

Effects of computer collaborative group work on peer acceptance of a junior pupil with attention deficit hyperactivity disorder (ADHD)

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Abstract

The study investigated the effects of computer collaborative group work, facilitated by an adult, on peer acceptance of a junior boy with Attention Deficit Hyperactivity Disorder (ADHD). It aimed to ascertain whether collaborative group work on a computer, with the facilitation of an adult, could help to raise his peer acceptance among his classmates. Data were gathered before and after computer group work sessions. Interviews and questionnaires were conducted on parents and teachers to help establish the history background data and their concerns on the boy's peer acceptance. Sociometrics testing of classmates was used to determine peer acceptance among the boy's immediate peer group. During the adult-facilitated computer sessions, the facilitator reinforced positive social behaviour and interactions. After the computer sessions, interviews and questionnaires were conducted again on parents, teachers and facilitator in an attempt to capture information on the child's behaviour and attitudes during the computer sessions. Sociometrics testing was also conducted again to determine if the peer acceptance among the boy's immediate peer group has changed. The results indicated encouraging improvements in the raise of his peer acceptance among his classmates in general. Although this was a discrete setting, the finding is promising and this strategy may be replicated in school to support mainstream inclusion for children with ADHD.

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1. Introduction

According to Reif (1993), some 10% of the children are affected by ADHD. He adds that the figure of 3–5% cited in many literatures is very likely an underestimation due to the fact that many ADHD girls go undiagnosed. One professional article for family physicians, American Family Physician, suggests that 6–8% of the

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children are affected by ADHD (Johnson, 1997). In the most recent report, Ratey and Johnson (1998) suggest that ADHD should be seen as residing in a substantial proportion of the population of over 10%. This figure is closely supported by reports from Barkley (1998) and Fowler (1994). There is an upward trend of ADHD incidences (American Psychiatric Association, 1994).

1.1. Diagnostic criteria of ADHD

According to the most recent version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), there are three patterns of behaviour that indicate ADHD (American Psychiatric Association, 1994). The diagnosis of children with ADHD is associated with a combination of inattention, hyperactivity and impulsivity. Their behaviours are marked by being out of seat too frequently, deviating from what the rest of the class is supposed to be doing, not following the teacher's instructions, talking out of turn or calling out, being aggressive toward classmates, easily distracted, bothering classmates by talking or intruding, being oblivious, losing and forgetting equipment (Cooper & Ideus, 1988). For a child to be diagnosed as having ADHD, these symptoms must be present in the child's behaviour before age seven and must persist for at least six months in two or more settings such as in school and at home (American Psychiatric Association, 1994). These behaviours cause them to be rejected by peers and thus, suffered a very low peer acceptance.

Contrary to most beliefs, the persistent symptoms of ADHD do not disappear after childhood. It is carried into the adulthood (American Psychiatric Association, 1994). These symptoms interfere significantly with the individual's functioning, to the extent leading to failure in school or in professional, personal and social life (Cooper & Ideus, 1988). Therefore, the number of people affected by ADHD and the severity and chronic effects of ADHD are too significant to ignore.

1.2. Inclusive education

Unlike other disabilities such as Autism and Down syndrome that are more severe in terms of impairment, there is no school in Singapore that caters to the specific needs of ADHD children. Though ADHD children require special attention, they are not categorized as "disabled". As such they are not eligible for special education services and have to remain in the mainstream (Knight, 1999).

The ideal inclusive education is a concept which views children with disabilities as true full-time participants and members of their neighbourhood schools and communities. For inclusion in schools to be successful, collaborative efforts are needed to provide services to all who need them. Teachers play a vital role. They need to be very organized, have expert skills, have routines well established and be adaptable to ever-changing factors and conditions in the mainstream classroom. However, the optimum factors to the ideal of inclusive education are not always present. This may cause the inclusion to be more like exclusion because the student's needs are not being met and appropriate services not provided in the regular classroom. This unintended exclusion can cause detrimental effects on an ADHD child as he is being stigmatized with discriminatory labels (Knight, 1999).

1.3. Problems of inclusive education

Children with ADHD are at higher than average risk for problematic school outcomes, which include academic underachievement, increased rates of non-compliance and aggression, disturbances in peer relationship (Junod & DuPaul, 2005). Due to the lack of interaction and social skills faced by ADHD children, it is not uncommon that they are being rejected in mainstream (Cook & Seminel, 1999). As a result of negative school and peer experiences, many ADHD children experience the world as a hostile place (Cooper & Ideus, 1988). They suffer deep feelings of unworthiness (Armstrong, 1999), low learning motivation, poor self-esteem, behavioural problems and social rejection (Fowler, 1994). It has been repeatedly shown that children with ADHD are the most rejected among their classmates (Zumpfe & Landau, 2002). Many choose to drop out of school (Bishop, 2003).

However, ADHD children are not antisocial but asocial. They desire to be included but lack the know-how to enter the social circle (Cumine, Leach, & Stevenson, 2000). Studies have shown that peer acceptance is a

crucial determinant of the quality of school life of students with disabilities (Haring, 1991). Low acceptance deprives children “of opportunities to learn normal, adaptive modes of social conduct and social cognition... [and] undermine[s] academic progress as well” (Parker & Asher, 1987, p. 358). So how do we measure peer acceptance? Cook and Seminel (1999) suggest that peer acceptance of included students with ADHD is measured by nominations from classmates regarding with whom they would most like to play and work, as well as with whom they actually played on a regular basis.

1.4. Ways of intervention and treatment

Having known the problems of rejection that ADHD children are most likely to face in inclusive education and the importance of peer acceptance, let us look at the various available ways of intervention and/or treatment. Not only do we need intervention, we need to help children learn to deal with it early on so as to minimize and/or prevent ADHD symptoms and negative outcomes from being carried into adulthood. This takes teamwork from parents, guidance counsellors, teachers and school administration (Knouse, 2004).

1.4.1. Medication

A commonly used medication to treat ADHD is psycho stimulants such as methylphenidate hydrochloride (Ritalin). Its effectiveness is strongly supported by many researches (Abikoff & Gittelman, 1985). However, in the last thirty years, the effectiveness of Ritalin-only intervention has been under a significant attack from academics who suggested that by administering Ritalin-only intervention, the society disables impaired individuals and that disability is something imposed on top of such impairments by the way disabled people are isolated and excluded from full participation in society (Bishop, 2003).

Other researches have also shown the needs and benefits from combining a variety of interventions, in addition to Ritalin treatment (Goldstein, 2004). Cooper and Ideus (1988) suggest that the problems that ADHD presents are not simply a product of biology, but are the result of a complex interaction between the child's biology and his or her experience of the environment. The benefit of medication is also reported as being “short-acting”, whose effects wear off after a few hours. Therefore, it is not by any means a “cure” or even a serious attempt to get at the root of whatever ADHD may turn out to be. “It is simply a symptomatic relief” (Armstrong, 1999, p. 15).

Among others, it is worth to mention that not all children are robust responders to medication (Goldstein, 2004). On the extreme, the administration of Ritalin may lead to drug abuse in the adulthood of children labelled ADHD (Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993). On the same note, Lee (2002) draws an analogy between taking Ritalin and taking a home loan. The loan helps to achieve the desired outcome in the short term but in the long term one has to pay more. For this same reason, Goldstein (2004) advocates adding other interventions to Ritalin treatment. In his study, he found that after one year of multiple interventions, stimulant treatment could be withdrawn more successfully in the combined treatment group than in the Ritalin only group. On top of these, the side effects of Ritalin make children feel “weird”, “strange”, and “different from the other kids”. It also provokes nausea and insomnia for some (Sleator, Ullmann, & Neumann, 1982). Therefore, it is necessary to adopt a more holistic approach to the ADHD issue, that is, to deploy a far wider range of techniques, methods, tools and research methodologies (Armstrong, 1999).

1.4.2. Collaborative work

Collaborative work has been known to increase the social status of a special need child, especially if the child plays a key role (Gross, 1996; Loughrey, 1991). Loughrey (1991) studies found that group work can help children with special needs to gain respect from their peers. As a result, they are no longer enisled from their peers. Furthermore, other children wanted to associate with them and they in turn chose to participate. Roeyers (1995) highlights the importance of providing opportunity for ADHD children to participate in interaction with more socially competent peers. He believes that through group work ADHD children are able to learn the acceptable social behaviour. This claim is supported by Armstrong (1999) who further suggests that whenever possible, children with ADHD should be given the role that resumes responsibility in a group collaborative work. From this, ADHD children may learn the acceptable social behaviour, which may in turn help to raise his social status and be accepted by his peer.

1.4.3. Computer work

Technology has established itself as an integral part of special education. Some view technology as the “great equalizer” among students with and without disabilities (Roblyer & Edwards, 2000). Studies have shown that special need children enjoy significant benefits from the use of computer in the areas of student recognition, support and the enhancement of motivation, self-confidence, and self-esteem (Keates, Clarkson, & Robinson, 2002; Sheiderman, 2000).

The attainments of children with learning difficulties such as ADHD in technology-enriched classrooms include higher student achievement, self-esteem, and classroom interaction (Page, 2002). It is worth noting that at-risk students who have been suffering from low peer acceptance have, after computers are introduced to the learning environment, been consistently observed to be interacting closely with other peers in task-related assignments (Diggs, 1997). Other supporting researches have shown that the use of computer helps to increase student collaboration, heightens student confidence, and promotes more accurate student communications and interactions (Dwyer, 1995). Bender and Bender (1996), Ford, Poe, and Cox (1993) and Millman (1984) believe that computer technology is a highly effective learning approach for ADHD children. The major advantages of computer-aided learning over face-to-face learning include high-speed instant feedback, self-control stimuli, bright colours and sounds and interactive aspects.

Other researches suggest that children with ADHD behave more normally in context where they can control the pace of the learning experience (Sykes, Douglas, & Morgenstern, 1973) and the use of educational software improves ADHD children in the area of academic performance, appropriate on-task focus and behaviour in the classroom (Shaw & Lewis, 2005).

Armstrong's (1999) findings show that the use of computer can enrich a child's neurochemistry, which is essential to brain growth. The enrichment of neurochemistry will help improve a child's behavioural chemistry. Jones (1996) suggests that computers can be used to motivate a child with behavioural difficulties. It helps in the development of personal relationship and social skills and can also be used directly for communication and expression. Benefits of computer to ADHD cannot be undermined and is evident in many studies (Barkley, 1998; Ford et al., 1993; Navarro, Ruiz, Alcalde, Marchena, & Aguilar, 2001; Slate, Meyer, Burns, & Montgomery, 1998).

Having said that, Crook (1994) believes that the choice of software is also vital to optimize the chances of helping ADHD children gain peer acceptance. It is believed that adventure games are more likely to promote and result in a more equitable participation.

1.4.4. Computer collaborative work

In addition to the findings of past researches that show success stories of collaborative work on special need students (e.g. students with ADHD), Repman (1993) further suggests that the use of computer in collaborative work could provide a third party focus. This third party focus is essential for ADHD children, whose problems are short attention span and easy distractibility. With third party focus, an ADHD child may develop peer group participation successfully and thereby may increase peer acceptance. It is also reported in Repman's (1993) findings that computerized collaborative work has resulted in significant gains in students' self-esteem. In Allen's (1998) findings, he noticed that during computer-centred small group work, facilitated by a teacher, instances of collaboration between children double over a 5-week period and there is a significant increase in social talk. These increases in participation and social talk are elements that an ADHD child needs in order to gain higher peer acceptance. Harrison (1998) adds that an effective way to achieve this is to involve a special need child and a small number of peers in an enjoyable and meaningful activity, which should be carefully planned and procedurally facilitated by an adult.

Contrary to all the researches mentioned above on the potential benefits of computer group work on a special need child, Solomonidou, Areou, and Zafiropoulou (2004) suggest that the most effective computer instruction method with pupils with ADHD is the individualistic way. In their study, it is noted that ADHD pupils displayed disruptive behaviour when working with a partner in collaboration. However, the finding is flawed as the ADHD pupils selected to participate in the study are not diagnosed by qualified professionals such as psychiatrist and psychologist. Instead, they are selected based on teachers' observation using the Greek adaptation of the American ADHD Rating Scale-IV. It is therefore not unreasonable to assume that there may be other “embedded” disorders in addition to the ADHD syndrome. Thus, the participants may not be purely

ADHD and may have other behavioural disorders as well as learning difficulties. These factors would render the study as grossly biased and highly subjective.

To sum it all, previous studies by Ford et al. (1993), Kleiman, Humphrey, and Lindsay (1981), Navarro et al. (2001) and Slate et al. (1998) have shown clearly that the use of computer can contribute to the increase of attention and impulse control. It is therefore a good tool for the reduction of ADHD symptoms. However, these studies have not touched on the possibility of using computer group work to raise peer acceptance of an ADHD child. Thus, the critical role of computer collaborative group work on peer acceptance of ADHD children has yet to be investigated.

2. Focus of study

The focus of this study is to ascertain whether computer group work, facilitated by an adult, could provide a means for a junior schoolboy with ADHD to raise peer acceptance among his classmates. The intervention focus is on developing positive peer group participation and collaboration for an ADHD boy rather than social skills “*training*”. As such, the use of adventure oriented education software, facilitated by an adult who is experienced in managing ADHD children, is deemed appropriate. In this study, we seek to answer the research question:

- To what extent can computer collaborative group work help a child with ADHD to raise his peer acceptance among his classmates?

Adapting from Cook and Seminel’s (1999) definition of peer acceptance, we would measure a child’s peer acceptance by nominations from his classmates with regards to who they would like to play with during lunch time, sit with in the coach during field trips, do their school work with and invite for sleepovers.

3. Limitation of study

This is a case study confined to a discrete setting with the subject being given only 10 sessions of 45 min computer collaborative group work over duration of 5 weeks. In addition, this study is limited to the use of specific adventure software. On top of this, the facilitator is an Educational Psychologist, who is highly experienced and has a good understanding as well as a close relationship with the subject.

Therefore, the extent of the effects of computer collaborative group work is not investigated with the use of other types of software and the deployment of another facilitator with varying skills and experience. Hence, the study may need to be conducted and replicated in other schools to support mainstream inclusion for children with ADHD, in order to be more comprehensive.

4. Methodology

4.1. Subject

The subject of this study is Jimmy, a boy about 7-year-old in Year 3 of a mainstream junior school. With the agreement of Jimmy’s parents and the endorsement of the Educational Psychologist (EP), it was decided that Jimmy could potentially benefit from the computer group work.

From the assessment reports of EPs, speech therapists and occupational therapists on Jimmy’s developmental history, both from his previous and current schools, Jimmy had been diagnosed as having met the criteria for a diagnosis of ADHD. He had been moderately-highly affected in all areas of the symptoms, namely, inattention, hyperactivity and impulsivity.

Jimmy had been very active physically from an early age of three and exhibited difficulties in staying on tasks he found difficult. He tended to fiddle with things and was easily distracted. He was often impulsive and required one-to-one attention in order to stay focused and on task. He expressed his excitement physically, by bouncing up and down. He also displayed compulsive hand-washing disorder. Though he understood the concept of personal space, he could not apply it. His ability to relate to others was affected by his tendency to

overreact. He was very chatty and always dominated and monopolised conversations, which added to his low peer acceptance. The consideration to administer medication for Jimmy's ADHD was discounted, as he was responding well to sensory integration. However, sensory activity such as hugging was inappropriate in peer relationships over the long run. Jimmy demonstrated good awareness of his difficulties, but did not know how to resolve and overcome them.

Academically, Jimmy was two years behind in terms of reading accuracy and speed. He also had particular difficulty with numeracy as shown in his writing of some numbers in reverse (mirror image). Jimmy's teacher and learning support assistant (LSA) described him as very outspoken and friendly. He was always seen introducing himself to new entrants of his school and attempted to engage his peers. However, his lack of social skills such as monopolizing conversations, inability to pick up social cues and react and participate appropriately in group situation, had resulted in him being unable to form appropriate friendships. He was shunned by his peers and he was beginning to show signs of withdrawal.

4.2. Procedures

Data collections were done over 7 weeks with activities clearly stated for each week using interviews, questionnaires and sociometrics tests. The people involved were the subject, subject's parents, subject's teacher and LSA, EP and subject's classmates (refer to [Appendix A](#) for Data Collection Details). The research design consisted of pre-task, reinforcement of good social behaviour during treatment and post-task. Questionnaires and interviews were adapted from [Cumine et al. \(2000\)](#) observation profile.

Questionnaire items were carefully crafted to communicate to the reader, allowing them to understand the focus and concerns of the researchers. This understanding helps strengthened the relationship, resulting in our ability to capture more candid comments ([Yancey, 1997](#)).

Interviews were semi-structured ([Opie, 2004](#)) and lasted less than 40 min each. Given the informal and flexible nature of a semi-structured interview, we encouraged two-way communication and using it as an extension tool to confirm what was already known, we aimed to clarify unclear issues from the questionnaire and seek to provide an in-depth view of the subject's social behaviour and level of peer acceptance.

Sociometrics testing ([Ochoa & Olivarez, 1995](#)), an instrument to capture information on the popularity of each child involved in the study was deployed. Together, the questionnaires, interviews and sociometrics testing, formed a good triangulation of data for the present study. Data from different sources using different tools were gathered, analysed and reported.

In Week 1, questionnaires were administered to the subject's parents, teacher and LSA, in an attempt to gather pre-task perceptions of Jimmy's social behaviour and level of peer acceptance. Following that, interviews were conducted on the subject's parents, teacher and LSA to clarify unclear issues from questionnaires. The pre-task activities ended with Sociometric test on both the subject and his classmates. It was to capture information about Jimmy's pre-task popularity among his classmates.

The intervention period lasted for 5 weeks. It consisted of the reinforcement of acceptable social behaviour and interactions by the facilitator, EP, during the twice per week 45-min sessions of computer group work.

The post-task procedures which were carried out in Week 7 were similar to the pre-task, except that the purpose was to capture the post-task perceptions of Jimmy's social behaviour, level of peer acceptance as well as his popularity among his classmates.

4.3. Data collection

4.3.1. Pre-task

During Week 1, a semi-structured interview ([Opie, 2004](#)) was conducted with the subject's parents during one of the monthly meet-the-parents sessions. Questions were aimed to gather insights on Jimmy's parents' perceptions of his social interaction skills, social communication skills, social imagination, motor/organisation skills, level of inclusion by peers, in terms of likeness and popularity ([Ochoa & Olivarez, 1995](#)) and any particular difficulties he had with his peers in his class (refer to [Appendix B](#) for sample of semi-structured interview form).

In the same week, Jimmy's teacher and LSA were given questionnaires (refer to [Appendix C](#) for sample of questionnaire) and were interviewed informally (Opie, 2004) and individually to collect information on Jimmy's social interaction and communication skills and level of inclusion by his classmates. It also served to determine and select the best possible grouping for the computer group work.

Sociometrics testing was conducted with the subject and his 12 classmates. The sociometrics rested heavily on peer nomination (Ochoa & Olivarez, 1995). It aimed to capture information about the popularity of the subject among his classmates. All classmates were asked to give the names of two of their classmates with whom they like to play with at lunchtimes; sit with in the coach during field trips; do their school work with and invite for sleepovers. The class teacher and LSA conducted the test with clear explanations to ensure that everybody understood the questions correctly and that nobody discussed his preference during the test to avoid bias caused by peer pressure.

4.3.2. Adult-facilitated computer group work

Two pupils, Campbell and Donald, were chosen to work with Jimmy. The selection was based on interviews and questionnaires with parents and teachers and the sociometrics peer nominations given by classmates during Week 1. Campbell was Jimmy's "best friend" since nursery and Donald had been seen playing with Jimmy occasionally during lunchtime. Donald had never nominated Jimmy, while Campbell selected Jimmy to be the classmate with whom he would like to sit with in school coach on field trip. The teacher and LSA agreed that the three make the best grouping for the computer group work.

"4th Grade Adventures: Puzzle of the Pyramid" (The Learning Company) was selected because it is an adventure game that ties in with the Year 3 history topic, "Ancient Egyptians" of the curriculum. This had been the topic that the children were following at school. This software builds on Year 3s' interest in mystery and adventure as well as their abilities in mathematics, language arts, geography, science and logical thinking. It requires the players to collect clues in order to complete the various problem solving activities. During each session, the three participants took turns at controlling the mouse for five minutes. The facilitator, who is the EP, ensured that the participants take turns. She also intervened to reinforce positive behaviours and communication. Tapping on the benefits of computer collaborative group work, the EP's main task was to foster an environment for developing positive peer group participation and collaboration. Each session ended with a debrief on group achievements. Praises were showered and affirmations were given to Jimmy when he displayed positive behaviours in the group collaboration. Other than behavioural issues, the EP refrained from providing any assistance on the adventure game itself.

4.3.3. Post-task

At Week 7, similar questionnaires and interviews were conducted with the subject's parents, teacher, LSA and facilitator (EP), in an attempt to gather feedbacks and reflections on Jimmy's participation in the 5 weeks of computer collaborative work including observation relating to his post-task social behaviour and level of peer acceptance.

Sociometrics testing was conducted again with the Jimmy and his 12 other classmates. It sought to capture information about the popularity of the subject among his classmates. It also served as a basis of comparison with the pre-task sociograms to gauge if there was a change on the subject's level of peer-acceptance.

5. Findings

The data collected were presented below, in chronological order.

5.1. Jimmy's classroom profile: pre-task

From the interviews and questionnaires with Jimmy's teacher and LSA, Jimmy had shown himself to have severe difficulty in following social cues in one-to-one classroom and social interaction with his peers. His inability to follow social cues in group interaction was also rated as being a great cause for concern. He often

talked out of turn and bothered classmates by talking or interjecting into their conversations. In addition, he displayed a lack of ability to share in others' pleasure and failed to imitate other children. He was usually oblivious to what the rest of the class was doing. However, Jimmy did not display any cause for concern in his ability to follow a simple sequence of instructions. He had also shown ability to follow social cues in one-to-one with adults. His ability to respond appropriately to social praise from adults was evident from his classes.

From the interviews with Jimmy's parents, there were great concern for Jimmy's poor social skills development and his lack of friends. Jimmy was becoming aware that he was being excluded by his classmates and his parents wanted Jimmy to develop the necessary skills to handle such situations.

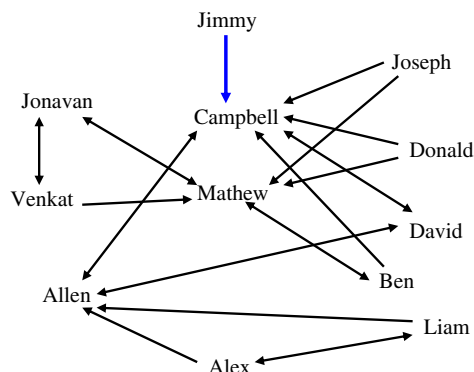
It was then agreed by Jimmy's parents, teacher and LSA that the most appropriate intervention to help Jimmy develop positive peer group participation and collaboration was through a carefully selected collaborative group to work with Jimmy on a computer software. It was hoped that this will improve his social skills. This appeared to be the most viable means for facilitating peer interaction and cooperation. Using this computer group work sessions, facilitated by the EP, we hoped to "alter" Jimmy's negative attitude and behaviour in social interactions by reinforcing and affirming positive attitude and behaviour throughout the planned computer group work. However, the greatest challenge remained in the ability to transfer the positive attitude and behaviour that Jimmy might have acquired and displayed during computer sessions to his classroom. The success of this transference would inevitably ensure a rise in his peer acceptance.

5.2. Jimmy's social profile: pre-task

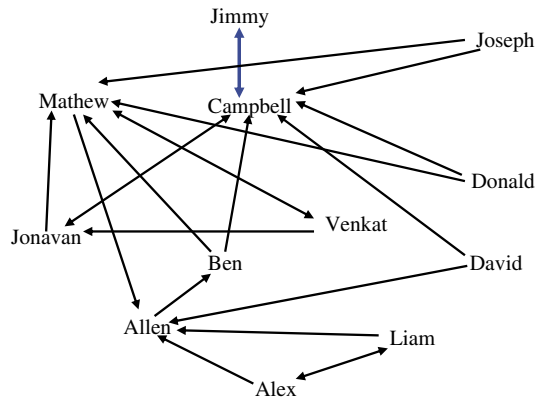
Sociometrics test was conducted during the pre-task on Jimmy and his peers in class. There were four questions in the sociometrics testing. In the first question, children were asked to name two classmates that they like to play with at lunchtimes. Jimmy selected Campbell and could not name another classmate. Jimmy was not selected by any of his classmates (refer to [Sociogram 1](#)). In the second question, children were asked to name two classmates that they like to sit with in the coach during a school field trip. Jimmy selected only Campbell again. This time he was also selected by Campbell (refer to [Sociogram 2](#)). In the third question, children were asked to name two classmates that they like to do their schoolwork with. Jimmy chose Campbell only. He could not provide another name and was not selected by any of his classmates (refer to [Sociogram 3](#)). In the final question, children were asked to name two classmates that they like to invite for a sleepover. Jimmy chose Campbell only. He could not provide another name and was not selected by any of his classmates (refer to [Sociogram 4](#)). It was obvious that Jimmy was very "sticky" to Campbell.

5.3. EP's observation: computer collaborative work sessions

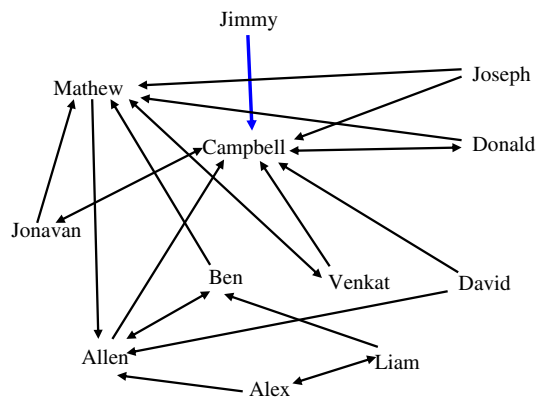
Jimmy, Campbell and Donald, under the facilitation of the EP, went through 10 45-min sessions of computer collaborative work, which were held in school during Humanities periods. Throughout the sessions, the EP affirmed appropriate behaviours with constant praise. Firm and consistent reinforcement of positive peer



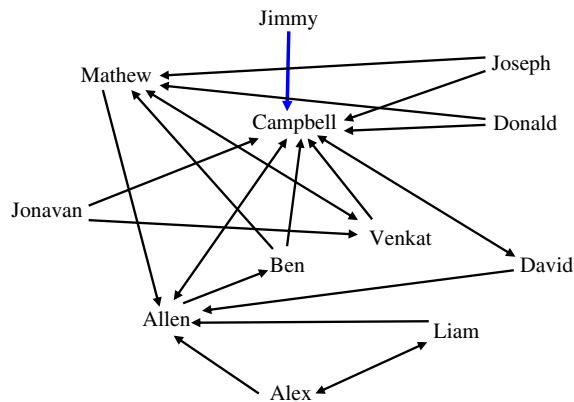
Sociogram 1. With whom would you like to play with during lunch time?



Sociogram 2. With whom would you like to sit with in Coach during field trips?



Sociogram 3. With whom would you like to do your school work with?



Sociogram 4. Who would you like to invite for sleepover?

group participation and collaboration were directed at Jimmy. Each session ended with debrief on group achievements with the emphasis on the need to work as a team with one another.

In the informal interview with the EP, it was found that right from the beginning of the treatment, Jimmy seemed to be aware and was able to accept that he had to take turns at the computer in controlling

the mouse. However, Jimmy was totally oblivious of the purpose of the three boys working together. He showed no interest on the given tasks when he was not in control of the mouse and his conversations would wander to issues totally unrelated to the assigned tasks. He would ask the facilitator “*Is it time to go?*” when he had finished his turn controlling the mouse. Nevertheless, it was observed that by the second session, Jimmy became more aware of the need to work in collaboration with Campbell and Donald to solve the puzzle problem in the adventure game. By the third session, Jimmy’s conversation began to be more task-related and focused on the puzzle problem. By the fourth session, Jimmy was highly engaged in the game and contributed ideas on solving the puzzle problem, even when he was not in control of the mouse.

The breakthrough in Jimmy’s participation in group work came about in the seventh session. While Jimmy was in control of the mouse, he asked Campbell and Donald “*Is this the right stuff (answer)?*” Prior to this session, Jimmy had never sought the opinion of the other boys intuitively. He would basically ignore them when he was in control of the mouse. At the eighth session, there was an encouraging change in interaction pattern. Instead of Campbell and Donald discussing with each other most of the time, the two boys would spontaneously include Jimmy in their discussion on the puzzle problems. Positive discussions were evident throughout the last three sessions. In addition, at the end of each of the last three sessions, Jimmy would imitate the EP by extending his hand towards Campbell and Donald while saying “*Well done, Campbell! Well done, Donald! I am happy that we are a team!*”

Towards the end of the computer group work sessions, Jimmy appeared to understand the need for collaboration and enjoyed the benefit from the group achievements. There were visible initiation of task-related interactions from Jimmy to Campbell and Donald. On top of this, in a very natural and progressive manner, Campbell and Donald seemed to have included Jimmy in all their discussions on the puzzle problem.

5.4. Jimmy’s classroom profile: post-task

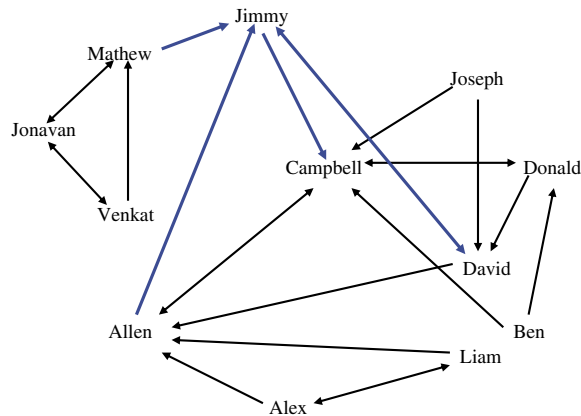
From the interviews and questionnaires with Jimmy’s teacher and LSA, it was revealed that Jimmy had continued to display his ability to follow a simple sequence of instructions, take social cues in one-to-one with adults and respond appropriately to social praise from adults in his classroom. He had shown improvement from a “*serious cause for concern*” to “*moderate cause for concern*” (refer to [Appendix C](#) for questionnaires) in his ability to follow social cues in one-to-one classroom and social interaction with his peers and in group interaction. However, while he would still talk out of turn, he had shown self-restraint frequently by saying “*Sorry, I think this is not related to our discussion*”. This sentence was frequently used by the facilitator to bring Jimmy back to task-related discussion during the computer group work whenever he strayed away. This notable improvement on self-awareness suggested that Jimmy was able to exercise his acceptable social behaviour and was working his way towards heightening his level of peer acceptance. In addition, the frequency where he bothered his classmates by talking or interjecting into their conversation had also reduced. He was also becoming more aware of what the rest of the class was doing. This was evident when he asked his classmate “*What now [are we supposed to do now]?*” Nevertheless, he still displayed a lack of ability to share in others’ pleasure and had continued to fail to imitate other children.

5.5. Jimmy’s social profile: post-task

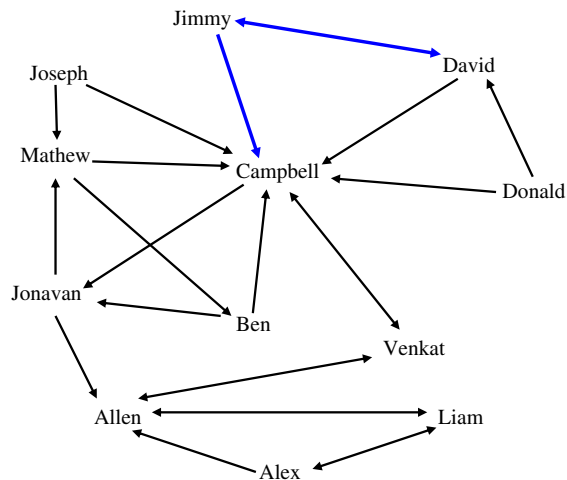
Sociometrics testing was conducted on Jimmy and his classmates after the computer group work sessions. Sociograms were constructed to capture information on Jimmy’s post-task popularity among his classmates. It ought to ascertain if there was a change in Jimmy’s pre-task and post-task peer acceptance.

Jimmy nominated Campbell for lunchtime play, field trip seating, school work and sleepover; David for lunchtime play, field trip seating, and sleepover and Donald for school work. Amazingly, Jimmy was selected by David for lunchtime play and field trip seating, by Donald and Campbell for school work and by Allen and Mathew for lunchtime play and sleepover. Apparently, Jimmy had gained popularity among

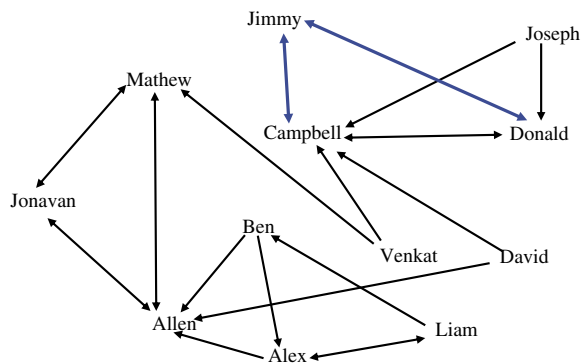
his peers (refer to [Sociogram 5](#) for lunchtime play, [Sociogram 6](#) for field trip seating, [Sociogram 7](#) for school work and [Sociogram 8](#) for sleepover). A quantitative analysis of changes was summed up in the table below.



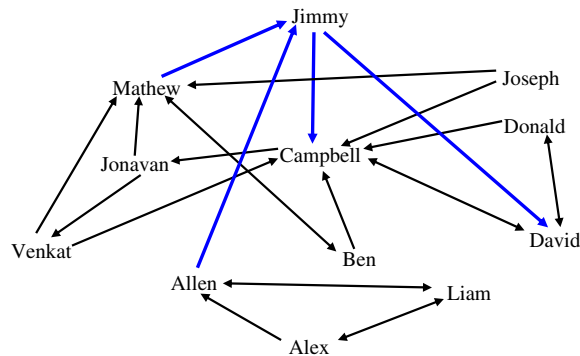
Sociogram 5. With whom would you like to play with during lunch time?



Sociogram 6. With whom would you like to sit with in Coach during field trips?



Sociogram 7. With whom would you like to do your school work with?



Sociogram 8. Who would you like to invite for sleepover?

Analysis of changes in Jimmy's peer acceptance

Activities	Number of peers nominated			
	For Jimmy		By Jimmy	
	Pre-task	Post-task	Pre-task	Post-task
With whom would you like to play with during lunch time?	0	3	1	2
With whom would you like to sit with in Coach during field trips?	1	1	1	2
With whom would you like to do your school work with?	0	2	1	2
Who would you like to invite for sleepover?	0	2	1	2

5.6. Parents' reflection on Jimmy's participation

Jimmy's parents revealed, in the interview, that Jimmy felt very proud that he had been handpicked to participate in the computer work. Jimmy had shown great enthusiasm and looked forward to Tuesday and Thursday's computer sessions. After each session, Jimmy would relate the details of the game and the compliments he received from the facilitator to his parents. However, Jimmy's parents were still very anxious to help Jimmy develop good behavioural and social skills.

5.7. Teacher's and LSA's reflections on Jimmy's participation

The teacher and LSA remarked that one of the most encouraging sights was towards the end of Week 6 when Jimmy was seen being hurried by two other boys to join them in a game during lunch time. Undeniably, Jimmy's popularity had increased. It was also observed that Jimmy was able to play card games, which are dominated by rules, with his classmates. However, Jimmy was unable to give in and became upset when there was an argument over some ambiguity on the rules of the game. The pleasing part was Jimmy's attempts to blend in with his peers during game sessions.

Another remarkable observation was Jimmy's ability to cope with group work activities. For instance, Jimmy was involved in a Science project which required the collection of information from other children. Jimmy and two other boys had collected information and recorded them on a hand-held electronic organizer. One of the other boys was appointed as leader of the team and had control over the organizer. Instead of forcing his way to gain control of the organizer, Jimmy was content to submit to the leadership of the boy

and would cooperate and contribute to the success of the team. This was deemed to be a major progress for Jimmy.

6. Implications, discussions and recommendations

The findings indicate beneficial results in a discrete setting where computer collaborative group work facilitated by an adult helped develop Jimmy's ability to interact and behave appropriately with his peers, Campbell and Donald, to accomplish a predefined task. This seems to imply that using facilitated computer collaborative group work, even in the absence of other intervention, for instance medication, a child with ADHD may still improve and develop acceptable social and peer interaction skills. It also implies that the role of the facilitator which include issues such as the skills, understanding and relationship with the subject, and the appropriateness of the context are determining factors in ensuring productive and meaningful interactions and cooperation among children participating in computer collaborative group work.

The pre-task and post-task sociograms indicate that the level of Jimmy's peer acceptance had risen. Pre-task sociograms indicate that Jimmy was not preferred for all the four contexts: lunchtime play, fieldtrip seating, school work and sleepover, except by Campbell for fieldtrip seating. The post-task sociograms indicate a dramatic raise in Jimmy's level of peer acceptance. Jimmy was selected by 3 peers for lunchtime play, 1 peer for fieldtrip seating, 2 peers for school work and 2 peers for sleepover. On the same note, Jimmy was able to provide 2 names for all the four contexts, instead of selecting only Campbell as in the pre-task. This suggests that Jimmy, having gone through the computer-centred group work, has become more open and sociable and has made attempts to mix with his peers. It is highly probable that the act of opening up would further enhance Jimmy's peer acceptance over time. Notably, Jimmy was selected for school work by 2 peers, Campbell and Donald, who both have participated in the computer collaborative group work.

Based on the encouraging findings, additional research could be mounted to capture the interaction process throughout the computer sessions. The focus could be on who initiated interaction, who the interaction was directed at and who responded to the interaction, for both task-related and non-task-related interactions. This additional data may help to provide us with further insights to the major improvement in Jimmy's social and interaction skills as well as his risen peer acceptance, particularly to the reasons for other children's (those not in the computer group) association with him. It may help to unlock the puzzling questions: Was the association bound to the fact that Jimmy was in the "chosen" group? Or was there a genuine improvement in Jimmy's social behaviour and interaction skills?

Having said all that, it is vital to note that the subject is like most ADHD children who are asocial and have the desire to be included but lack the know-how to enter the social circle (Cumine et al., 2000). This willingness and disposition to change for the better is another key characteristic of the subject that enables the treatment to be effective.

Other questions that had been sparked off by the findings include:

1. What is the effect if the computer sessions were to be extended to 10 weeks?
2. What is the effect if another type of software, instead of Adventure game, was used?
3. Is Jimmy's improvement in social behaviour and interaction and risen peer acceptance sustainable?
4. Could collaborative work using other instruments such as board games instead of computer, within the same learning environment and facilitation, produce similar positive effects?

In line with the initial statement of this paper, which had looked into whether computer collaborative group work can help to raise the peer acceptance of a child with ADHD, it is highly recommended that these areas be explored in future study for the benefit of educators and parents who are interested in using computer collaborative group work as a means of intervention for a child with ADHD.

7. Conclusion

The findings of this study do not set out to claim that computer collaborative group work is the remedy for the low peer acceptance of a child with ADHD. Instead, the strategy of computer-centred collaborative group work may have benefited the child with ADHD by encouraging and reinforcing appropriate and acceptable social and cooperative behaviour and skills. Using a carefully selected peer group within a natural classroom setting and facilitated by an experienced adult such as the LSA, a class teacher may craft a computer collaborative group work project as an intervention for a child with ADHD. The facilitator should be one who is aware of the communication and social difficulties of the particular child and has the ability to modify the level of support appropriately. Cumine et al. (2000) observation profile is highly recommended as a useful tool to be used in conjunction with the expertise of a class teacher and/or EP for setting appropriate intervention goals. The researchers would recommend further study to establish the beneficial potential of computer collaborative group work on children with ADHD.

Appendix A

Data collection details

Week	Purpose	Instruments	Data from
1	To gather pre-task perceptions of Jimmy's social behaviour and level of peer acceptance	Interview	Subject's parents
	To gather an overview of Jimmy's pre-task social behaviour and level of peer acceptance	Questionnaire	Subject's teacher and LSA
	To clarify unclear issues from questionnaires on Jimmy's pre-task social behaviour and level of peer acceptance	Interview	Subject's teacher and LSA
	To capture information about Jimmy's pre-task popularity of among his classmates	Sociometrics Test	Subject and classmates
7	To gather Jimmy's social behaviour during treatment	Interview	Facilitator, EP
	To gather feedback and reflection on Jimmy's participation in the computer project and issues on Jimmy's post-task social behaviour and level of peer acceptance	Interview	Subject's parents
	To gather an overview of Jimmy's post-task social behaviour and level of peer acceptance	Questionnaire	Subject's teacher and LSA
	To clarify unclear issues from questionnaires on Jimmy's post-task social behaviour and level of peer acceptance	Interview	Subject's teacher and LSA
	To capture information about Jimmy's post-task popularity of among his classmates	Sociometrics Test	Subject and classmates

Appendix B

Sample Parents', Teacher's and LSA's semi-structured interviews (adapted from Cumine et al.'s (2000) observation profile)

Interviewee: _____

Interviewer: Roger Tan

Date: _____

Subject : Jimmy

Skills	Awareness	Problems	Suggestions
Social Interaction			
Social communication			
Social Imagination			
Motor / Organisation			
Level of peer acceptance			
Other difficulties with peers			

Appendix C

Sample Teacher's and LSA's questionnaires (adapted from Cumine et al.'s (2000) observation profile)

Name : _____		Subject : <u>Jimmy</u>				
Date : _____						
Key:	1 No cause for concern					
	2 Mild cause for concern,					
	3 Moderate cause for concern					
	4 Serious cause for concern					
	5 Great cause for concern					
		1	2	3	4	5
1.	ability to follow social cues in 1 : 1 with adults.					
2.	ability to follow social cues in 1 : 1 with children.					
3.	ability to follow social cues in group interaction					
4.	ability to share an activity with other children and with an adult					
5.	ability to develop peer friendships.					
6.	ability to seek comfort/affection when upset.					
7.	ability to offer comfort / affection to others.					
8.	ability to share in others' enjoyment/pleasure					
9.	ability to imitate other children.					
10.	ability to imitate adults					
11.	ability to show different responses to different people in different situations.					
12.	ability to respond appropriately to social praise.					
13.	ability to respond appropriately to criticism.					

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