



The acceptability and efficacy of an intelligent social tutoring system



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ABSTRACT

This study tested the acceptability and efficacy of an innovative intelligent tutoring system (ITS), *Adventures Aboard the S.S. GRIN*, that translates the evidence-based in-person Social Skills Group Intervention (SSGRIN) into an interactive game-based social tutorial. This randomized controlled pilot trial tested the first half of the social tutorial software for children with social skills challenges. Participating children in grades 3–5 were randomly assigned to immediate treatment ($n = 19$) or wait-list control ($n = 17$). User ratings indicated the software was easy to use and well-liked for this audience. The program was also associated with observable changes in social skills and behavior; children who interacted with *Adventures Aboard the S.S. GRIN* exhibited lower psychosocial distress and higher behavioral and emotional strength at post-test compared to children who did not. This pilot study offers important insights about the feasibility and potential effectiveness of online social skills training and lays the groundwork for future full-scale effectiveness testing. The advantages of using this state-of-the-art approach and its implications for improving social, emotional, and academic outcomes are discussed.

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1. Introduction

1.1. Social skills are crucial for success

There is growing recognition that social skills are critical for success both in school and in life. Strong support for social skills education is shared by the public, educators, and policymakers alike (Camilli, Vargas, Ryan, & Barnett, 2010; Meier, DiPerna, & Oster, 2006; National Association for the Education of Young Children, 2009; National Research Council, 2012). Gallup Poll results indicate that a majority of people think these skills should be taught to children (Bushaw & Lopez, 2013), and this opinion is increasingly being reflected in state and federal policies (Dusenbury, Zadrizil, Mart, & Weissberg, 2011; HR 1875, 2013). Parents, educators, mental health professionals, and others invested in the development of children and youth are seeking tools to promote positive social development.

There is good reason for this increasing emphasis on social competence. Children who struggle with social skills are at heightened risk for a wide array of externalizing and internalizing problems and serious negative outcomes, including aggression, anxiety, bullying, depression, and substance abuse, as well as academic failure and school dropout (DeRosier, Kupersmidt, & Patterson, 1994; Dodge & Crick, 1990; French & Conrad, 2001; Hawkins, Catalano, & Miller, 1992; Kupersmidt & DeRosier, 2004; Najaka, Gottfredson, & Wilson, 2001; Olweus, 1993; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006; Solberg, Olweus, & Endresen, 2007; Spooner, 1999; Weiss & Hechtman, 1993). Unaddressed problems with peers tend to worsen over time, and as these problems become more chronic and severe the likelihood of serious negative consequences in adolescence significantly increases (DeRosier et al., 1994; Kupersmidt & DeRosier, 2004; Parker et al., 2006).

1.2. Social skills training

Fortunately, social skills training (SST) can improve outcomes for children who struggle. Scores of studies support the efficacy of these interventions for improving children's social skills and academic functioning, and for reducing aggression, mental health problems, and

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substance use (e.g., Beidel, Turner, Young, & Paulson, 2005; DeRosier, 2004; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Foster & Bussman, 2007; Hawker & Boulton, 2000; Joseph & Strain, 2003; Losel & Beelmann, 2003; Zins, Weissberg, Wang, & Walberg, 2004). Effective universal or targeted interventions can help children learn and practice the social skills that increase positive and/or inhibit negative social interactions (Asher & Renshaw, 1981; Coie, Dodge, & Kupersmidt, 1990; Dodge & Feldman, 1990; Merrell & Gimpel, 1997). For example, SSTs directly teach cooperative skills that promote companionship and decrease domineering or impulsive behaviors. Similarly, SSTs enhance empathetic behaviors that promote communication and the ability to take another's perspective.

Unfortunately, the reach of traditional in-person SST is limited (Mueser & Bellack, 2007). Logistical barriers, such as the need for trained professionals to administer the program, financial costs to families, and time and travel requirements for children to participate, mean that many children who could benefit from SST never receive intervention. The families of children in need of social intervention may lack the means to access such treatment, or be unable to commit the time or resources required for in-person intervention. Even when individuals can afford and access traditional SST, in-person treatment delivery often does not provide the repeated opportunities for skill practice and concept exposure shown to result in greater intervention benefits (Foster & Bussman, 2007; Greenberg, Domitrovich, & Bumbarger, 2001), including extending learning and practice opportunities beyond the group setting (Greenberg et al., 2001). The opportunity to not only address these barriers but also offer an unprecedented level of individualized, adaptive intervention is now available, as advances in emergent technologies are making it possible to translate evidence-based SST programs into broadly accessible engaging game-like platforms.

1.3. Intelligent tutoring systems for social skills training

An Intelligent Tutoring System (ITS) is a computer-based learning system that attempts to adapt to the needs of learners (Self, 1999). ITSs foster and assess learning through adaptive interaction between the student and the system, and the instruction contains both domain-specific pedagogical knowledge and knowledge of the learner (Bordeau & Grandbastien, 2010; Collins & O'Brien, 2011). As the learner interacts with the software, the software responds by selecting the most appropriate content and pedagogical style for that learner; in this way, the software reacts in much the same way a human tutor would. The active engagement through interactivity between a child and the software can enhance learning and memory beyond more passive instructional methods (e.g., Corbett, Koedinger, & Hadley, 2001; Graesser, Jeon, & Duffy, 2008).

ITSs offer an innovative way to advance SST, address barriers to effective implementation, and reach children on a much broader scale than traditional methodologies. In effect, ITSs for SST have the potential to lower cost, eliminate the need for travel, accommodate any schedule, and eliminate inconsistencies in treatment delivery across different providers. Beyond these practical benefits, ITSs can improve upon traditional SST models by providing repeated and unlimited practice opportunities within an intelligent, interactive learning environment that can individualize instruction at a level not typically possible with in-person SST. Specifically, ITS software has the capacity to adjust to a child's individual needs by varying difficulty based on performance and providing immediate personalized feedback and pedagogical assistance to guide the child towards target learning goals (Hutcherson, Langone, Ayers, & Clees, 2004; Mazzotti, Test, Wood, & Richter, 2009).

An additional advantage of interactive game-like ITSs is that they are inherently engaging and motivating for today's children, for whom technology has become a ubiquitous part of life (Fitzgerald, 2005; NCREL & Metiri Group, 2003). Learning through virtual or simulated environments can be a great motivator in the educational process and a valuable part of learning and development (Joyce, Gerhard, & Debry, 2009; Ke, 2009). An interactive digital environment lets a child think, understand, prepare, execute actions, and adjust strategy as needed (Gee, 2003) by employing simulated situations analogous to those they experience in real life. Employing ITSs for SST offers the opportunity to improve technical capability and clinical practice in SST. It also provides a safe practice environment; practicing fledgling social skills with peers can be risky, but practicing in the virtual environment gives children a safe place to fail and then try again.

Although the use of ITSs for academic skills such as math and science is becoming more commonplace, an ITS for SST is highly innovative, and as a result the research base is just being established. Early results indicate that interactive software may be an effective tool for remediating social skills for children. To date, most of the available research (e.g., Golan & Baron-Cohen, 2006; Sansoti & Powell-Smith, 2008) has focused on children with autism spectrum disorders, who experience marked social skill deficits, and most of the existing programs are simplistic in design and implementation with little to no dynamic adjustment in difficulty or personalized feedback. One recent system designed to promote social skills and prevent bullying called *Quest for the Golden Rule* (Rubin-Vaughan, Pepler, Brown, & Craig, 2011) includes more complex social problem solving situations, and preliminary results look promising. However, because that research did not include a control group, it's not possible to draw conclusions about the effectiveness of *Quest for the Golden Rule*.

1.4. Adventures aboard the S.S. GRIN

1.4.1. Social skills group intervention: the evidence-based in-person program

The primary goal of the interactive program is to enable broad delivery of an evidence-based SST and provide children with a safe and private learning environment in which to build and practice social skills through interactive social problem solving (SPS) scenes. The specific skills included were based on *Social Skills Group Intervention (SSGRIN)*, an evidence-based in-person SST program. Developed at 3C Institute and currently used with thousands of children across the United States and abroad, *SSGRIN* has been repeatedly tested resulting in a strong empirical base for its effectiveness (e.g., DeRosier, 2004; DeRosier & Gilliom, 2007; DeRosier & Marcus, 2005).

SSGRIN is a 10 week in-person small group intervention for children with social skills deficits, led by a trained professional (e.g., psychologist or school counselor). *SSGRIN* is designed to be broadly applicable to children experiencing a wide range of social difficulties, including immature social skills relative to same-aged peers; social isolation with few close friends; rejection, teasing, or bullying by peers; social anxiety or awkwardness with peers; aggressive or bullying behavior with peers; and impulsive, disruptive behaviors. The program addresses the five social and emotional learning (SEL) competency clusters identified by CASEL (2013), which include self-awareness, self-management, social awareness, relationship skills, and responsible decision making. It focuses on increasing children's capacity to evaluate social situations and respond in an adaptive, prosocial manner to achieve social goals. Children who participate in *SSGRIN* show increased

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