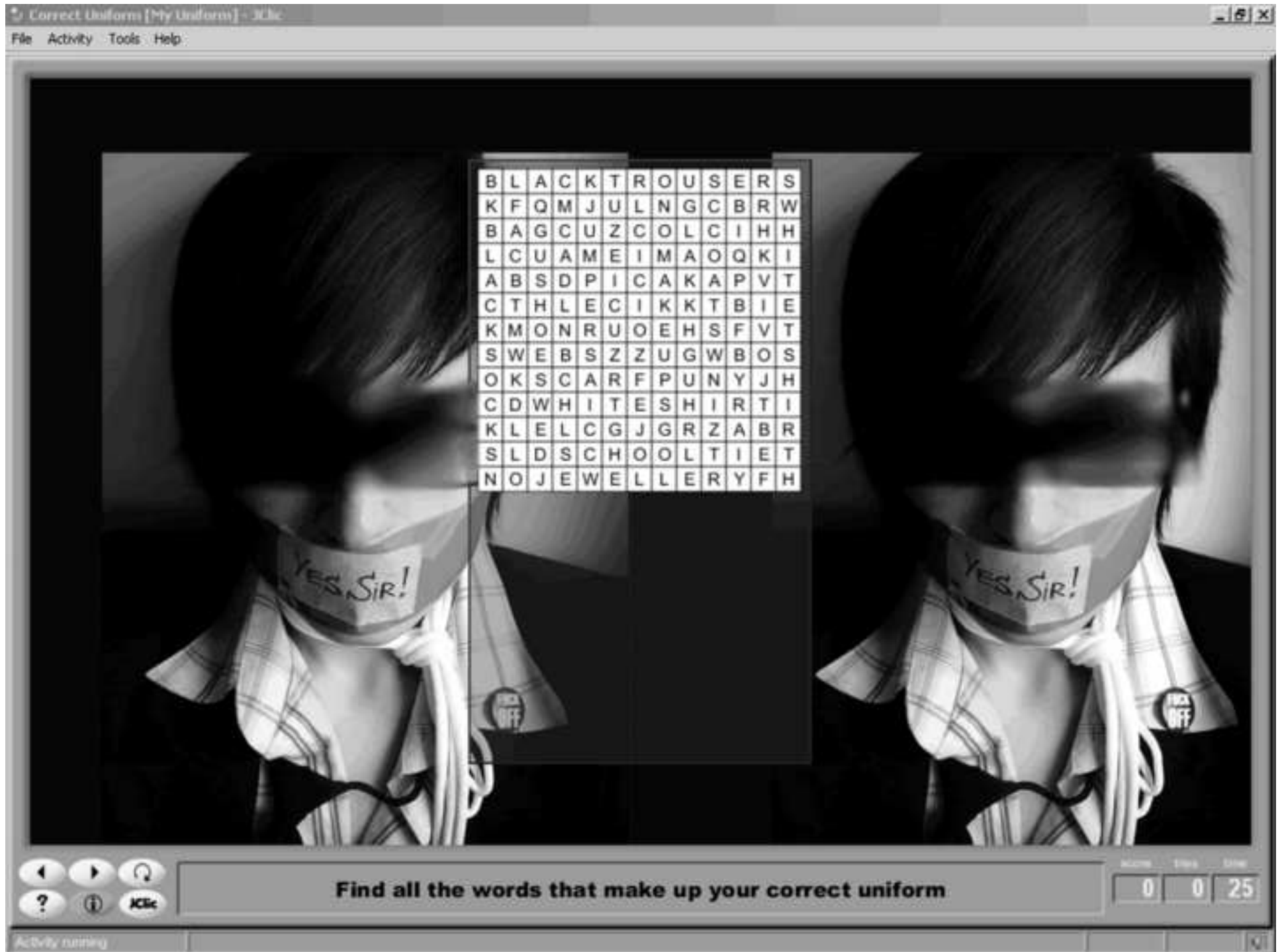
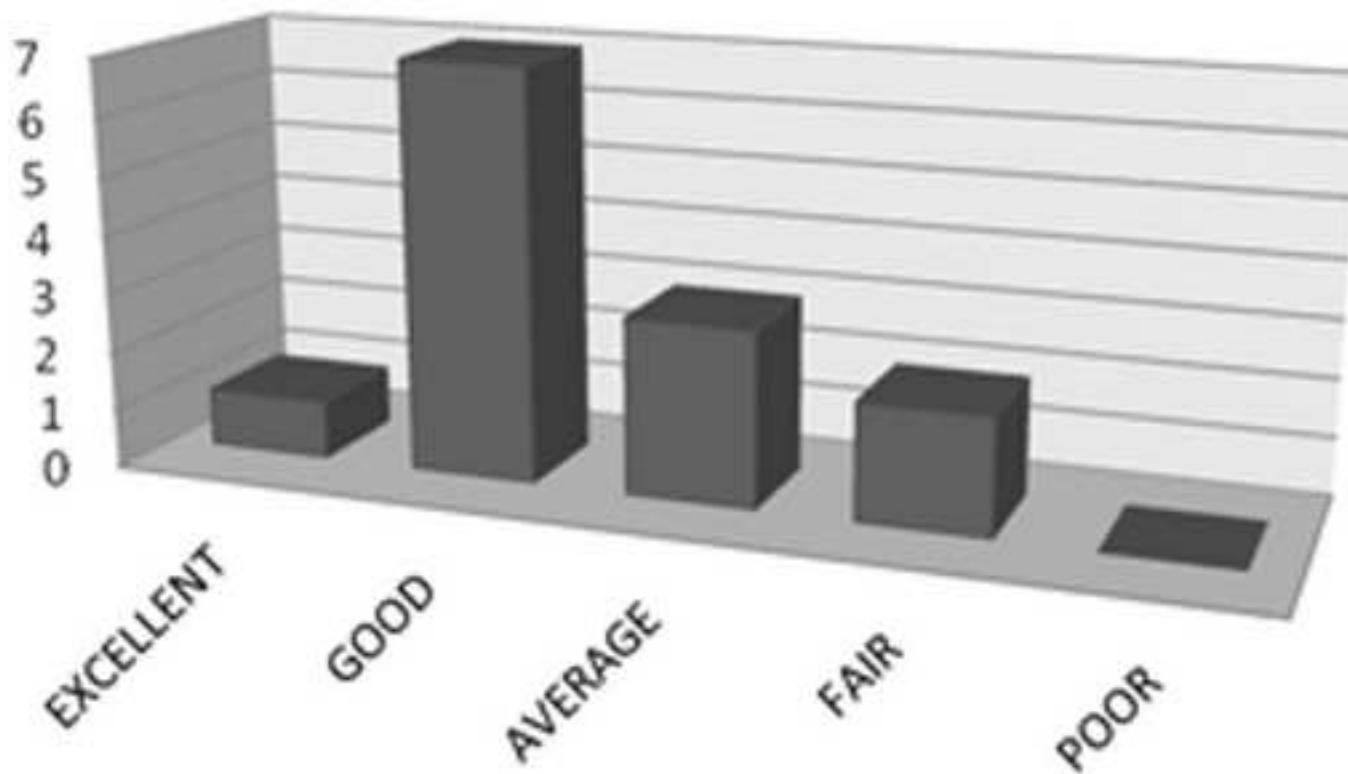


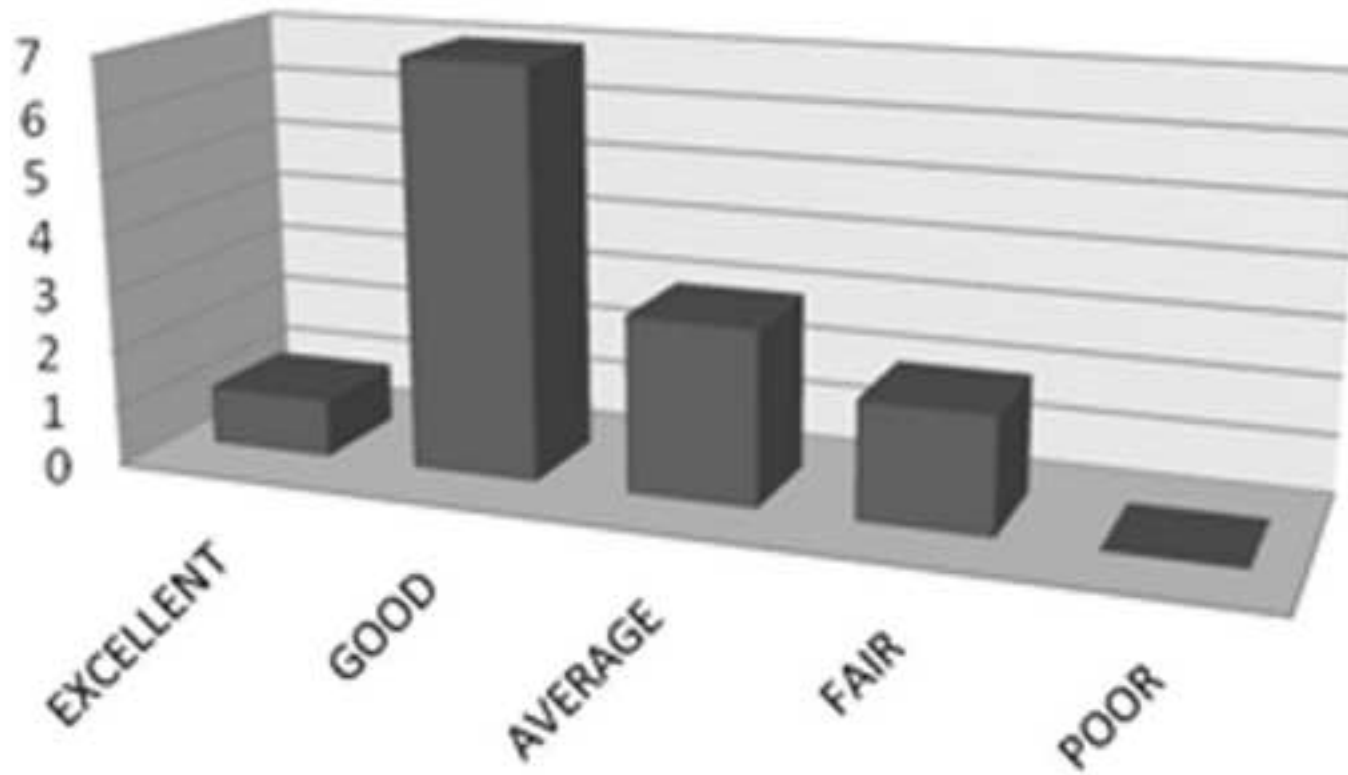
Figure 12 grayscale
[Click here to download high resolution image](#)



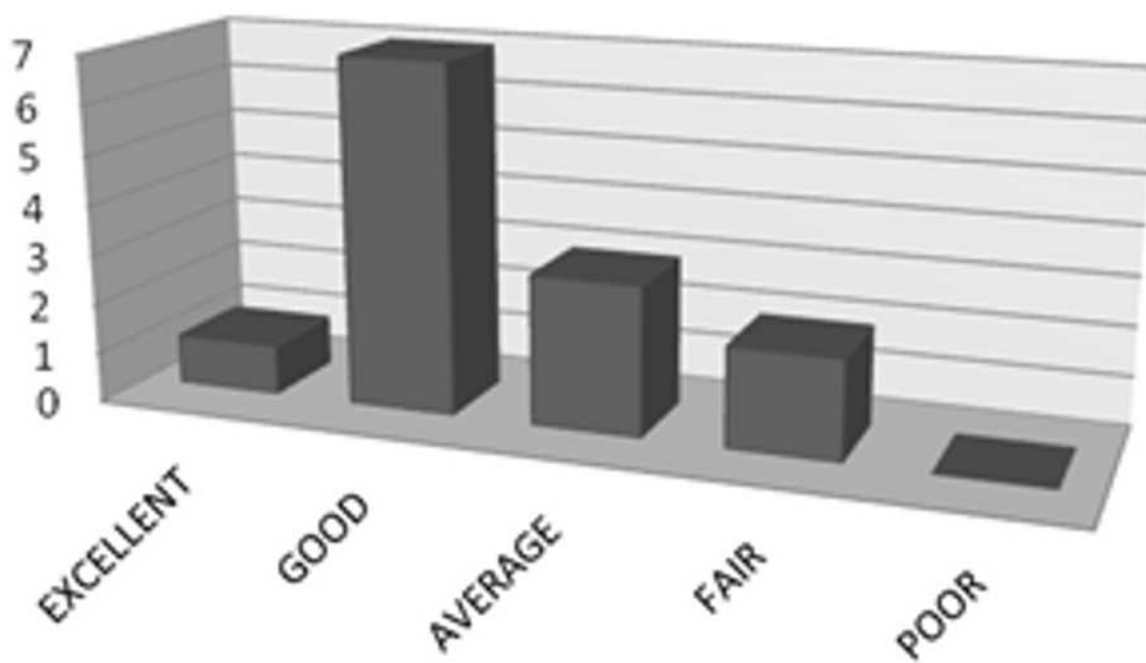
Improvement in Targeted Behaviour



Improvement in Targeted Behaviour



Improvement in Targeted Behaviour



List of Captions for Figures – Reach & Teach

- Figure 1** **Reach & Teach Home and Resources' pages**
- Figure 2** **Social Story Tutorial**
- Figure 3** **Authoring Tools' Tutorial**
- Figure 4** **Sample Social Story: What should I do when My Teacher is talking? (At School)**
- Figure 5** **Sample Story Titles**
- Figure 6** **A Social Story Template**
- Figure 7** **Getting My Hair Cut: Social Story by Parent 6**
- Figure 8** **Easy Adaptation of the Intervention**
- Figure 9** **Feature matching Learning Style**
- Figure 10** **Activity to teach Social Understanding**
- Figure 11** **Improvement in Children's Particular Situation**
- Figure 12** **School Uniform: Word Search created by Parent 1**
- Figure 13** **Improvement in Targeted Behaviour**