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**Instructional and Improvisational Models of Music Therapy with
Adolescents who have Attention Deficit Hyperactivity Disorder (ADHD):
A Comparison of the Effects on Motor Impulsivity**

**A thesis presented to fulfil the requirements for the degree of
Master of Music Therapy
at Massey University, Wellington, New Zealand**

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ABSTRACT

This study compared the impact of instructional and improvisational music therapy approaches on the level of motor impulsivity displayed by adolescent boys who have Attention Deficit Hyperactivity Disorder (ADHD). Measures included numbers of errors made on a Synchronised Tapping Task (STT); and Conners' Rating Scales (Conners, 1997). Participants (n=13), aged 11 – 16 years, were enrolled in a special residential school. A combination of a multiple contrasting treatment and an experimental control group design was used. Students were randomised to three groups; control (Group A) and two treatment groups. Students in Group B received eight sessions of improvisational music therapy followed by eight sessions of instructional music therapy, while the order was reversed for Group C.

There was no statistical difference between the impacts of the contrasting music therapy approaches on the level of motor impulsivity displayed by the students as measured by the STT and the Restless-Impulsive and Hyperactive-Impulsive Conners' subscales. However all students significantly improved on the STT across each phase of treatment and improvement was slightly greater during the instructional treatment periods for both groups. During these same periods teachers reported a small decrease in restless and impulsive behaviours. The results therefore cautiously imply that the instructional approach might contribute to a reduction in motor impulsivity in the classroom.

Significant improvement on STT without the corresponding improvement in motor impulsivity suggested that increased accuracy on the STT might be attributable to progress in other developmental domains. Teacher report of significant improvement for treatment groups on the DSM-IV Total Subscale adds weight to this suggestion, and implies that combined music therapy approaches might have contributed to a reduction in DSM-IV symptomology in the classroom.

Rickson's (2001) tentative suggestion that creative music-making might over-arouse students with ADHD was not confirmed. Students did make more errors

when tested on the STT a second time on the same day but this was regardless of whether they had been involved in instructional, improvisational or no music therapy programme. It is possible that students who have ADHD are easily aroused by the general school milieu and classroom or music room interactions with peers.

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BACKGROUND AND INTRODUCTION

This research follows a pilot study that aimed to gather evidence regarding the effectiveness of music therapy in promoting prosocial behaviours in aggressive adolescent boys (Rickson, 2001; Rickson & Watkins, in press). Inclusion criteria for that study were based on symptomatic behaviour rather than specific diagnosis. However, despite random assignment to three study groups, significant differences were found between groups with respect to diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) ($p=.044$), and response to treatment, particularly on levels of within-session impulsivity ($p=.009$) as it was defined in that study.

It also seemed that some of the students¹ in that study, particularly those with ADHD, might have had difficulty adapting between a music therapy environment that encouraged increasing autonomy and individual responsibility for self and group members, and a classroom approach that gave clear direction. Rickson (2001) tentatively suggested that the creative music-making environment might over-arouse students with ADHD, and therefore immediately following such sessions they might be less able to effectively manage their own behaviour in a controlled environment such as the classroom. This is perhaps not surprising given that it is generally agreed that children with ADHD respond more positively to structured programmes that have a high level of predictability (Barkley, 1998). However, other variables also influenced the 2001 study, notably group size and the age of the students. It would therefore be premature to conclude that the music therapy programme had a negative effect on the classroom behaviour of the students in the 2001 programme.

Despite the variable response from the students who had ADHD in the earlier study, the results overall tentatively suggested that a music therapy programme may help to increase adolescents' awareness of others, and assist them to develop positive relationships with peers in a residential villa setting. This is important because researchers agree that deficits in peer relationships could be the most

¹ The 2001 study and the current study were both undertaken in educational settings. The participants have therefore been referred to as students throughout this document.

severe area of impairment for ADHD children (Barkley, 1998; Henker & Whalen, 1999; Pelham & Waschbusch, 1999). This current study attempted to gather further evidence to support or refute the cautious suggestion made in the earlier study that 1) a creative music therapy approach might over-arouse adolescents with ADHD, 2) they might display an increase in impulsive behaviours in the classroom setting following music therapy sessions, and 3) a highly structured programme of music therapy might be more advantageous for this population. It might also go some way towards addressing the concerns of Geldard and Geldard, (2001), who assert that “more research is needed to identify the relative effectiveness of various therapeutic approaches when working with children in groups who have common mental health disorders” (p.17).

The current study aimed to compare the impact of instructional and improvisational music therapy approaches on the impulsivity of adolescents who have ADHD.

Both of the music therapy treatments offered in this study, instructional and improvisational music therapy approaches, have been used successfully with adolescents (Aigen, 1997; Eidson, 1989; Haines, 1989; Hauck & Martin, 1970; Henderson, 1983; Kivland, 1986; Lefebvre, 1991; Robbins & Robbins, 1991; Thaut, 1989; Underhill & Harris, 1974). There is general agreement that rehearsal of rhythmic tasks is likely to lead to improvement in internal organisation and impulse control (Gaston, 1968; Gibbons, 1983; Thaut, 1992). Moving to, or playing, rhythmically organised sound, i.e. music, leads to muscle activation in synchrony with the music, a process called “muscular entrainment through auditory rhythm” (Thaut, 1992, p.267). Further, involvement in improvisational music-making activities may help the adolescent to gain a degree of self-control in response to musical, and possibly other environmental stimuli. The creation of organised music, especially with peers in a group situation, demands considerable attention and self control. Thus internal organisation may be possible when the adolescent has a high degree of motivation for musical success. Regular involvement in spontaneous music-making sessions may therefore also lead to improvement in attention as well as time perception and reproduction skills, and subsequently to increased inhibition and impulse control.

Music therapists and others have noted that many children and adolescents exhibit disordered impulsive beating, and are unable to sustain a steady beat or an organised rhythm due to poor impulse control (Barratt, 1983; Duryea & Glover, 1982; Frisch, 1990; Gibbons, 1983; Hong, Hussey, & Heng, 1998; Merle-Fishman & Marcus, 1982; Nordoff & Robbins, 1977; Perilli, 1995). It is now generally accepted that timing is impaired in ADHD (Barkley, 1998; Barkley, Murphy, & Bush, 2001; Smith et al., 2002; Toplak et al., 2003) and that there is a link between this impaired timing and impulsive behaviour (Smith et al., 2002; Toplak et al., 2003). Therefore, measuring beat reproduction accuracy is likely to lead to useful and efficient information concerning the child's behaviours.

In this study, the ability to keep a beat with an external stimulus (i.e. a synchronised tapping task [STT]) is used as measure of impulsivity. When choosing the speeds for the synchronised tapping tasks, this researcher was particularly interested to remain within a spectrum that was relevant to the processing of musical stimuli. However, evidence suggests that 1) timing of very short intervals of duration and longer intervals of duration might be mediated by differing neural mechanisms (Barkley, 1998) and 2) children and adolescents who have ADHD have a tendency to increasingly under-reproduce intervals as their length increases. Specifically, intervals of less than one second may provoke an automatic response from an internal timing mechanism while the processing of longer intervals is thought to involve short-term (working) memory (Barkley, Murphy, & Bush, 2001; Toplak et al., 2003). Two tapping speeds were therefore used as dependent variables, one above this threshold (75 beats per minute [75bpm] i.e. 800 millisecond [ms] intervals) and one below (40 beats per minute [40bpm] i.e. 1500 millisecond [ms] intervals). Students were tested before and after sessions to gather evidence regarding possible within-session arousal. The potential impact of any change in students' synchronised tapping ability on general behaviour was measured using the Restless-Impulsive and Hyperactive-Impulsive subscales from Conners' Ratings Scales (Conners, 1997), parent and teacher versions. A considerable portion of the study is also given to a description of group dynamics. This information is particularly relevant to clinical practice and is an important aspect of applied music therapy research.

LITERATURE REVIEW

ADHD has been described as “a paradigm for a true biopsychosocial disorder, raising critical questions concerning the relations between genetic, biological, and environmental factors” (Tannock 1998, p.65). This literature review begins with a description of ADHD from a broad medical perspective and an explanation of the psychosocial impact of the disorder. A discussion on current understandings of cognitive processes in ADHD, definitions of impulsivity and various perspectives on perception and reproduction of time and rhythm follow in more detail. An exploration of the literature relating to music therapy with children and adolescents who have ADHD is included. The paragraphs on planning and providing structure in group work lead to a discussion on how music therapists determine the approach they will use. An explanation of the specific contrast between the instructional and improvisational models that are the independent variables in this study is then presented. A short summary leads to the methods section of the study.

1. Attention Deficit Hyperactivity Disorder (ADHD) – The Medical Model

As the name suggests, the core symptoms of ADHD are inattention, impulsivity and hyperactivity. ADHD is conservatively estimated to occur in 3% to 6% of children, predominantly identified in males (3:1), and although the presentation of the disorder may change, it encompasses the life-span from children through adolescence into adulthood (Barkley, 1998; Tannock, 1998). According to the Diagnostic and Statistical Manual, 4th Edition of the American Psychiatric Association (DSM-IV) (1994), a diagnosis of ADHD requires that six or more symptoms of inattention, and/or hyperactivity/impulsivity must be present and must have persisted for at least six months to a degree that they are maladaptive.

There are three subtypes of ADHD listed in the manual:

- 314.00 Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type
- 314.01 Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type.
- 314.01 Attention-Deficit/Hyperactivity Disorder, Combined Type (if criteria for both subtypes are met).

For the hyperactive-impulsive type, six of the following nine symptoms must have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity,

- a) often fidgets with hands or feet or squirms in seat
- b) often leaves seat in classroom or in other situations in which remaining seated is expected
- c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
- d) often has difficulty playing or engaging in leisure activities quietly
- e) is often “on the go” or often acts as if “driven by a motor”
- f) often talks excessively

Impulsivity,

- g) often blurts out answers before questions have been completed
- h) often has difficulty awaiting turn
- i) often interrupts or intrudes on others (e.g. butts into conversations or games).

(DSM-IV, 1994, p.84)

Between 50% and 80% of children who have ADHD also meet diagnostic criteria for other disorders, most frequently other disruptive behaviour disorders, developmental learning disabilities, mood disorders and anxiety disorders. Recent research by Jensen, Martin and Cantwell (1997) suggests that there is evidence for two new subtypes of ADHD, i.e. an aggressive subtype and an anxious subtype.

Family, twin, and adoption studies have provided considerable evidence that ADHD is a heritable disorder (APA, 1994; Barkley, 1998; Tannock, 1998). Other factors that have been connected with ADHD include premature birth, maternal alcohol consumption, high levels of lead in early childhood, and brain injuries (Cantwell, 1996). While various overlapping models have been posited to account for the developmental psychopathology of ADHD, two in particular have been prominent in the literature. Cognitive explanations focus on faulty information processing (discussed in more detail in Section 3, on p.9) while neurobiological models highlight genetic influences on structural and biochemical impairments (Tannock, 1998).

Visual imaging techniques have enabled researchers to determine the involvement of the prefrontal cortex and the vermis region in the cerebellum in ADHD, as well as clusters of nerve cells in the basal ganglia (Barkley, 1998). Berquin et al. (1997, in Douglas, 1999) found neuroimaging evidence to support dysfunction in a cerebello-thalamo-prefrontal circuit, which may subserve the motor control and inhibition, and/or executive function deficits encountered in ADHD. These findings are congruent with symptomatic behaviour in ADHD, as the pre-frontal cortex is associated with planning for voluntary activity, resisting distractions, decision making, and developing an awareness of self and time. The precise function of the vermis region is unknown, but preliminary findings suggest it may regulate motivation. Specific cells in the basal ganglia help to control automatic responses and allow the cortex more time to consider and co-ordinate neurological input. Rubia et al. (2003) therefore suggest that abnormalities in prefrontal brain regions are related to motor timing deficits that may underlie the behavioural impulsiveness of children who have ADHD.

Barkley (1998) claimed that while it is generally agreed that ADHD is probably a polygenetic disorder, a variant in the dopamine receptor D4 is more common among children who have ADHD. Dopamine is secreted by neurons in some parts of the brain to slow down or moderate the activity of neurons, especially those that are concerned with emotion and movement. Stimulant medication, most commonly Methylphenidate with the trade name Ritalin, has been found to be

highly effective and is widely used in the treatment of ADHD (Gadow et al., 1990; Ialongo et al., 1993; Jenson et al., 1999; Kaplan et al., 1990). Although it may seem incongruous to ‘stimulate’ a hyperactive and impulsive child, it seems that stimulant medication speeds up *inhibitory* processes, so the child has time to consider options before responding. The medication increases the child’s ability to inhibit and regulate impulsive behaviours by slowing down the dopamine transporters, thus increasing the time that the dopamine has to bind to its receptors on other neurons. Stimulant medication can improve performance by *either* slowing or speeding responses depending on the nature of the task (Douglas, 1999).

While some reinforcement contingencies can enhance performance, stimulant medication has been demonstrated to be generally more effective. However, researchers have also offered preliminary evidence that stimulant medication may not be as effective in reducing motoric activity in more aggressive children with ADHD (Matier, Halperin, Sharma et al., 1992, in Tannock, 1998), or in improving working memory in the more anxious children with ADHD (Tannock, 1998). Further, the latter group may be at greater risk for the side effects of the medication (Tannock, 1998).

Genetic, biological and environmental parameters do not act alone, but are likely to wield their influence in a cumulative and interactive manner. The benefits of medication on attention-to-task, rule-governed behaviour and interpersonal deficits are not likely to be maintained over the long term unless supported by significant psychosocial interventions (Cousins & Weiss, 1993).

2. ADHD – The Psychosocial Model

Self-control, i.e. the ability to inhibit or delay immediate emotional and motor responses, is necessary for the successful completion of any basic task. Unless a person can inhibit interfering thoughts and impulses, they are unable to remember their goals, prompt themselves about what they need to do to reach those goals, keep emotions in check, or remain motivated. Such deficits are pervasive and lead to a range of ever-increasing and perpetual difficulties.

ADHD is a chronic and difficult to treat syndrome affecting academic, social and emotional adjustment in children (Barkley, 1998; Cousins & Weiss, 1993). Further, ADHD and comorbid disorders, such as Conduct Disorder (CD) are small but significant predictors of both physical and sexual aggression (Theriault & Holmberg, 2001), and children who are aggressive are at risk of higher levels of physical injury in adolescence than non-ADHD adolescents (Cobb et al., 1995). These children are also at increased risk of being rejected by their peers and/or abused by their parents (Webster-Stratton, 1991). Not surprisingly, aggressive behaviour is also significantly associated with reduced life satisfaction (Boyle & Offord, 1990; Valois et al., 2001) and limited opportunities to attain socially desirable objectives (Boyle & Offord, 1990). Cousins and Weiss argue that “impaired social skills may well be the most disabling and lasting deficit of the child and adolescent who have ADHD, continuing well into their adult life” (Cousins & Weiss, 1993, p.455). Boys who have ADHD with its associated social disability are also significantly more at risk for mood disorders, anxiety (Johnson et al., 1995) and disruptive and substance use disorders (Greene et al., 1997).

Parental influences and family interactions often magnify the child’s difficulties and exacerbate problems (Dadds et al., 1996; Lytton, 1990). Family-focused programmes, which concentrate on work with the parents, comprise the largest body of research in the area of treatment for CD disordered children and results are promising (Webster-Stratton, 1991). However, Webster-Stratton also acknowledges that “some parents do not participate either because of their own dysfunction, because they do not accept there is a problem, or because they have given up and are not motivated to change their behaviours” (p.1055).

3. Cognitive Processes in ADHD

In her overview of the cognitive control processes in ADHD, Douglas (1999) reported extensive and often confusing literature in this area because many different aspects of regulatory control appear to be problematic for ADHD

children. A summary of Douglas' chapter reveals that they are likely to have difficulty with:

- a. inhibiting their response to inappropriate stimuli, changing response speed on demand or following an error,
- b. sustained effort, maintaining focus and performance across time and
- c. response preparation, responding to specific stimuli appropriately, and adapting to changing demands.

As a result, they will exhibit impaired performance on tasks that involve planning, organisation, and self-monitoring. According to Barkley's theory (1998), ADHD is not necessarily a disorder of attention per se but is a result of developmental failure in the brain circuitry that underlies inhibition and self-control, as explained in earlier paragraphs. Barkley believes this in turn is responsible for the difficulties in executive functioning experienced by children who have ADHD (for an explanation of executive functioning see paragraph below). Further, he suggests that because children who have ADHD are unable to cognitively process external stimuli, they do not develop the "internal speech" which is necessary to be able to restrict inappropriate behaviour. They will also have difficulty with reconstitution, i.e. the ability to reflect on and learn from their behaviour (Barkley, 1998).

Tannock (1998) explains that the popular use of the term 'executive functions' does not usually refer to basic cognitive processes, such as sensation, perception, motor activation, attention, or memory. Rather, the term is typically used to refer to psychological processes involved in self-regulation of affect-motivation-arousal, sequencing of behaviour, flexibility of thinking or responding, response inhibition, planning, and organisation of behaviour. As mentioned earlier, response inhibition is a central consideration in current medical models of ADHD.

A disorder of response inhibition, also known as behavioural inhibition, impairs other important brain functions that are crucial for maintaining temporal organisation of behaviour. Barkley, Murphy and Bush (2001) quote several investigations that have shown that poor motor inhibition is associated with deficits in a sense of time, particularly as assessed by time reproduction

paradigms. In these tests children do not need to understand numbers and/or adult time concepts, as they are simply asked to reproduce a modelled interval of duration (e.g. to reproduce a tone for a specific length of time). Impulsive premature responses have been observed in ADHD children undertaking timing tasks, particularly where waiting is required (Rubia et al., 2003). Time perception and reproduction in ADHD is discussed in more detail later in this literature review.

Deficits in temporal processing mean that children who have ADHD also have difficulty deferring immediate rewards for later or greater gain (Barkley, 1998; McInerney & Kerns, 2003; Rubia et al., 2003). They prefer small instant rewards to larger delayed ones, and are less tolerant of reward delays. There appears to be a lack of intrinsic motivation (Douglas, 1999) which makes it difficult to differentiate whether the child ‘can’t’ or ‘won’t’ complete a task. McInerney and Kerns (2003) suggest that a child’s level of motivation toward a given task should figure in the interpretation of results. They argue that children who have ADHD may appear to have more severe deficits than is actually the case, and propose that their true abilities are really only observable through a ‘motivational lens’.

However, there does seem to be little doubt that the impaired performance of children who have ADHD is associated with slow, variable inhibitory processes (Douglas, 1999) and poor “intertemporal competence” i.e. the ability to associate events which are separated by time (Rubia et al., 2003). Nevertheless, researchers are following various lines of enquiry, including failure to allocate adequate attention or effort to a particular task (Douglas, 1999; Sergeant, Oosterlaan, & van der Meere, 1999). Douglas posits that interest in these matters reflects the unusual blending of motivation and cognitive differences that characterize the performance of ADHD children.

To sum up this section, it seems likely that problems exist with both attentional and inhibitory systems, as well as defective regulation of arousal and activation levels. Further, the attention problems are probably not entirely due to distractibility – these children may in fact not be able to focus or give enough attention to relevant stimuli. There is increasing evidence to suggest that children

who have ADHD are most likely to show distractibility on tasks which could be described as difficult or boring (Douglas, 1999), and some studies have further suggested that they may have a tendency to seek out further stimulation in order to increase chronically low arousal levels (Sergeant, Oosterlaan, & van der Meere, 1999; Zentall & Zentall, 1983, in Sonuga-Barke et al., 1994).

4. Definitions of Impulsivity

Kagan (1966), in discussing situations that involved high response uncertainty, referred to the individual differences in the time and effort children put into thinking about alternative possibilities before making a decision as *reflective-impulsive* style. More recently, researchers describe the impulsivity of children who have ADHD as a “temporally inadequate, premature and erratic response style, where motor acts are executed prior to the appropriate time without consideration of future consequences” (Rubia et al., 2003, p.302; Smith et al., 2002, p.529). Impulsivity has also been used to refer to a tendency to make rapid response without consideration for accuracy, in tasks which demand more clear-cut responses, and which might involve fast processing (Douglas, 1999). According to DSM-IV criteria (APA, 1994), impulsivity “manifests itself as impatience, difficulty in delaying responses, blurting out answers before questions have been completed, difficulty awaiting one’s turn, and frequently interrupting or intruding on others to the point of causing difficulties in social, academic, or occupational settings” (p.79).

Children who demonstrate these symptoms have also been referred to as behaviourally disinhibited. Barkley (1998) described children and adolescents who have ADHD as having difficulty inhibiting or delaying initial motor responses to external stimuli. Premature impulsive responses in turn lead these children to make more errors than their peers because they are less likely to take time to consider an alternative response. In Barkley’s model, behavioural inhibition refers to three interrelated processes - withholding an automatic response to stimuli, stopping an ongoing response, and interference control (maintaining control by ignoring incoming stimuli). In 1995, Sonuga-Barke (in Douglas, 1999) described two kinds of deficits in behavioural inhibition as

‘ongoing’ and ‘momentary’ inhibition. The former relates to the ability to suppress responding over a period of delay, i.e. to wait for a signal, and the latter to withholding a response following a signal, i.e. to consider whether a response is required.

In Rickson’s 2001 study, impulsivity was measured using a ‘top down’ method of analysis by means of videotape data of selected segments of music therapy sessions. The analysis began with thorough description and categorisation of the behaviour of students according to the quality of their interactions. Behaviours were labelled ‘impulsive’ when the student interrupted peer/s and/or executed a sudden unplanned or unconsidered movement or comment.

5. Varying Perspectives on Rhythm Perception and Production

Humans are dominated by time-based behaviour, which ranges from seasonal activities to daily synchronisation with fellow workers, and movement or dance. There is a wealth of research literature focusing on how people perceive and produce patterns of events with temporal accuracy and structure, and it is clear that researchers have not reached a consensus of opinion. Interestingly, two contrasting theories are analogous to the music therapy approaches employed in this study.

There is considerable debate as to whether sequencing and timing of action are controlled by different mechanisms (Summers, 2000). According to Summers, the “dynamic systems” theorists posit that time is not directly controlled in movement, but is a product of self-organising processes in the neuromotor system itself. He explains that this theory of self-organisation, or pattern formation, is an approach that proposes systems composed of many individual parts that interact with each other in a nonlinear fashion. These can form spatial, temporal or functional structures by means of self-organisation. Rhythms can be produced in response to stimuli automatically, and perception and production can thus become synchronised. Following this line of reasoning, one could argue that the improvisational music therapy approach has a lot to offer the self-organisation

process, as it is a holistic treatment process providing a variety of stimuli from which the students can draw.

In contrast, theorists who continue to develop the cognitive model of movement timing and rhythm perception propose that the timing of movements is under the control of an internal clock or a motor programme that produces a regular series of pulses, but with some variability. Wing and Kristofferson (1973) suggest there is a central clock that sends pulses to the motor system and an implementation mechanism that generates responses, albeit with some delay.

6. Time Perception and Reproduction in ADHD

According to Pennington and Ozonoff (1996), poor performance on planning tasks, in which future events have to be taken into consideration, suggests inadequate temporal competence. Temporal processing has many aspects, including:

Time perception which includes:

- a. verbal time estimation (being able to guess how much time has passed),
- b. temporal production (being able to produce a suggested durational interval e.g. holding a tone over given time span),
- c. time reproduction (being able to recreate a time interval, e.g. the playing of a tone, as demonstrated by the researcher) and
- d. time discrimination (being able to differentiate whether intervals of time are the same, longer, or shorter).

Motor timing involves adjusting a motor response to sensory stimulation.

The literature describes inconsistent associations between time perception and motor timing, but it seems that both are impaired in ADHD (Rubia et al., 1999; Smith et al., 2002; Toplak et al., 2003). Accuracy in motor timing reproduction tasks depends on ability to attend to incoming stimuli, to estimate time periods, and to plan, organise and produce a response. Children who have ADHD are impaired in these different processes of motor timing (Rubia et al., 2003). They are likely to have difficulty preparing their motor response in anticipation of events (Rubia et al., 1999; Zahn, Kruesi, & Rapoport, 1991) as well as the

execution of that response (Carte, Nigg, & Hinshaw, 1996). This population is also likely to be unaware of how to correct errors and does not slow down after making mistakes (Barkley, 1998).

Rubia et al. (2003) cite several studies that show that both fast and slow event rates have a detrimental effect on the performance of hyperactive children, suggesting that they are less able to adjust their own speed to the externally demanded pace in motor and cognitive tasks. Douglas (1999) also cites evidence that children who have ADHD respond too *quickly* on some tasks and too *slowly* on others, and that they have slow, variable reaction times and high error rates on a variety of testing tasks. She therefore posits a relationship between remaining vigilant, maintaining preparation, and coping with unpredictability. However, response times that are slower and more variable in warned reaction time (WRT) tasks are also attributable to aversion to delay, or the lack of stimulation associated with overall slow event rates. In these tests, children are given a series of trials in which there is a warning signal followed by a preparatory interval and a signal to respond. Douglas points out that the findings suggest that sustained-attention or response-preparation deficits in ADHD are highly dependent on contextual factors, especially slower event rates and perhaps monotonous repetition. Delayed responses do not fit criteria for impulsivity.

In contrast, several researchers who have demonstrated a relationship between poor motor inhibition and deficits in sense of time have argued that children who have ADHD make greater *under-reproductions* than non-ADHD controls (Barkley, Murphy, & Bush, 2001; Rubia et al., 2003; Smith et al., 2002; Sonuga-Barke, Saxton, & Hall, 1998; Toplak et al., 2003). It seems that both normal controls and ADHD groups make more errors as the duration to be reproduced increases, but the errors are greater for hyperactive students. The longer the durational interval, the harder it is to wait, judge, remember and reproduce an interval. For example, Toplak et al (2003) found in their study that the average duration of children's reproductions were generally longer than their target 400 millisecond (ms) intervals, somewhat shorter than their 2000ms intervals and much shorter than their 6000ms target intervals. Hyperactive/impulsive children also tap faster than normal children on a free tapping task (Stevens, Stover, &

Backus, 1970) and with greater inconsistency in synchronised or timed tapping tasks (Rubia et al., 2003).

Toplak et al. (2003) also found that the performance of an ADHD group on a duration discrimination task significantly correlated with all the short-term (working) memory measures they tested. This is important because the duration discrimination task is a cognitive rather than a motor timing task. Further, child and adolescent ADHD groups in their study both displayed significantly more intra-individual variability on time estimation tasks than control groups, especially at the longer durations. They also found that the over reproductions on time estimation tasks of adolescents who have ADHD (at 400ms) significantly correlated with full-scale IQ and teacher reports of inattentive and hyperactive-impulsive behaviour on the Conners' measurement tool (Conners, 1997). The teacher reports of hyperactivity and impulsivity were found to be significant predictors of performance on the 400ms task. However, because of the high degree of variability and inconsistency in the performance of ADHD children (Sergeant, Oosterlaan, & van der Meere, 1999; Toplak et al., 2003) researchers remain puzzled about the precise relationship between motor control and co-ordination deficits and the regulatory control problems described above.

Barkley (2001) has suggested that ADHD may impair timing because of the links between deficient inhibition, particularly interference control, and working memory - interference in working memory from internal and/or external distracting events can be a disrupting influence on motor responses. Rubia et al. (1999) also attributed the deficits in motor timing tasks found in their participants to inconsistency of motor adjustment and impulsive style of performance, although they were unable to replicate their findings in a later study. Smith et al. (2002) agree that deficits in time estimation could underlie several problems of impulsiveness, playing a role in the observed deficits in motor output control or impulsive executive style. They believe that impulsivity appears to lead to an underestimation of time, which manifests in shorter production or reproduction of time intervals.

Barkley (1998) proposed that a sense of time may be held in nonverbal memory guided by a unit of measure such as an internal clock. This sense of time may be enhanced by verbal working memory, using techniques such as counting by means of self-speech. This suggestion is important because working memory is used when attending to temporal durations of at least a second or more, whereas motor timing and time perception involving intervals less than one second may be mediated more by the basal ganglia. As mentioned previously, it was for this reason that students in the current study were asked to reproduce beats with intervals of 1500 milliseconds (ms) (40 beats per minute) and 800 ms (75 beats per minute). However, the precise point, or interval at which the processing differs, does not appear to be well established. Smith et al. (2002) suggest it might be somewhere in the region of 1-3 seconds (1000ms – 3000ms or 60bpm – 20bpm). They were able to determine that the discrimination of temporal intervals of short duration, which differ by hundreds of milliseconds, appears to be a different time perception process from the reproduction or verbal estimation of longer intervals of several seconds.

7. Music Therapy With Children and Adolescents who have ADHD

Several studies suggesting that a child will exhibit disordered impulsive beating and be unable to sustain a steady beat or organised rhythm due to poor impulse control have been cited in earlier paragraphs. Over two decades ago, Gibbons (1983) reasoned that rhythm response success or failure is likely to be related to internal behaviour controls that provide the organisation required to perform the rhythm tasks, and argued “if rhythm reproduction accuracy, or lack of it, does reflect internal organisation, then appropriate rhythm measurements may contribute useful information concerning the child’s behaviours in a readily accessible, efficient, cost effective format” (p.101). Following Gibbons’ argument, it can be assumed that periodic measurement of rhythmic response would provide evidence of changes in adolescents’ skills with behaviour control. According to Barkley (1998), once children who have ADHD learn techniques to overcome their deficits in self-control in a smaller less competitive environment, they might be able to function outside such programmes.

Musical messages are received directly by the emotional centres of the brain (hypothalamus and limbic system) via the thalamus. Response to music in the first instance is therefore not dependent on the processing of the sensations by a higher cortex (Taylor, 1997). Taylor reports that there is a widely accepted view that rhythm in music serves as a structure that is used by the brain for temporal organisation of bodily movements. “Movements, especially of skeletal muscle, result from musical auditory stimuli that disperse throughout the brain as generalized neuronal discharges. These impulses activate specific structures in the cerebellum, basal ganglia, frontal association cortex, and the primary motor cortex...” (p.30). The principle input to the primary motor cortex is from the frontal association cortex, and this might explain why movements are readily coordinated with musical stimuli. Rhythm has the capacity to organise and energise the listener and to give us cues for response or movement that enables group synchronicity (Gaston, 1968).

A steady pulse can contain and hold a client (Bunt & Hoskyns, 2002, p.75) and rhythm has been used to improve body awareness (Wigram, Pederson, & Bond, 2002, p.181) and motor co-ordination (Gibbons, 1983; Howell, Flowers, & Wheaton, 1995; Moore & Mathenius, 1987; Staum, 1983; Thaut, 1985). However, Staum also suggested that although rhythmic stimuli could aid in correcting arrhythmia, it depends on the type of disability causing the arrhythmia. Rickson (2001) also found that while music activities seemed to engage and facilitate internal organisation in some students in her study, the adolescents who had ADHD were not always able to settle and concentrate enough to enable group musical cohesion to develop.

The music therapy approach employed in the Rickson (2001) study was based on a humanistic client-centred philosophy which greatly valued the therapeutic relationship, placed emphasis on encouraging autonomy, and relied heavily on the music-making to motivate and facilitate change. In a similar study, Montello and Coons suggested that an active rhythm-based intervention may not be appropriate for adolescents whose need for structure and security is paramount (Montello & Coons, 1998). These researchers delivered sessions as part of a classroom programme and describe some of their active techniques as “teaching”, but they

also refer to the use of improvisation and encouragement of participants to be spontaneous and creative and to express feelings. Montello and Coons found that the students with Attention Deficit Disorders (ADD)² had difficulty in dealing with the complexities of rhythm training within the group setting, while Rickson (2001) concluded that the sometimes-chaotic responses of students might even have served to increase internal disorganisation in themselves and others.

In both studies, the researchers suggested that music therapy programmes for this population might utilise highly structured rhythm activities with individuals and/or very small group settings. These results were supported by an earlier study, discussed previously in this section, by Gibbons (1983) who found that participants in her “mild need for structure” group performed significantly better on rhythm tasks than those in the “moderate and severe need for structure” groups. She concluded that rhythm might be an important and useful element to consider in assessment, evaluation, and subsequent music therapy programmes for emotionally disturbed adolescents in the 11-15 year age range.

8. Planning and Structuring Group Work

Group work with children and adolescents can be used to foster healthy development and become a catalyst for growth (Geldard & Geldard, 1999, 2000; Malekoff, 1997). The music group can be a particularly suitable context for therapy with adolescents because they view music positively as an important part of their subculture. There has been considerable discussion regarding the potential for successful group work with children who lack impulse control (Kraft, 1966; Malekoff, 1997). Malekoff (1997, p.54) refutes early clinicians’ claims that “the literature states that groups don’t work for ADD kids” and predicts benefits for these children as long as groups are specifically designed and carefully planned to meet well defined and limited goals.

The general literature relating to children who have ADHD strongly recommends a multi-modal individualized approach to treatment, and a more structured

² The diagnosis of Attention Deficit Disorder (ADD) has been superseded in DSM-IV (1994) by the diagnosis of ADHD and the differential categories reported on page 5 of this study.

environment to promote learning (Barkley, 1998). According to Malekoff (1997) structure refers to both the concrete arrangements (physical, organisational, and in some cases financial aspects) and the initial steps the facilitator takes towards the physical and emotional security and safety of the group. Consideration of group numbers is important for this population. It is likely to be beneficial to structure programmes so that group numbers can be kept small in order to counter the high activity levels, inattention and impulsive behaviour that could be predicted. Hartford (1971) advised that groups must be small enough for each person to be heard, to contribute, and to feel the impact of the group upon his beliefs and behaviours, without being so small as to over-expose members or to provide too little stimulation. Balancing the level of stimulation and monitoring the possibility of over-arousal in individuals is likely to be crucial to the success of group work with students who have ADHD.

The current study puts an additional emphasis on the level of structure in the *content* of the therapy sessions. Describing what the group *does* in order to reach its goals is vital in evaluating two different approaches to treatment. There are many types of groups for children and adolescents, each of which is described in terms of the theoretical and philosophical beliefs that underpin them. Geldard and Geldard (2001) explain that the theoretical approach adopted in therapy groups will depend on the training and theoretical orientation of the group leader but that while there may be differences between types of groups there is also overlap. They argue that success in group work sometimes depends on combining essential elements of more than one type of group, and on integrating concepts from more than one theoretical approach.

9. Determining a Music Therapy Approach

“Music therapy is an interpersonal process wherein musical experiences are used to improve, maintain, or restore the well-being of the client” (Bruscia, 1989). Music therapists work with clients individually or in group settings. They employ various psychotherapeutic frameworks according to their training experience, the setting in which the therapy takes place, and/or the needs of the individual client or group with whom they are working. As Geldard and Geldard (2001) suggest, it

may be necessary to use an integrated approach that draws on more than one theoretical model.

Wigram (2002, p.419) explains that the eclectic model promoted in some music therapy training courses involves students learning a variety of therapeutic theories that they can draw on, depending on the client group with whom they are working. The rationale for this is that the needs of music therapy clients are diverse, and one particular approach may be more appropriate than another for a specific client group or setting. Music therapy clients who have deep emotional issues which inhibit communication and interaction and yet who need clear behaviour guidelines might benefit from a combination of therapy, counselling and education techniques. The therapist might employ techniques from developmental, behavioural and creative music therapy approaches while continuing to consider the issues of transference and counter-transference, concepts taken from a psychoanalytical framework.

McFerran-Skewes (2003) provides a good example of the importance and relevance of the therapist's approach when discussing her work with bereaved adolescents. She explains that "adolescents who are grappling with complex and existential issues do not require the same level of containment provided for those who are coping with the first experience of psychosis; nor do they require the assistance and facilitation provided for those dealing with the implications of intellectual or multiple disabilities" (p.2). The question is, therefore, how can the music therapy clinician most effectively address the needs of adolescents who have poor internal organisation which affects their ability to maintain a beat or perform on rhythm tasks? This current study aims to determine whether students who have ADHD can draw from an approach that focuses primarily on their social, emotional and psychological needs and gives them opportunities for choice and control, or whether a greater level of containment might be more beneficial.

Firstly, it might be important to offer direct verbal instruction to group students. Frisch (1990) found, in her work with adolescents, that words increased the music's effectiveness when they were used in a way that structured, directed or highlighted the music activities of the session. In contrast, psychologist and

musician John Sloboda (1985) argues (sic. in normal musical development) that specific instruction is not necessary for music skill acquisition, but practice is. He contends that through practice, and possibly through general developmental changes, similar stages in skill acquisition can be observed in several generative domains. Secondly, it might be useful to incorporate direct modelling techniques into the programme. When Moore and Mathenius (1987) examined the effects of modelling, reinforcement and tempo on imitative rhythmic responses of moderately retarded adolescents, they found percussion performance showed marked improvement when simultaneous modelling was offered, compared to a condition without modelling.

On the other hand, while they agreed that a child will exhibit disordered impulsive beating and be unable to sustain a steady beat or organised rhythm due to poor impulse control, pioneers of the 'Creative Music Therapy Approach' Paul Nordoff and Clive Robbins argued that human beings have a capacity for 'self integrative experience' in music (Nordoff & Robbins, 1977, p.2). They described the elements of music (including pulse, rhythm, and tempo) as being intrinsic to the human condition. Bruscia (1987) concurs that components of rhythm are usually considered as manifestations of instinctual energy. Researchers have built on this, arguing that in organising a particular rhythm, clients are experiencing a measure of self-control and gaining mastery over involuntary musical impulses (Frisch, 1990). Bruscia posits that improvised music reflects the players' way of 'being in the world', both in the here-and-now and in the wider context of their life, and each musical element has its own range of possibilities for expressive meanings (Bruscia, 1987). Pulse, rhythm, metre and tempo are metaphors for the organisation of life energy in time. Being involved in music-making, and supported, encouraged and challenged by a perceptive music therapist can motivate the appropriate responses, as the catalyst for change lies within the music and the therapeutic relationship. Hong, Hussey and Heng (1998) agree that when we are making music, the music itself delineates clear outlines for behavioural expectations. They maintain that a child's independent execution of tasks indicates increased ability to internalise structure.

It is important for all therapists working with groups to be clear about the type of group they are running and the theoretical foundations for that work. However, in order to compare two music therapy treatment approaches, the instructional model with the improvisation model, it is even more essential to clearly define the construct of each method. The two contrasting music therapy approaches (independent variables) used during course of the study are described in the following paragraphs.

a. An Instructional Approach

The instructional approach is based on pedagogy, behavioural and developmental theory and involves direct teaching and modelling of specific beat and rhythm tasks. The intervention includes a hierarchy of rhythmic activities presented in a highly structured and repetitive format, culminating in the rehearsal and performance of a simple percussion ensemble. The therapist takes an overt leadership role. Verbal communication is frequent, and group members are given direct instruction and advice, feedback on errors, and frequent praise and reinforcement for accurate or improving responses. It is possible that the rhythm environment might be less stimulating than the improvisational music-making environment and providing clear direction might enable the students to engage in the activities more readily. Further, given the overt hierarchy of skill development in this programme, it is also likely that students would be aware of their progress and success early in the treatment process and develop an increasing positive sense of self. According to Geldard and Geldard (2001), the primary objective of developmental skills groups is to achieve social competence and task mastery in an interactive way. The desire to improve musical skill acquisition culminating in successful group performance is considered a powerful behavioural reinforcer for the adolescents in this study.

Within the behavioural model, therapists use music as an external reinforcer and/or regard music as intrinsically rewarding. Behavioural techniques, which rely on the contingent use of music as a reinforcer, have been used successfully in music therapy programmes with similar populations to that of this study (Eidson, 1989; Hauck & Martin, 1970; Underhill & Harris, 1974), and activity-based

treatment protocols are widely used in music therapy programmes for adolescents and adults who display antisocial and aggressive behaviours (Henderson, 1983; Kivland, 1986; Thaut, 1989). A criticism of the behavioural approach is that it addresses symptomatic behaviour and disregards the cause of the client's difficulties. In this study, music was not directly employed as a contingent reinforcer. That is, participation was not dependent on good behaviour, and music was not withdrawn from group members at any time. However, other contingent rewards were used, such as direct verbal praise and *additional* musical reward such as the opportunity to play at the drum kit or to choose an instrument from a "special" collection.

The rhythm intervention offered in the current study was framed in a musical context, with various timbre, accents and patterns of interest, repetition and form. It did not however, especially in early sessions, draw extensively on creativity, aesthetics and the emotional impact of music itself in the same way as did the intervention involving musical improvisation. Windsor and Desain (2000) caution that isolating temporal parameters from other musical attributes (melody, harmony and timbre) could be a dangerous reduction and describe detailed experiments undertaken in laboratory settings with "artificial and impoverished stimuli" as having a very modest relevance to music listening and performance. While Windsor and Desain's argument is not pertinent to the music therapy treatment, it certainly has relevance to the computer-generated Synchronised Tapping Task (STT) used as a dependent measure in this study, which can only be considered a "test of temporal competence" and not a musical experience. Further, their argument *is* pertinent to other laboratory ADHD studies cited in this literature review.

b. An Improvisational Approach

The theoretical underpinning for Rickson's 2001 study was the Creative Music Therapy approach (Nordoff & Robbins, 1977), and the improvisation sessions in this current study were also strongly influenced by this paradigm. Creative Music Therapy is based on the humanistic client-centred models of psychotherapy. Practitioners see music as a human experience facilitating growth, and music

creation and expression as a way of actualising and realising the self (Ansdell, 1995; Nordoff & Robbins, 1977). The music therapy approach is predominantly improvisational, beginning with what the client brings to the session – the music therapist begins from a position of “not knowing”. The therapist relies on the music itself to promote growth and development, and believes that the client, regardless of their illness, disability or trauma, will be able to respond to music in a way that enables therapeutic change to occur. The process is experiential, the client achieves increased self-awareness, confidence and self esteem through successful music-making with others, and through the relationships that develop in that interactive music-making. Because the role of the therapist is to support and challenge clients musically, verbal input is likely to be minimal and the approach is non-directive. Case studies, which document positive outcomes for adolescents using creative or eclectic music therapy approaches, have been widely published (Aigen, 1997; Haines, 1989; Lefebvre, 1991; Robbins & Robbins, 1991).

Using such a non-directive and ego-supportive environment, Merle-Fishman and Marcus (1982) were able to determine that a clinic group of emotionally disturbed children demonstrated a higher incidence of disordered beating (defined as impulsive rhythmic behaviour) than a control group of school children. However, these researchers were also able to report that during the period of their study, they observed improvement in the clinic group in several areas including rhythmic development i.e. moving from disordered beating to limited rhythmic freedom. Nevertheless they recorded that the clinic children required more frequent intervention by the therapist than the school children did, and “a number of them could not tolerate the lack of structure, direction, and degree of stimulation inherent in the study methodology”. They add “at times, therefore, it was necessary to intervene and add structure to the environment” (p.8).

10. Summary and Aims of the Study

This review described some of the biological, cognitive and psychosocial features that characterise ADHD, and it is clear that the origins of the presenting behaviours are complex. Although it may be possible to identify anatomical differences in the brains of children and adolescents with this diagnosis, it is evident that a) there is no definitive medical model for ADHD and b) considerable questions remain as to what specific cognitive deficits affect functioning. Recent findings suggest that aspects of time perception are related to short term (working) memory and deficits in these cognitive processes are separable from the motor control problems associated with children and adolescents who have ADHD. However, it appears that speed preference and motor timing variability in hyperactive children, in particular their impulsive style of responding, are related to their time perception difficulties. Further, environmental influences will also have a significant impact on their ability to function.

Nevertheless, clinicians are required to make choices regarding the treatment approach they will employ with clients. They may choose to address a cognitive deficit by offering pre-planned tasks to teach specific skills, or to take a more psychotherapeutic approach which aims to address a wider range of issues. Both of the music therapy approaches used in this study build on the basic premise that success or failure in rhythm response is likely to be related to internal behaviour controls that provide the organisation required to perform the rhythm tasks. Active involvement in music sessions, whether the music is improvised or more prescribed, might lead to improvement in time perception and reproduction skills, and subsequently to increased inhibition and impulse control. This study aims to determine the relative effectiveness of the two contrasting interventions selected.

Null Hypotheses

There will be no statistically significant difference at $p < .05$ between the impact of instructional and improvisational music therapy approaches on the level of motor impulsivity displayed by adolescent boys who have Attention Deficit Hyperactivity Disorder (ADHD) as measured by

- a. Numbers of Errors made on a Synchronised Tapping Task (STT) and
- b. Conners' Rating Scales Restless-Impulsive and Hyperactive-Impulsive subscales.

METHOD

1. Population Sample

The total population of adolescent boys, N=90, was enrolled in a residential education facility for students who have intellectual, social and emotional deficits. The programme aims to have students return to their communities after approximately two years intensive intervention. Student turnover is therefore relatively high, i.e. approximately 50% per year. Thus, those enrolled prior to May 2002 were excluded from the study since they were likely to leave the school before treatment had been completed.

The special residential school setting provides a variety of highly structured treatment programmes, and is in itself an active treatment. To control for improvement due to other interventions and the general influence of the school environment, students were required to have been attending the school for at least one full term prior to the commencement of music therapy treatment.

2. Ethics Approval

Ethics approval was gained from Massey University Human Ethics Committee (MUHEC: WGTN Protocol – 03/106) and Canterbury Ethics Committee (CTY/03/12/CPD). School, Individual, and Parental Consents were obtained for all 15 students eligible for inclusion.

3. Inclusion Criteria

All students included in the study

- Were enrolled between May 2002 and March 2003
- Had a formal diagnosis of ADHD
- Were being treated with stimulant medication.
- Had not been involved in a music therapy programme previously.

Note: *Because this was an applied clinical treatment study rather than a pure laboratory experiment students were not asked to cease their medication prior to testing. The implications of this will be explored in the discussion.*

4. Study Sample

The number of students invited to participate was 15. One student did not agree to participate. Another who had a moderate/severe borderline intellectual disability was eliminated following baseline testing because he did not appear to understand the task, and his scores were considered to be extreme. He subsequently participated in a music therapy programme that was not part of the study.

The final number who agreed to participate (n=13) were aged 11 – 16 yrs with a mean age of 13 yrs. Four identified themselves as Maori while the rest were NZ European. All had a primary diagnosis of ADHD according to DSM-IV guidelines, from a Developmental Paediatrician, Child & Adolescent Psychiatrist, or Clinical Psychologist. All were taking stimulant medication. Eight were on slow release and five were on regular doses at the time of beginning the study. School records provided differential diagnosis of ADHD subtype for only three students. One of these was listed as Combined OR Hyperactive-Impulsive subtype. The other two were Combined subtype, and Hyperactive-Impulsive subtype.

All students had learning difficulties, most had a mild intellectual disability and many had comorbid diagnoses as follows: Five had Oppositional Disorders (OD); one had an Obsessive Compulsive Disorder (OCD); one had Post Traumatic Stress Disorder (PTSD) and a mood disorder; one had Foetal Alcohol Syndrome (FA); and another was diagnosed with Intermittent Explosive Disorder (IED). This latter student was also given a provisional diagnosis of Autistic Spectrum Disorder (ASD) but presentation was not clear. Another student had experienced a major depressive episode and had attempted suicide in 2002, and two were reportedly suffering from previous family abuse but did not have a formal diagnosis of PTSD.

5. Assignment to Groups

Students were randomised to three groups; Control Group A (n=5), Group B (n=4), Group C (n=4).

6. Research Design and Procedures

A combination of a multiple contrasting treatment and an experimental control group design was employed to compare treatment effects and control for internal threats to validity (see Table 1) (Reaves, 1992).

Table 1 – Research Design

	<i>Baseline Term 2,2003 <u>Test 4 Times</u></i>	<i>Phase 1 Term 3,2003 <u>8 Sessions</u></i>	<i>Phase 2 Term 4,2003 <u>8 Sessions</u></i>	<i>Study Completion Term 1, 2004 <u>8 Sessions</u></i>
Group A (N=5) (Controls)	STT test	No treatment	No treatment	Best treatment
Group B (N=4)	STT test	Improvisation	Instructional	No treatment
Group C (N=4)	STT test	Instructional	Improvisation	No treatment

Group A formed a waitlist control group and students were not offered music therapy treatment until after the study was completed. Group B had eight sessions of improvisational music therapy during Term Three (Phase 1) followed by eight sessions using the instructional approach during Term Four, 2003 (Phase 2). The process was reversed for Group C who received eight sessions using the instructional approach during Term Three (Phase 1), followed by eight sessions of improvisation during Term Four, 2003 (Phase 2).

In term 1, 2004, at the completion of the study and after a six-week school holiday break, Group A were given the opportunity to be involved in a ten-week programme. The treatment approach for that programme aimed to reflect ‘best practice’ and integrated some of the positive findings from this study.

7. Testing and Treatment Setting

Music therapy sessions were held in the school music room during the first period of the day. The music room was well equipped with large and small percussion instruments, guitars, and piano. The students from both treatment groups and during both treatment phases were seated in a semicircle near the piano so that the piano could also be accessed for music-making if required. The video camera was mounted on a wall facing the group and was turned on prior to the students entering the room. The room was also used at times by the Occupational and Speech Therapists and although their materials were stored out of sight whenever possible, other equipment would be occasionally visible to the music therapy students.

The Synchronised Tapping Task (STT) (see paragraph 8.a below) testing was done in this same music room. A desk with the STT computer equipment and single switch for operating same (see Figure 1) were set up away from the 'music area', but music equipment in the room was visible to students. Group B had music therapy on Monday mornings, while Group C had sessions on Fridays. STT testing was done at 9.00am prior to sessions - this was test (a). The testing took approximately 10-15 minutes. Three students waited while the others were tested, and were given plasticine or another object to manipulate with their hands during this time. The music therapy sessions lasted approximately 30-45 minutes. Immediately following the music therapy session STT testing was done again – this was test (b).

8. Measures – Dependent Variables

a. Synchronised Tapping Task (STT) - (Null hypothesis #1)

The STT was used as a measure of motor impulsivity. The computerised test measured each student's ability to activate a single switch simultaneously with a woodblock sound emitted from the computer at durational intervals of 1500 milliseconds (ms) or 40 beats per minute (40bpm), and secondly at 800

milliseconds (ms) or 75 beats per minute (75bpm). The two testing speeds were presented in random order for each boy. To help the students to begin on cue, they were given an introduction consisting of four taps at the test speed using a contrasting sound patch, with the additional support of a visual count down (“4, 3, 2, 1, Go”) on the screen. A ‘warning’ beep also sounded with count 1 to cue them to start on the next tap with the “Go!” The word “Go” remained on the screen during the 32 taps of the test but was static and therefore did not give students any timing cues. At 40bpm the test took 48 seconds, and at 75bpm, 25.6 seconds. On the 32nd tap, the sound emitted from the computer changed and the word “Stop” was simultaneously shown on the screen. After three seconds of silence the screen message changed to “Great Work”.



Figure 1 – A student at the computer, undertaking the STT.

Baseline data were gathered for all 13 students prior to the introduction of the music therapy intervention. Data were collected at baseline on four days over a two week period (approximately 3 days apart). For every boy, on each of the four days, a test at each speed – test (a) – was followed 45 minutes later by another test at each speed – test (b). The students went back to their classrooms for usual class activity between the STT trials.

During Phases 1 and 2, students who were in treatment did the STT before and after their music therapy sessions. The pre-session trial was labelled ‘test (a)’ and the post-session trial was labelled ‘test (b)’.

In addition to the baseline measures, data were also collected from Group A in the middle of the study on one day only. Two trials, ‘test (a)’ and ‘test (b)’, were done on the same day and have been referred to in the study as the ‘probe’ test. At the end of the study, data for the control group were collected over a two-week period, trials (a) and (b), on four different days. In keeping with baseline protocol, control group students did all the STT in the music room at 9.00am – test (a) – and were sent to classrooms for a 45 minute interval before being brought back for test (b).

Data were analysed for Error Numbers (EN) to answer Null hypothesis #1, and the size of those errors or Error Time (ET) was also measured (see Figure 2, p.35) to gain a more complete clinical picture. By measuring the size (duration) of errors, it was hoped to capture any improvement or deterioration in synchronisation skills that was not reflected in changes in error number. The ‘tolerance level’ for error *number* was set at ± 0.1 or ± 0.1 seconds (secs). That is, playing ± 0.1 second before or after the beat was considered, in this study, to be within normal range, and responses that were outside of this time were considered to be deviant and were recorded as errors. Error times were calculated by measuring the interval of time between the computer-emitted sounds and students’ responses, while taking the ± 0.1 sec tolerance for error into consideration. In order to compare the size of the error *times* 75bpm with 40bpm a mathematical adjustment was necessary, and tolerance for error time was therefore set at ± 0.19 secs for 40bpm, and ± 0.1 sec for 75bpm (see Table 2 below, and Figure 2, p.35).

Table 2 – Error Time Calculations

At ..	Stimulus	Mid Point	Late (+val)	Early (-val)
40bpm	Every 1.5 secs	.75secs	$+(>.19,<.75\text{sec})$	$-(>.19,<.75\text{sec})$
75bpm	Every .8 sec	.4 second	$+(>.1,<.4\text{sec})$	$-(>.1,<.4\text{sec})$

Data from the tests were saved directly onto Microsoft Word Excel data sheets. The software programme recorded the precise times that the sounds were emitted from the computer, and when the tapping switch was pushed in response.

During analysis, the response data were aligned with the closest match to the stimulus sound, and the error time calculated. Any additional responses were coded as extra beats (EB), and where gaps existed they were coded as missed beats (MB) (see Figure 2, p.35).

b. STT Data Collection and Organisation

As outlined in previous paragraphs, baseline data were collected from four days testing in one fortnight, as were the data for control Group A at the end of phase 2. Therefore, when comparing baseline data with Phase 1 or 2, only data from the last four treatment sessions for Groups B and C in each phase has been included. The data for Group A in Phase One are the means from two testing sessions (a) and (b) on one day only (probe). When comparing the two treatment groups (Groups B and C), data from all eight sessions was included. Tables 3 and 4 on p.34 demonstrate how data were organised for analysis.

Data Collection and Organisation

Table 3 – Data Collection and Organisation (Baseline vs Phase 1 and Phase 2)

<u>Group</u>	<u>Baseline</u>	<u>vs Phase 1 AND vs Phase 2</u>
A	2 tests per day (i.e. a and b), 4 days within one fortnight	<u>Phase 1</u> : 2 tests per day (i.e. a and b), 1 day only... ‘Probe’ <u>Phase 2</u> : 2 tests per day (i.e. a and b), 4 days within one fortnight
B	2 tests per day (i.e. a and b), 4 days within one fortnight	Tested before and after sessions (a and b), once per week, last four sessions only included in analysis
C	2 tests per day (i.e. a and b), 4 days within one fortnight	Tested before and after sessions (a and b), once per week, last four sessions only included in analysis

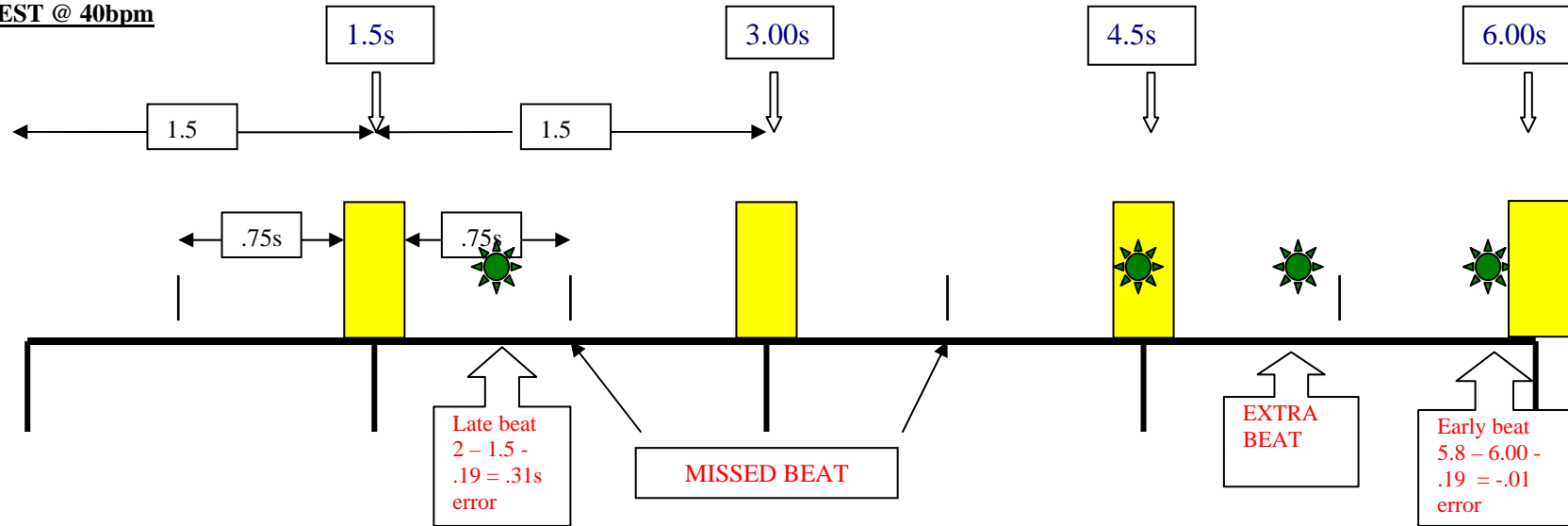
Table 4 – Data Collection and Organisation (Phase 1 Data vs Phase 2 Data)

<u>Group</u>	<u>Phase One</u>	<u>Phase Two</u>
A	2 tests per day (i.e. a and b), 1 day only... ‘Probe’	2 tests per day (i.e. a and b), 4 days within one fortnight
B	Tested before and after sessions [(a) and (b)], once per week. All eight sessions included for analysis	Tested before and after sessions [(a) and (b)], once per week. All eight sessions included for analysis
C	Tested before and after sessions [(a) and (b)], once per week. All eight sessions included for analysis	Tested before and after sessions [(a) and (b)], once per week. All eight sessions included for analysis

HOW THE SYNCHRONISED TAPPING TASK DATA WAS ANALYSED

FOUR BEATS (TAPS)

TEST @ 40bpm



TEST @ 75bpm

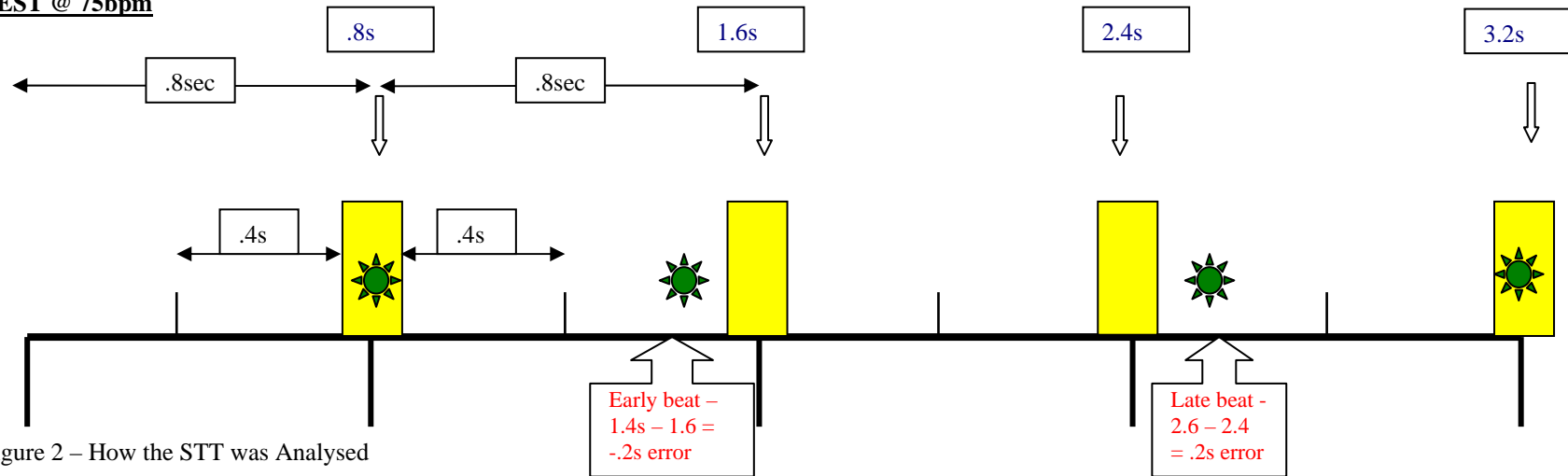


Figure 2 – How the STT was Analysed

- c. Conners' Global Index Restless-Impulsive Scale and Conners' DSM-IV Hyperactive-Impulsive Scale – (Null hypothesis #2)

[from Conners' Rating Scales (Revised: Long Version) (CRS-R:L)
(Conners, 1997)]

The potential effects of the music therapy programme on classroom and residential behaviour were measured using the Conners' Rating Scales – Revised Teacher and Parent Long Versions (Conners, 1997) – a recommended tool for monitoring treatment effectiveness and changes over time. The Conners' Global Index Restless-Impulsive Scale and Conners' DSM-IV Hyperactive-Impulsive Scale were specific subscales of the Conners' used to identify any potential changes in impulsivity. Seven Restless-Impulsive items and nine Hyperactive-Impulsive items, as outlined in the Diagnostic Statistical Manual – Version IV (DSM-IV) (APA, 1994) criteria for ADHD, have been included in the scales.

Further information regarding students' general behaviour was obtained from the additional subscales of the Conners' Rating Scales. The Conners' long version provides 80-item Parent Report Forms (CPRS-R:L) and 59-item Teacher Report Forms (CTRS-R:L), as well as adolescent self-report forms. DSM-IV emphasises the importance of gathering information from multiple informants in assessment, and the use of parent, teacher, and self-reports together certainly contribute towards that end. The Conners' self-report form is suitable for respondents 12 to 17 years of age, but given the mild/moderate intellectual disability and the social and emotional difficulties of this particular sample, students were not asked to complete self-report forms. The study took place in a residential school, and Residential Social Workers (RSW's) filled out parent versions of the Conners' for the students for whom they were Case Managers, while Classroom Teachers completed the teacher version.

Each item of the Conners' is given a rating of '0', '1', '2' or '3' depending on the teacher's (for CTRS-R:L) or residential social worker's (for CPRS-R:L) perception of the degree of presence of a particular behaviour by the student over

the most recent past school term. '0' is used for "not true at all (never, seldom)", '1' for "just a little true (occasionally)" '2' for "pretty much true (often, quite a bit)" and '3' for "very much true (very often, very frequent)". Items load on to thirteen subscales plus total score scale. While the shorter Conners' ADHD/DSM-IV Scales may have yielded all the necessary data for this study, the long version was chosen in order to get a more comprehensive clinical picture of the students. Further, in asking RSWs and teachers to complete the full version, the researcher was to a certain extent able to disguise the specific questions of interest and therefore to reduce potential experimenter bias.

Note: Because the Conners' measures symptomatic behaviours, a reduction in scores can be read as "improvement" in behaviour.

The Conners was administered to all students at the end of Terms Two, Three, and Four. Group A measures served as a control, while for Groups B and C they served as a baseline and external measures of treatments one and two.

d. Additional Session Observations

The music therapist continued with session observations and evaluations that are part of her usual music therapy practice. Session observation forms were therefore also completed for each student (see Appendix 5). The music therapy assistant together with the therapist recorded whether the student was restless and fidgety, moving around the room, touching equipment inappropriately, blurting out answers before questions were completed, did not appear to be listening to others (speech or music), or was unable to keep instruments quiet between activities or when waiting for a turn. Each behavioural category was scored as 'Never' = 0, 'Occasionally' = 1, 'Often' = 2, and 'Very Often' = 3. The session observation forms, daily notes and videotape data have been used in this study to provide more information about the performance of students within the music therapy sessions. In this author's 2001 study, video data added considerable and valuable evidence of students' within-session interactions. Video data has therefore been included in the current study and forms the basis of the report on group dynamics.

9. Treatment Variables

a. Instructional Sessions – Independent Variable #1

A range of simple percussion instruments was available for the students to use during the sessions. Following a greetings song, the group was engaged in structured rhythmic exercises. For example, students were asked to choose an instrument and to play in time to the beat set up by the therapist, who would count out loud, 8 bars of 4/4. To provide motivation for students to attend and rehearse, the therapist might choose a student who had worked well to lead the group, on a popular instrument such as the floor tom or snare drum, while peers continued to keep time and the therapist modelled simultaneously. Students were also asked to choose an instrument and to “pass the beat”, playing one bar each with therapist modelling the beat. Call and response activities were used, using simple rhythms (e.g. XxxXX, where upper case = one beat, and lower case = ½ beat), and each boy was invited to introduce a rhythm, from those taught, for the group to imitate. Then they were asked to maintain the beat on an instrument of their choice, while each was given a chance to ‘solo’ one of the rhythms. Finally, the therapist introduced rhythmic patterns that were specific parts of a percussion ensemble. All students rehearsed the four parts, so that they would be able to interchange during performance. Once the students were familiar with the parts, they rehearsed the simple percussion ensemble. The sessions concluded with a farewell song.

b. Improvisation Sessions – Independent Variable #2

A range of simple percussion instruments was available for the students to use during improvisations. Following a greetings song, students were asked to choose a style, mood or theme for a group improvisation. The students might engage in several improvisations depending on the length of each. As mentioned previously, in this experiential approach the therapist relies on the music itself to promote growth and development. It was anticipated that students would achieve increased self-awareness, confidence and self esteem through successful music-making with others, and that verbal input from the therapist was likely to be minimal. Cue cards were used to help the students with choice-making if necessary. All students then chose an instrument on which they could express the style, mood or

theme chosen. The therapist supported on an instrument of her choice. Cue cards for the improvisations included Country, Rap, Blues, Rock, Ballad, Jazz; Happy, Sad, Bored, Excited, Angry, Calm; The Train, The Forest, The Fairground, The Beach, Car Racing, School. The session closed with a farewell song.

RESULTS

A note to explain the column graph presentations in this section:

The study groups A B C are displayed on the X axis three times to represent baseline, Phase 1 and Phase 2 scores. The grey colour represents no treatment, the dark improvisation, and light the structured treatment. To track a particular group's progress follow the A B or C across the graph.

The first paragraphs in this section give a report on STT Error Number (EN) to address null hypothesis #1, beginning with results from baseline testing. This is followed by a report on findings from Conners' Restless-Impulsive and Conners' Hyperactive subscales to address null hypothesis #2. An examination of the STT data to determine variations in the size (duration) of errors i.e. Error Times (ET) precedes an examination of Error Numbers (EN) and Error Times (ET) at separate speeds. A comparison of 'before session' (a) and 'after session' (b) results is also included. Data are then examined to determine whether errors are predominantly premature or late, and whether students began the task on cue. This is followed by findings from the additional Conners' subscales and a report on findings relating to medication differences. Finally in this section, there is a description of group dynamics and within-session observations of students during treatment sessions.

1. STT Data - Null hypothesis #1
 - a. Baseline Testing

A three-way analysis of variance (ANOVA) at the $p < .05$ level was used to determine (a) that there were no significant group differences at baseline and (b) that results were stable during the baseline period. Because it is feasible that students might have improved on the synchronised tapping task with practice, all four baseline measures have also been presented visually (see Figure 3). When $p < .05$, there were no significant differences between groups and no significant change in error numbers (EN) over the period of the baseline testing.

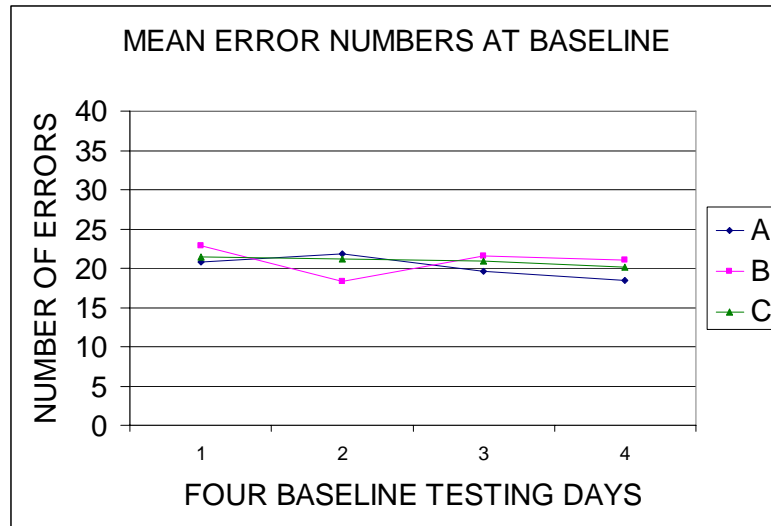


Figure 3 – Error Numbers at Baseline

b. STT Data – Addressing the Null hypothesis

Null hypothesis #1 was addressed using group means of STT Error Number data from (a) and (b) tests at both speeds (40bpm and 75bpm) combined.

An initial ANOVA compared the Error Numbers of each of the three groups, over Baseline, Phase 1 and Phase 2 periods. Instructional and improvisational sessions each led to improved timing on the synchronised tapping tasks for both groups (see Figure 4 and Table 5).

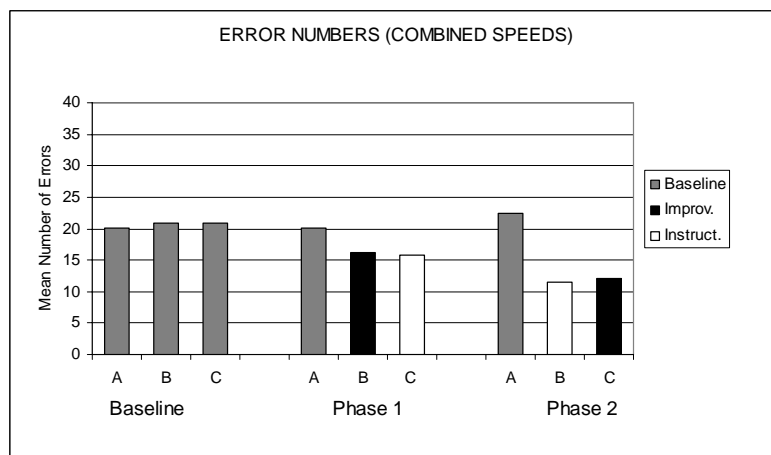


Figure 4 – Error Numbers (Combined Speeds)

While control Group A made more errors during Phase 2, Groups B and C continued to improve over Phase 1 and Phase 2. Each treatment group improved significantly (see Table 5). So when baseline and Phase 2 data for all three

groups were compared, the differences between groups were highly significant (df=2, f=10.419, p=.004) (see Table 5 for means).

Table 5 – Mean Error Numbers – ANOVA Combined Speeds (Base vs Last 4 Sessions)

ERROR NUMBERS	BASELINE	PHASE 1	PHASE 2	df	f	p
GROUP A	20.13	20.05 (No treatment)	22.43 (No treatment)	ns		
GROUP B	20.91	16.11 (Improvisation)	11.56* (Instructional)	1	18.770	p=.023
GROUP C	20.89	15.73 (Instructional)	12.18* (Improvisation)	1	20.947	p=.020

Unpaired t-tests using data from all *eight* sessions in each phase were used to compare instructional and improvisational approaches. No statistically significant difference at $p < .050$ between treatments was found ($p = .250$) (see Table 6) and null hypothesis #1 is accepted.

Table 6 - Error Numbers – (Instructional vs Improvisational Sessions)

Mean Instructional	Mean Improvisation	t	sd	df	p
15.50	16.50	1.15	9.54	468	p=.250

Table 7 reports the results in further detail. Group B achieved a significant reduction in error numbers during each phase, improvisation followed by instructional treatment. Group C also significantly reduced error numbers in both phases with instructional as first treatment followed by improvisational music therapy. While there were no significant differences in treatment effects, both groups (but particularly Group B) did make a little more progress during their instructional phase.

Table 7 – Mean Error Numbers – t tests at Combined Speeds (8 vs 8)

Group	Baseline	Ph 1	Ph 2	t.test	sd	df	p
B	20.91	17.90 Imp.		2.00	9.69	182	p=.047*
		17.90 Imp.	13.20 Str.	3.71	9.72	234	p=.0001**
C	20.89	17.70 Str.		2.39	8.52	181	p=.018*
		17.70 Str.	15.10 Imp.	2.28	8.99	232	p=.024*

2. Conners' Rating Scales (CTRS-R:L & CPRS-R:L) –Null Hypothesis #2

A two-way ANOVA of Conners' data revealed no significant difference (at $p < .050$) between the impact of instructional and improvisational music therapy approaches on the level of motor impulsivity displayed by adolescent boys who have Attention Deficit Hyperactivity Disorder (ADHD) as measured by Conners' Rating Scales Restless-Impulsive and Hyperactive-Impulsive subscales. Null hypothesis two is thus accepted.

a. 'CPI/CTI' Conners' Global Index Restless/Impulsive Scale

Table 8 displays the Restless/Impulsive subscale scores for each group across baseline, Phase 1, and Phase 2. These data are also displayed visually in figures 5 & 6.

Table 8 – Mean Scores, Conners' Global Index Restless/Impulsive Scale

	Group	Baseline	Phase 1	Phase 2
RSW (Parent)	A	65.40	67.20	62.20
	B	64.00	71.25	73.50
	C	66.75	71.00	68.75
Teacher	A	64.40	68.20	70.60
	B	73.25	72.50	68.50
	C	56.75	53.50	53.00

At the end of Phase 1, Residential Social Workers (Parent Version) reported a slight increase in restlessness and impulsivity over all groups (see Table 8, and figure 5). At the end of Phase 2 they again reported a very slight increase in restlessness and impulsivity for Group B (instructional treatment following improvisation) but improvement for Groups A and C.

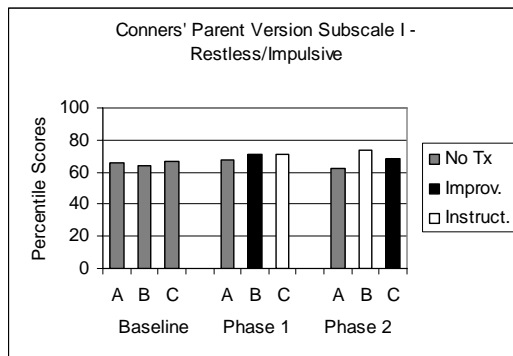


Figure 5 – Restless/Impulsive (Parent)

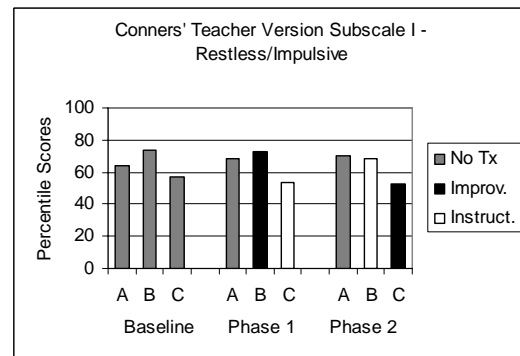


Figure 6 – Restless Impulsive (Teacher)

On the other hand, in Phase 1 the teachers reported virtually no change for Group B and slight improvement for Group C, who had completed the instructional programme (see Table 8, and Figure 6). In Phase 2 they reported improvement for Group B, who had just completed *their* instructional programme, and no change for Group C. There were no significant differences between groups at the end of either treatment phase. It is also important to note that Group C had very low scores at baseline, and restless and impulsive behaviours were almost within normal range for this developmental age group.

b. ‘CPM/CTM’ Conners’ DSM-IV Hyperactive-Impulsive Scale:

Table 9 – Mean Scores, Conners’ DSM-IV Hyperactive-Impulsive Scale

	Group	Baseline	Phase 1	Phase 2
RSW (Parent)	A	70.60	72.00	68.80
	B	69.00	69.50	74.50
	C	66.75	71.25	69.50
Teacher	A	65.00	69.40	73.20
	B	74.50	71.00	66.25
	C	51.75	52.25	53.75

Table 9 displays the Hyperactive-Impulsive subscales scores for each group while figures 7 & 8 provide the visual analysis.

On the Hyperactive-Impulsive scale, the RSW’s (as ‘parents’) again reported slightly higher scores for all groups following Phase 1, and an increase in errors for Group B following Phase 2 instructional sessions. They reported a very small improvement for Group C following Phase 2, during which they were involved in improvisational sessions (see Table 9, and Figure 7). There were no significant differences between groups at the end of either treatment phase on the parent version.

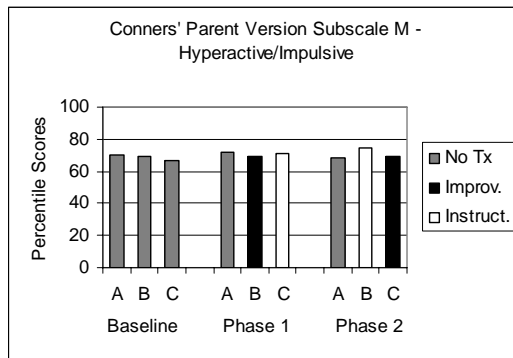


Figure 7 - Hyperactive/Impulsive (Parent)

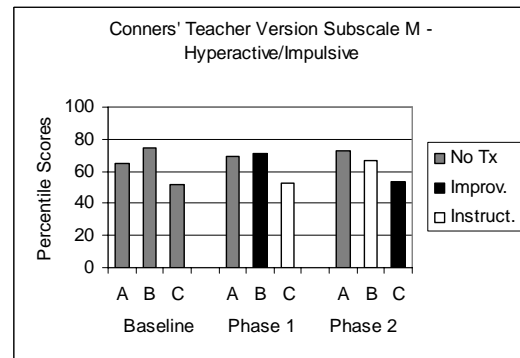


Figure 8 – Hyperactive/Impulsive (Teacher)

On the teacher version group differences at baseline were nearing significance ($p=.052$). However, in contrast to the RSW report, the teachers recorded a progressive increase in hyperactivity and impulsivity for Group A, progressive decrease for Group B and virtually no change for Group C (see Table 9, and Figure 8). The difference between groups following treatment (baseline and Phase 2) was nearing significance ($df=2, f=3.610, p=.066$). Note again that Group C had the lowest scores at baseline, just above the 50th percentile, indicating that teachers perceived this group as almost within normal range for hyperactivity and impulsivity.

3. Other Findings

a. Error Times

At baseline, the STT error times (ET) varied between the groups, with Group A (Control Group) making the fewest errors and Group B making the most. Although Group A's scores remained constant for the 'Probe' tests in Phase 1, they were much higher during the four days' testing at the end of the study. Both Groups B and C, who had treatment, reduced the size of their error times during Phase 1, but during Phase 2 Group B scores remained the same, while Group C's were slightly higher. Error times are illustrated in figure 9, and means in table 10.

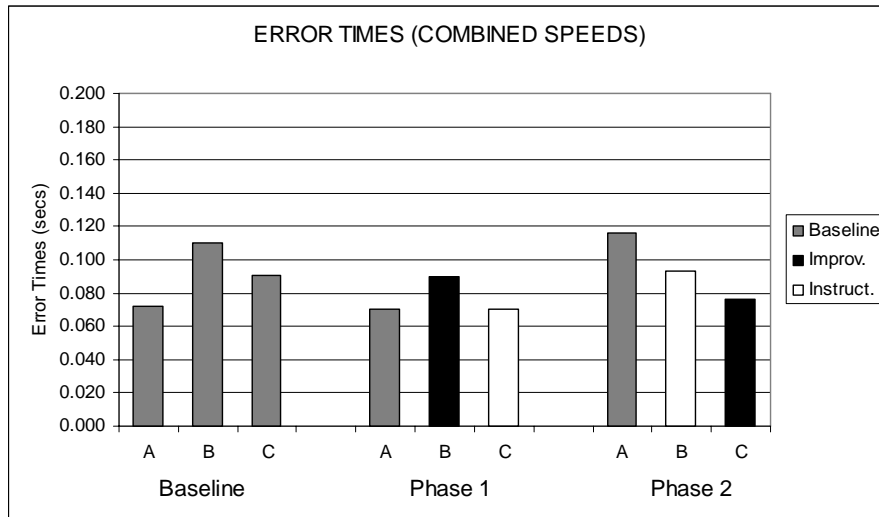


Figure 9 – Error Times (combined speeds)

Table 10 – Mean Error Times (Combined Speeds)

ERROR TIMES	A	B	C
Baseline	0.072 sec	0.110 sec	0.091 sec
Phase 1	0.070 sec	0.090 sec, Improv.	0.070 sec, Instruct.
Phase 2	0.116 sec	0.093 sec, Instruct.	0.076 sec, Improv.

b. Error Numbers and Times at Separate Speeds

i. Baseline at Separate Speeds

Baseline: All students (n=13) had higher error numbers at the slower speed with mean scores of 22.92 errors at 40bpm and 18.35 at 75bpm. Moreover, even with the proportional adjusted tolerance for error, there was a large difference between size of the Error Times at 40bpm speeds (Mean ET .110secs) and 75bpm speeds (mean ET .071secs) speeds. Although there was no significant change in mean error numbers (EN) or mean error times (ET) over the period of the baseline testing at combined speeds, at the slower speed students made significant reduction in error numbers over the period of the four days (p=.027). Baseline scores at the faster speed were consistent.

ii. Analysis of Error Numbers at Separate Speeds

Graphs displaying error numbers and trends for each group, at separate speeds and with data points for each session, are displayed in Appendix 6. Over the period of the study, Group A did not reduce their error numbers (EN) at 40bpm and had increased error numbers (EN) at 75bpm. In contrast, both treatment Groups B and C demonstrated a reduction in numbers of errors (EN) at both speeds. Students consistently made more errors at the slower speed – for Group B the difference between the 40bpm and 75bpm data was not significant, with means of 19.78 (40bpm) and 12.68 (75bpm) $p=.076$, but for Group C the difference did reach statistical significance, with means of 18.36 (40bpm) and 14.71 (75bpm), ($df=1$, $f=13.653$, $p=.034$).

Although there was no evidence of overall difference between treatments, there were some significant differences between the three study groups at specific stages of treatment when the data is analysed at the two different speeds (see Figures 10 and 11).

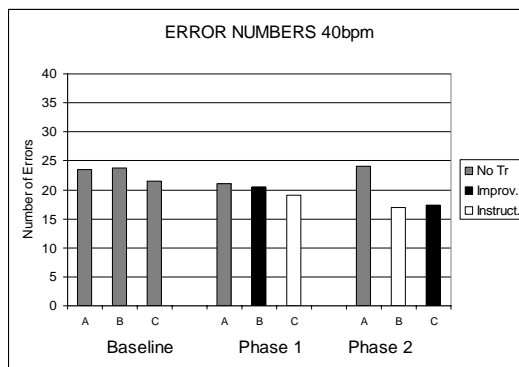


Figure 10 – Error Numbers @ 40bpm

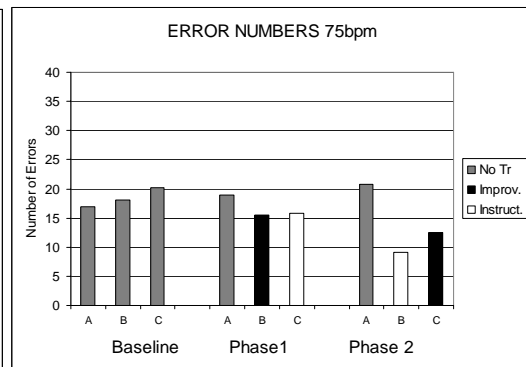


Figure 11 – Error Numbers @ 75bpm

At 40bpm (see Figure 10) differences in the mean error numbers for all students ($n=13$) between baseline (22.88) and Phase 1 (20.04) reached significance ($df=1$, $f=8.028$, $p=.018$). While there was no significant difference between groups ($p=.877$) it is important to note that the control Group A data in Phase 1 related to ‘probe’ testing only. There were no significant differences between Phase 1 and Phase 2 scores. However, the difference between baseline Phase 2 for ‘all

students' scores was highly significant ($df=1$, $f=11.029$, $p=.008$) and differences between groups were nearing significance ($df=2$, $f=4.022$, $p=.052$), due to slight deterioration in Group A scores and considerable improvement in Groups B and C scores (see Table 11 below).

Table 11 – Mean Error Numbers 40bpm

Group	Phase	Mean
A	Baseline	23.40
	Phase 2	24.08
B	Baseline	23.72
	Phase 2	15.84
C	Baseline	21.53
	Phase 2	15.19

At 75bpm (see Figure 11) the differences in the mean error numbers for all students between baseline (18.40) and Phase 1 (14.55) was significant ($df=1$, $f=7.487$, $p=.021$), and differences between groups also reached significance ($df=2$, $f=4.979$, $p=.032$) (see means Table 12 below). Results must again be interpreted with caution since Group A data in Phase 1 relates to 'probe' testing only. There were no differences between Phase 1 and Phase 2 scores. However, differences between Baseline and Phase two scores for 'all students' were highly significant ($df=1$, $f=17.467$, $p=.002$) as were differences between groups ($df=2$, $f=12.860$, $p=.002$) (see also Table 12 below).

Table 12 – Mean Error Numbers 75bpm

Group	Phase	Mean	Phase	Mean
A	Baseline	16.86	Baseline	16.86
	Phase 1 (No treatment)	19.00	Phase 2 (No Treatment)	20.78
B	Baseline	18.09	Baseline	18.09
	Phase 1 (Improvisation)	12.03	Phase 2 (Instructional)	7.28
C	Baseline	20.25	Baseline	20.25
	Phase 1 (Instructional)	12.62	Phase 2 (Improvisation)	9.17

iii. Analysis of Data by Error Time at Separate Speeds

Graphs displaying error times and trends for each group, at separate speeds and with data points for each session, are displayed in Appendix 7.

There was no significant change in mean error *times* (ET) over the period of the baseline testing at either of the speeds. Error times for control Group A also increased for both speeds over the period of the study. In contrast, treatment Groups B and C showed a trend towards reducing the size of their errors in both speeds.

At 40bpm (see Figure 12) there were no significant differences between baseline and Phase 1 scores. However, group differences reached significance between Phase 1 and Phase 2 ($df=2, f=4.282, p=.045$) (see Table 13 below). Note that results will be affected by the low scores of Group A during the ‘one off’ probe testing and subsequent deterioration, improvement in Group B scores, and no change in Group C. No significant differences were found between baseline scores and Phase 2 data.

Table 13 – Mean Error Times 40bpm

Group	Phase	Mean
A	1	.075 sec
	2	.132 sec
B	1	.125 sec
	2	.107 sec
C	1	.081 sec
	2	.080 sec

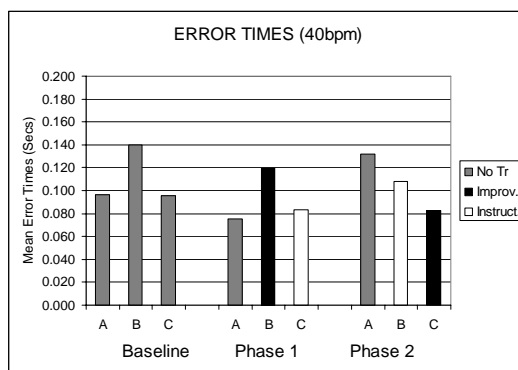


Figure 12 –Error Times @ 40bpm

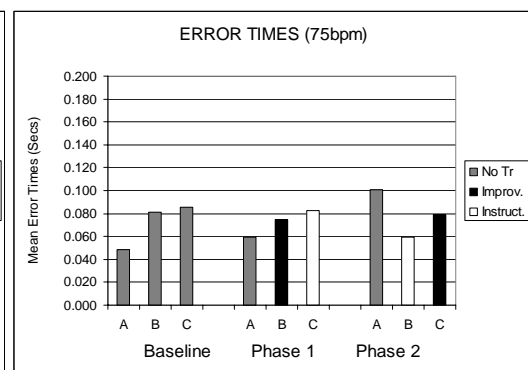


Figure 13 – Error Times @ 75bpm

At 75bpm (see Figure 13) there was also no significant difference between baseline and Phase 1, nor between Phase 1 and Phase 2 scores. However, group differences were found between Baseline data and Phase 2 scores ($df=2, f=4.227,$

p=.047) on mean scores demonstrated in table 14 below. Group A’s low scores at baseline clearly had a significant influence on this result.

Table 14 – Mean Error Times 75bpm

Group	Phase	Mean
A	Baseline	.047 sec
	Phase 2	.100 sec
B	Baseline	.081 sec
	Phase 2	.068 sec
C	Baseline	.086 sec
	Phase 2	.069 sec

c. Difference Before and After Sessions

Baseline comparisons of mean number of errors for tests (a), i.e. early morning series and tests (b), i.e. those undertaken approximately one hour later, generally show improved scores on the slower speed and slightly worse scores at the faster speed when students were retested on the same day.

Graphs displaying *number* of errors ‘before’ and ‘after’ sessions i.e. tests (a) and (b) can be found in Appendix 8. Graphs displaying error *times* ‘before’ and ‘after’ sessions i.e. tests (a) and (b) can be found in Appendix 9.

The students generally made more errors, and larger errors, when tested a second time on the same day, regardless of whether they had been involved in instructional or improvisational music therapy, or had no treatment. Although control Group A did not experience either of the music therapy treatments, they were tested twice on each testing day [tests (a) and (b) approximately 1 hour apart)] going back to class for usual classroom activities between tests, and scores were usually found to be worse on the second trial.

i. Error Numbers

At 40bpm the difference in mean error number scores for tests (a) and (b) reached significance between Baseline and Phase 1 (df=2, f=6.741, p=.027). Dramatic differences were also evident in (a) and (b) tests for all students between Phase 1

and Phase 2 ($df=2$, $f=21.622$, $p=.001$), with mean scores of (a) 18.19 and (b) 21.39, but there were no significant group differences.

At 75bpm during Phase 1 and Phase 2 periods, the difference between (a) and (b) trials for all students was highly significant ($df=2$, $f=13.356$, $p=.004$), with means of 13.95 and 16.75; and baseline and Phase 2 periods ($df=2$, $f= 12.497$, $p=.005$) with means of (a) 14.03 and (b) 16.78. There were no differences between groups on (a) vs (b) measures.

ii. Error Times

There were no significant differences between (a) and (b) Error Time scores at 40bpm.

At 75bpm there was a significant difference when (a) and (b) trials were compared between groups in the baseline and Phase 1 periods ($df=2$, $f=5.017$, $p=.031$), and also in Phase 1 and Phase 2 periods ($df=2$, $f=.4831$, $p=.034$) (see Table 15 below). For Group A, with Baseline and Phase 1 mean scores combined, the scores were higher on (b) trials, while Groups B and C had improved scores on (b) trials at that stage. During the Phase 1 and 2 periods, both Groups A and B had higher (b) scores while Group C did not.

Table 15 – Mean Error Times (Before-and-after-Session Scores by Group)

Group	Phase	Trial	Mean	Mean
A	Baseline/Phase 1 4 vs 4	a	.044 sec	.062 sec .097 sec
		b	.062 sec	
	Phase 1 / Phase 2 8 vs 8	a		
		b		
B	Baseline/Phase 1 4 vs 4	a	.075 sec	.059 sec .078 sec
		b	.069 sec	
	Phase 1 / Phase 2 8 vs 8	a		
		b		
C	Baseline/Phase 1 4 vs 4	a	.083 sec	.082 sec .075 sec
		b	.074 sec	
	Phase 1 / Phase 2 8 vs 8	a		
		b		

For all students, the overall difference between Error Time (a) and Error Time (b) trial scores also reached significance over Phases 1 and 2 ($df=1$, $f= 7.569$, $p=.020$), with means of (a) .068 sec and (b) .083 sec. Finally, there was a

significant difference between Baseline and Phase 2 Error Time (a) and Error Time (b) scores for all students ($df=1, f=9.474, p=.012$) (see Table 16 below).

Table 16 – Mean Error Times (Before-and-after-Session Scores) All Students

<u>Phase</u>	<u>Trial</u>	<u>Mean</u>
B	a	.072
	b	.070
2	a	.063
	b	.094

Despite significant ‘deterioration’ post session, gradually decreasing error numbers overall indicated that while students may not do so well immediately after treatment, the positive carryover effect of treatment was greater than the temporary deterioration. This is particularly evident on the 75bpm scores.

d. Are the Errors Premature or Late Responses?

Because the literature indicated that the responses of children with ADHD might be premature *or* delayed, the data were examined to determine whether students’ were tapping ‘early’ or ‘late’.

It is important to note that this analysis cannot be strictly accurate as it cannot account for extreme errors. For instance, a very early response is classed as being late for the previous beat, while a very late response is classed as being early for the next beat. However, in total, students were collectively asked to respond to 8192 taps per phase at each speed. From this large amount of data it is possible to gain relatively precise information on the way the students’ responded to the STT.

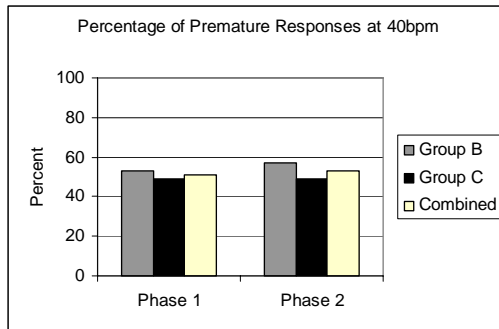


Figure 14 – Premature Responses @ 40bpm

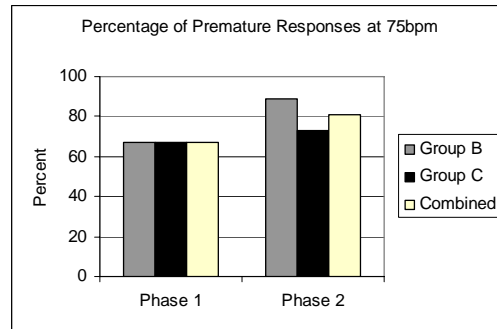


Figure 15 – Premature Responses @ 75bpm

At 40bpm (see Figure 14) in Phase 1 students in treatment made a total of 2195 errors, 1118 that were early responses (51%) and 1077 that were late; in Phase 2 total errors reached 1921, and 1017 were early (53%) while 904 were late. Although Group B were inclined to relatively higher numbers of premature responses overall, there were no differences between the groups across phases at the slower speed.

At 75bpm (see Figure 15) in Phase 1, students made 1712 errors. 1151 of these (i.e. 67%) were early while only 561 were late. In Phase 2 total errors reached 1197, and 946 of those were premature responses (81%) while 251 were late.

At 75bpm in Phase 1 there were no differences between groups - in fact the results were remarkably similar – Group B made 858 errors which were early (67.25%), while Group C made 854 errors, 67.21% of which were premature responses. During Phase 2 however, the *relative* number of early responses increased, particularly for Group B (see Figure 15). While the overall numbers of errors were reducing for both groups the improvement also related to late responses.

e. Students’ Ability to Begin on Cue

Because the literature indicated that children with ADHD might have difficulty preparing and activating a response, data relating to their ability to begin the STT test on cue was closely examined. In Phase 1, in particular, ‘Extra Beats’ or ‘Missed Beats’ were often associated with responding to the cue to begin i.e. students had difficulty synchronising their tap with the first beat following the

introduction and warning beep. Figure 16 compares the number of missed beats with extra (early) beats for Group B. Each data point represents the number of errors made on that day (i.e. trials (a) and (b) at both speeds). Group B had a tendency to begin before *and* after the beat.

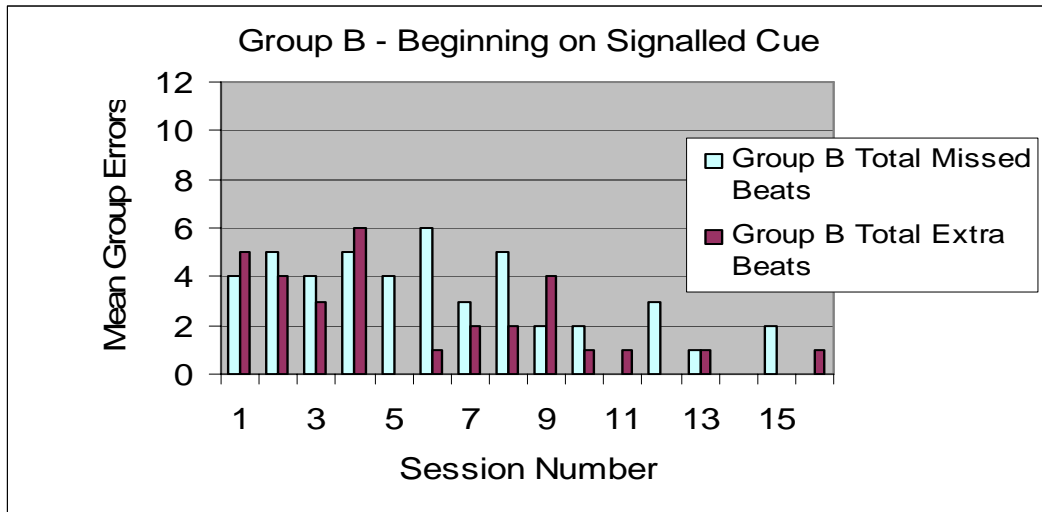


Figure 16 – Group B, Beginning on Signalled Cue

Group C students were most often *late* responding to cue to begin (see Figure 17). It is clear that during the course of the study both groups improved in their ability to synchronise their response with the first beat. However, it is interesting that at least one of the students in Group C began to respond *before* the signal in Phase 2.

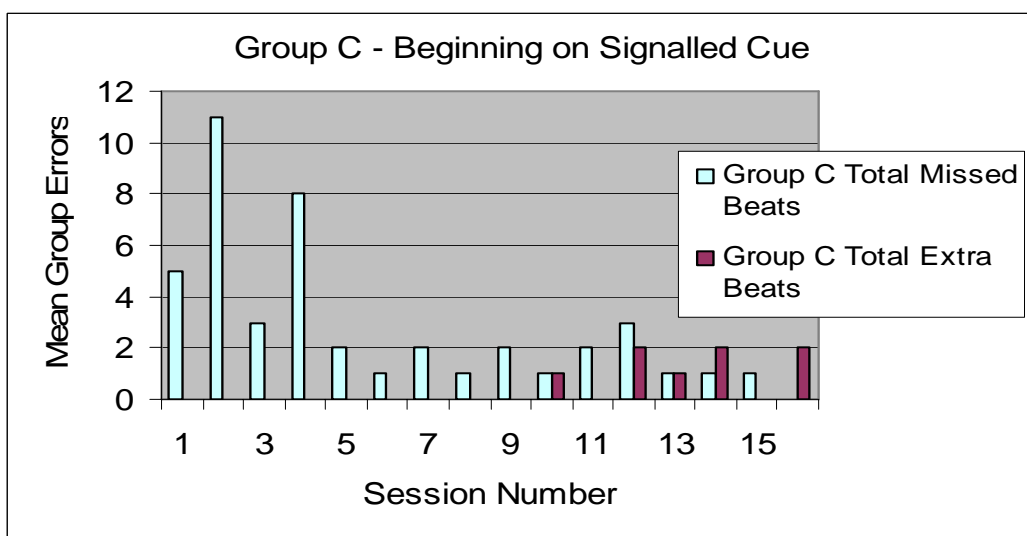


Figure 17 – Group C, Beginning on Signalled Cue

f. Conners' Parent and Teacher Report Forms – Other Relevant Findings

The Conners' Parent Rating Scale and the Conners' Teachers Rating Scale scores were very different at baseline. Using Spearman's Rank Order, significant correlations were found on the Social Problems subscales only ($r=.620$, $p=.024$).

Graphs representing mean scores for all students in treatment across all subscales are presented in Appendix 10. Parent scores generally indicated no change or deteriorating scores, while teachers reported almost consistent continuing improvement across all subscales.

The most pertinent Conners' results, i.e. those that relate directly to impulsivity, have been presented previously. The following paragraphs present findings which are significant or nearing significance and which relate to other subscales i.e. 'CPA/CTA' Oppositional, 'CPB/CTB' Cognitive Problems, 'CPD/CTD' Anxious/Shy, 'CPI/CTJ' Emotional Lability, 'CPK/CTK' Conners' Global Index, 'CPL/CTL' Inattentive, 'CPN/CTN' DSM1V Total.

Correlations Between Conners' and STT Scores: Because of the contrasting reports from Residential Social Workers and Teachers, several significant correlations found on one version were negative on the other. Information on significant correlations between Conners' data and STT error numbers is included only where the Conners' findings were significant. Significant positive correlations show that the direction of the scores on each measure is similar and implies a possible relationship between the measures.

i. Oppositional Subscale

On the 'Oppositional' subscale RSW's recorded very little change over time. Teacher baseline and Phase 2 scores, however, (see Figure 18), show Group A gradually deteriorating, Groups B and C improving, and the group differences were nearing significance ($p=.053$).

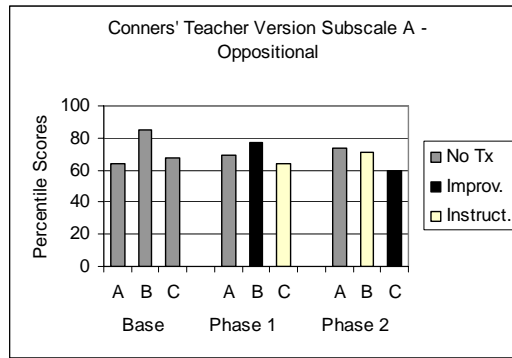


Figure 18 – Conners’ Oppositional Subscale (Teacher Version)

ii. Cognitive Problems Subscale

On the Cognitive Problems scale, RSW’s reported ‘improvement’ in Group A and ‘deterioration’ in both treatment groups B and C (see Figure 19).

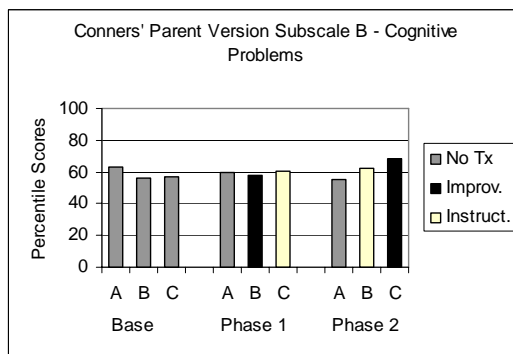


Figure 19 – Cognitive Problems (Parent)

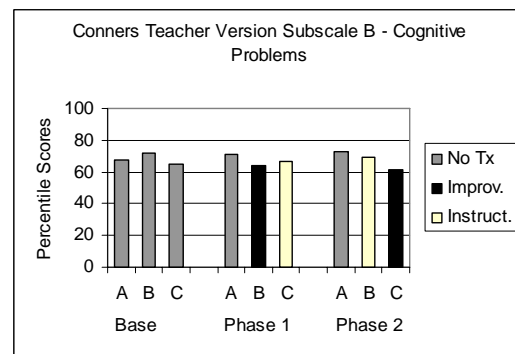


Figure 20 – Cognitive Problems (Teacher)

While there were no differences between groups following Phase 1, their scores indicate highly significant group differences between Phase 1 and Phase 2 ($p=.006$) with Group A continuing to improve, and Groups B and particularly C deteriorating (see Table 17). The difference between groups when comparing Baseline and Phase 2 was, naturally, again highly significant ($p=.001$) (see Table 18).

Table 17 – Conners’ Cognitive Problems Subscale (Parent Version, Phase 1 vs Phase 2)

Group	Phase	Means
A	Phase 1	59.40
	Phase 2	55.20
B	Phase 1	58.25
	Phase 2	62.50
C	Phase 1	60.25
	Phase 2	68.00

Table 18 – Conners’ Cognitive Problems Subscale (Parent Version, Baseline / Phase 2)

Group	Phase	Means
A	Baseline	62.80
	Phase 2	55.20
B	Baseline	56.50
	Phase 2	62.50
C	Baseline	57.25
	Phase 2	68.00

Teachers, however, gave a contrasting report, particularly for Group B (improvisation treatment) following Phase 1. They record an *improvement* in Group B when comparing baseline and Phase 1, and the difference between groups at this stage, according to teacher data, was also highly significant ($p=.008$) (see Figure 20 above, and means Table 19 below).

Table 19 – Conners’ Cognitive Problems Subscale (Teacher Version, Baseline vs Ph 1)

Group	Phase	Means
A	Baseline	67.80
	Phase 1	71.20
B	Baseline	72.00
	Phase 1	64.25
C	Baseline	64.50
	Phase 1	66.75

iii. Anxious/Shy Subscale

In Phase 1, RSW’s reported a decrease in anxious/shy behaviours for Group B during their improvisation period and an increase for Group C who were completing the instructional sessions. At the end of Phase 2, the RSWs recorded an increase in anxious/shy behaviours for Group B following their instructional sessions (see Figure 21), and the difference between groups across Phase 2 was significant ($p=.021$).

Teachers agreed with the RSW's Phase 1 evaluation. They recorded higher scores for Group A (controls) and slightly higher scores for Group C (who had completed the instructional programme), but a decrease for Group B (who had completed the improvisation programme) at the end of Phase 1 (see Figure 22). Group differences were significant at that stage ($p=.010$) and also when baseline data is compared with Phase 2 data ($p=.044$). In Phase 2 teachers reported no change in anxious/shy behaviours for Group B during their instructional programme, and a decrease for Group C as they completed their improvisation sessions. So overall, teachers reported no change in anxious/shy behaviours for Group A, improvement for Group B, and a slight increase for Group C.

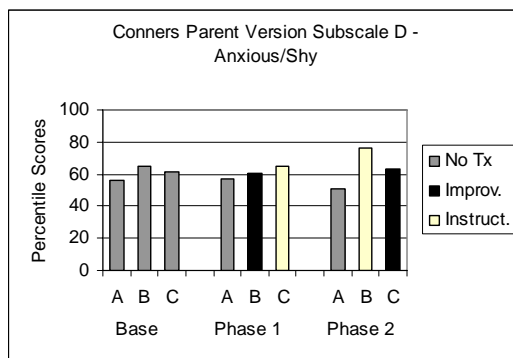


Figure 21 – Anxious-Shy Subscale (Parent)

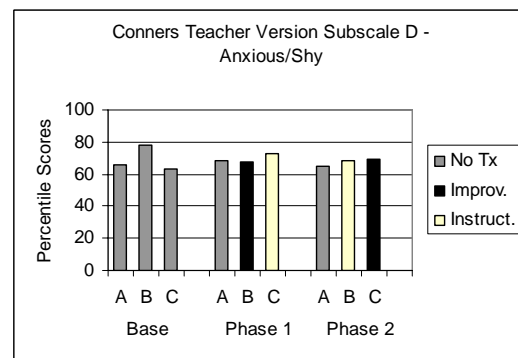


Figure 22 – Anxious-Shy Subscale (Teacher)

The Anxious/Shy subscale was the only one post baseline in which RSW and teacher data significantly correlated, and this only during Phase 1 of the study ($r=.650$, $p=.016$). Data from teacher version had a positive correlation with error number scores at 75bpm in Phase 1 ($r=.617$, $p=.025$).

iv. Psychosomatic Subscale

Subscale G, which only applies to parent version, records psychosomatic symptoms (see Figure 23). Following the first phase of treatment, RSW's reported that Group A students had an increase of symptoms while Group B, who had completed improvisation treatment, had fewer, and Group C were much the same. At this stage, the group differences were nearing significance ($p=.053$), and following Phase 2 of treatment the scores had reversed, leading again to

significant group differences ($p=.022$). There were no overall groups differences between baseline and Phase 2 results.

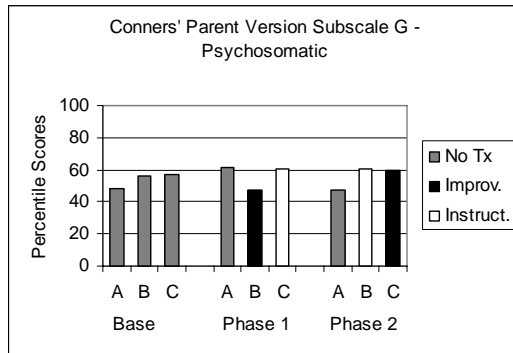


Figure 23 – Psychosomatic Subscale (Parent)

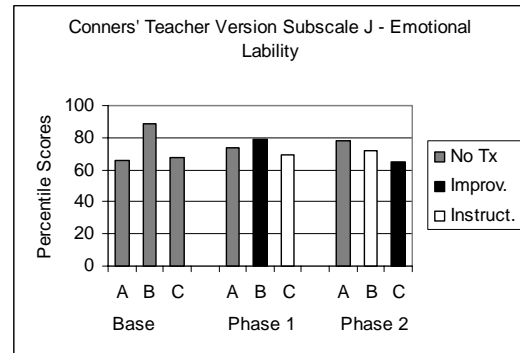


Figure 24 – Emotional Lability (Teacher)

v. Emotional Lability Subscale

On the Emotional Lability subscale there were no significant differences in groups over time, according to parent report. Teachers, however, reported significant group differences ($p=.036$) comparing baseline with Phase 1, with Group A (controls) deteriorating, Group B (improvisation programme) improving, and Group C (instructional programme) remaining much the same (see Figure 24). When baseline data was compared with Phase 2 results, group differences were also significant ($p=.018$). Data from the teacher version significantly correlated with error numbers at 75bpm at baseline ($r=.560$, $p=.046$).

vi. Inattentive Subscale

Phase 1 and Phase 2 data from RSW's revealed significant group differences, with Group A improving, Group B remaining stable, and Group C deteriorating ($p=.018$) (see Figure 25). Comparing baseline and Phase 2 data revealed group differences almost reaching significance ($p=.065$).

Teachers, however, recorded deterioration in Group A's attending behaviour in Phase 1 and improvement in both Groups B and C ($p=.079$) (see Figure 26). No other group differences were found.

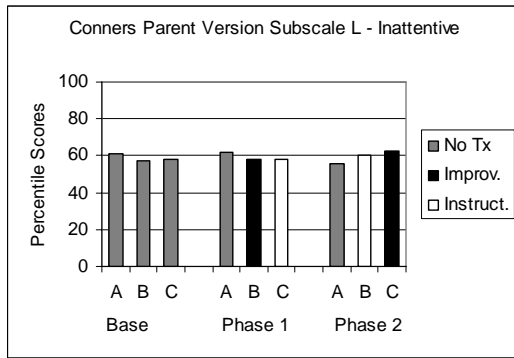


Figure 25 – Inattentive Subscale (Parent)

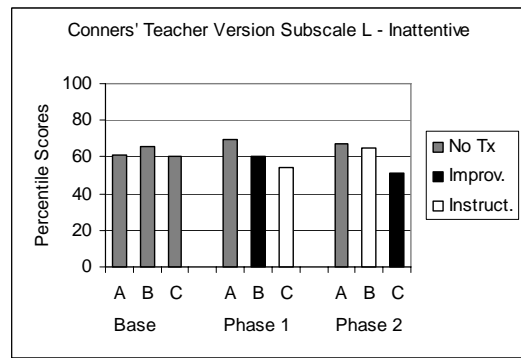


Figure 26 – Inattentive Subscale (Teacher)

vii. DSM-IV Total Subscale

RSW's scores revealed no significant group differences on the DSM-IV Total subscale.

However, teacher baseline and Phase 2 scores led to group differences ($p=.019$) as scores for Group A increased and both Groups B and C decreased (see Figure 27).

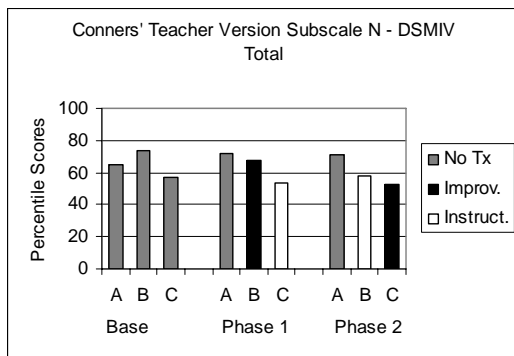


Figure 27 – DSM-IV Subscale (Teacher)

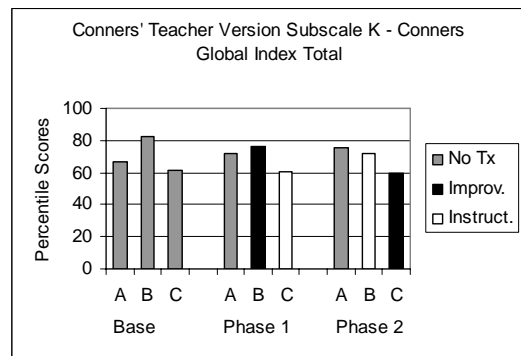


Figure 28 – Global Index Total Subscale (Teacher)

viii. Conners' Global Index Total Subscale

RSW's scores did not change significantly on the Conners' Global Index subscale. On the teacher version of this subscale, however, there were group differences between baseline and Phase 2 data ($p=.031$), with Group A scores increasing, Group B decreasing, and Group C remaining stable (see Figure 28).

g. Effects of Medication

Students continued to take medications during the period of the study. However, because the testing was undertaken early in the morning, the slow-release medication might not have taken complete effect at the time of testing. It therefore seemed possible that there might be differences between the STT scores of students who were taking Ritalin 10mg four-hourly, and those who were on Slow Release 20mg daily. Analysis at baseline determined that there were no significant differences between the scores of the students who took Ritalin 10mg (r) and those who were on slow release (SR). However, there were some interesting variations.

Firstly, over combined speeds, while the students on regular medication showed limited improvement over baseline, the scores for the students who were on slow release were stable. Secondly, students on slow-release medication made more errors than those on regular medication, particularly at the *faster* speed (see Table 20 and Figure 29).

Table 20 – Mean Error Numbers and Error Times – Medication Effects

	EN40	EN75	ET40	ET75
Regular Meds	22.70	15.05	0.112	0.059
Slow Release M.	23.07	20.49	0.108	0.078

Similarly students on slow release medication made *larger* errors than those on regular medication at the faster speed (see Table 20 and Figure 30). At 75bpm, they recorded a mean ET of 78ms against a mean ET of 59ms for students on regular medication. However, there was very little difference between medication groups at 40bpm (SR=108ms vs. r=112ms).

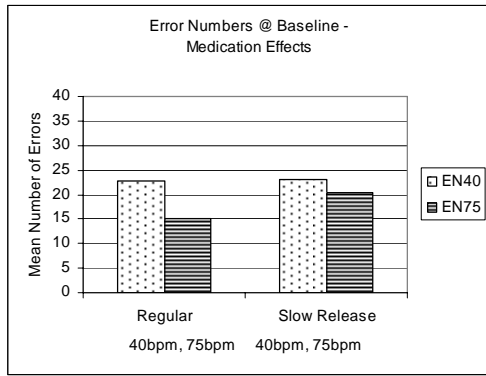


Figure 29 – EN, Baseline, Med Effects

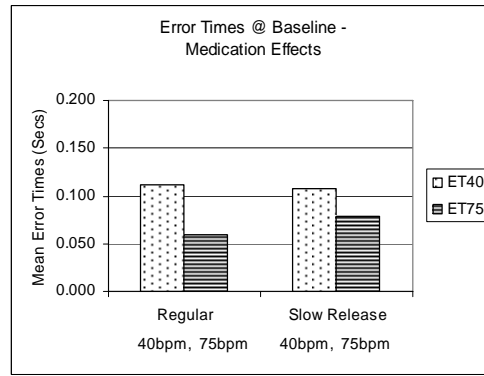


Figure 30 – ET, Baseline, Med. Effects

Significant correlations were found between the STT error numbers at 75bpm for students on slow-release medications and several of the Conners’ Parent subscales: Oppositional $r=.786$ ($p=.036$), Restless/Impulsive $r=.786$ ($p=.036$), Emotional Lability $r=.741$ ($p=.057$), Conners’ Global Index $r=.929$ ($p=.003$), and Hyperactive Impulsive $r=.821$ ($p=.023$).

4. Group Dynamics

The information for the following table was obtained from session notes and video data. A full description of sessions can be found in Appendix 11. Tables 21 and 22 provide a summary of the therapist’s session notes and are included as an illustration of group process, to add to the clinical picture of students already provided in this study. It is not a comprehensive qualitative research analysis.

Both groups underwent a process that reflected gradual improvement in their abilities to listen, to attend and to engage in group activities. Musical growth was especially apparent, and it was evident that during music-making the students were able to sustain higher levels of attention, concentration and self control than they could maintain between activities.

There were also considerable differences in the way the groups progressed. This is likely to be due to personalities of individual group members, the collective levels of restlessness, hyperactivity and impulsivity of the group, and the order of the two contrasting music therapy treatments.

Table 21 – Themes from Music Therapy Group Work, Phase I

	<u>Group B</u>	<u>Group C</u>
<u>Phase 1</u> Sessions 1 & 2	<u>Improvisation – Students were:</u> <ul style="list-style-type: none"> • Uncertain, looking for support • Focusing on louder, larger instruments 	<u>Instructional – Students were:</u> <ul style="list-style-type: none"> • Declaring the activities boring and stupid • One student refusing to participate but taking a passive interest
3 & 4	<ul style="list-style-type: none"> • Egocentric musically, not playing as a group • Needing musical form, e.g. blues, to provide containment • Finding containment in improvised song • Beginning to listen • Developing an appreciation for lighter/softer sounds • Recognising and responding to structure in musical form • Developing interest and enthusiasm 	<ul style="list-style-type: none"> • Supporting and encouraging peers
5 & 6	<ul style="list-style-type: none"> • Still reluctant to take risks • Becoming cohesive musically • Providing support to peers • Developing motivation for improvement and group success • Initiating (risk taking) • Negotiating 	<ul style="list-style-type: none"> • Enthusiastic • Creative • Developing good listening skills • Developing self control • Continuing to have limited confidence in own abilities • Demonstrating mutual respect and appreciation for group members
7 & 8	<ul style="list-style-type: none"> • Demonstrating tendency to lapses in self control • Anxious • Unsettled • Dealing with closure issues 	<ul style="list-style-type: none"> • Demonstrating mastery and pride

Table 22 - Themes from Music Therapy Group Work, Phase II

	<u>Instructional</u>	<u>Improvisation</u>
<u>Phase 2</u> 9 & 10	<ul style="list-style-type: none"> • Possibly influenced by external events • Back in a ‘cycle of chaos’ (Anxiety leading to resistance/avoidance to musical chaos, leaving no space for peers which leads to anxiety....) • Unable to see the ‘whole’ – cannot imagine that they can learn to play a short rhythmic ensemble as a group 	<ul style="list-style-type: none"> • Creative • Enthusiastic • Cooperative • Expressive • Using vocal sounds • Coping with silence • Able to establish steady beat as a group • Creating group soundscapes that are expressive, and without firm rhythmic grounding • Recognising and responding to appropriate opportunities for closure in an improvisation
11 & 12	<ul style="list-style-type: none"> • Beginning to engage • Continuing to demonstrate some resistance with verbal protests; requesting improvisation sessions 	<ul style="list-style-type: none"> • Enjoying humour • Strongly affected by absence of group ‘leader’. • Anxious and needing more support and musical containment from therapist • Using dynamics expressively

13 & 14	<ul style="list-style-type: none"> • Concentration developing • Becoming more cooperative <p>Continuing to develop concentration but attention span is still considerably shorter than what they were able to achieve during improvisation phase</p> <ul style="list-style-type: none"> • Beginning to see the whole rather than the parts • Developing enthusiasm • Aware of and exploring dynamic possibilities in music with changes in tempo and volume • Continuing to request opportunities for improvisation 	<ul style="list-style-type: none"> • Improvising without a theme • Active and disorganised <i>between</i> music activities • Continuing to use vocals • Enthusiastic • Communicating in music - 'leader' tries to regain leadership position with strong playing; musical assertion • Affected by the music – it holds and settles the group • Developing confidence and trust • Communicating in music – call and response; initiation and imitation; effective changes in dynamics and tempo; alternating soloing and supporting roles; waiting (long pauses or passages of rest); using eye contact and facial expression to communicate during improvisation
15 & 16	<ul style="list-style-type: none"> • Developing high levels of motivation to achieve specific goal • Willing to rehearse repetitively • Anxious regarding performance but supporting each other • Developing musical expression and freedom • Demonstrating high levels of self control while playing music, but not able to maintain the same levels between activities • Task mastery, pleasure and pride • Anxious during closing session • Deflated and unsure • Despite chaotic moments, able to contain themselves in music-making 	<ul style="list-style-type: none"> • Engaging in banter between activities – therapist is mindful of vulnerability and need to add additional support when things go 'over the top' • Musically playful • Gaining pleasure from watching and listening to peers making music • Musically independent from therapist – group does not need musical grounding • Still unable, or see no need, to describe the work verbally • Establishing group commitment • Communicating musically – able to express feelings musically and to influence affect states musically • Accepting of self and others • Beginning to link music experiences with verbal debriefing • Having difficulty with closure • Demonstrating an increase in negativity and provocative behaviours • More active and restless • Making loud, energetic, arrhythmic music which becomes cohesive only to return to chaos. Repetitive cycles. • Able to bring music to powerful closure, finishing with loud cymbal crash, affirming "this is us!"

Group C, beginning with the instructional approach settled to structured tasks and were fully engaged, supporting and encouraging peers after 2-3 sessions of structured music therapy. They were quickly able to gain confidence, were enthusiastic about music-making, keen to rehearse and learn new skills and demonstrated pride in their achievements. Further, they were demonstrating mutual respect and appreciation for other group members, as well as pride in their own work. Their transition to a programme of improvised music-making was immediately successful. They were confident enough to use their voices, to tolerate periods of silence, and to include humour in their musical interactions. They became musically independent and were able to improvise without support from the music therapist. Further, the depth of their musical communication appeared to lead to more personal connections and they were able to express and alter feeling states through music-making.

Group B, who began with the improvisational approach, appeared to be more anxious and looking for support and direction during the course of these sessions. They began in an egocentric way, playing for themselves, unable to engage musically with peers. Although they did demonstrate an improvement in listening skill, and an interest in making music as a group, they continued to need high levels of musical containment and support from the therapist. Even after musical cohesion developed and anxiety appeared to be reducing, they still appeared vulnerable to disintegration, especially between activities. The change to the more structured approach was difficult for them – anxiety levels were again elevated and they demonstrated resistance to the introduced activities. They could not conceive the ‘finished product’ that they were working on as a group and regularly wanted to return to the ‘instant reward’ that improvised music can afford. By the end of the programme, they had developed considerable concentration skills, were cooperating well with peers and demonstrated enthusiasm for the activities. They did not appear, however, to develop the same level of musical-emotional connection that Group C were able to achieve.

a. Within-Session Measures

A graph representing within-session observations of students' restless, impulsive and inattentive behaviours has been presented in figure 31. Note that this method of data collection did not begin until session three of Phase 1.

It is clear that Group B, who completed improvisation treatment in Phase 1, were less on task during this period than Group C. The scores are congruent with overall RSW and teacher Connors' reports, which generally show Group B as having more difficult behaviours than Group C. Despite demonstrating different levels of ADHD symptoms, the two groups often mirrored each other in terms of having a 'good day' or 'bad day'. Also of note is the contrast in consistency of behaviour between Phase 1 (Term 3) and Phase 2 (Term 4 of the school year).

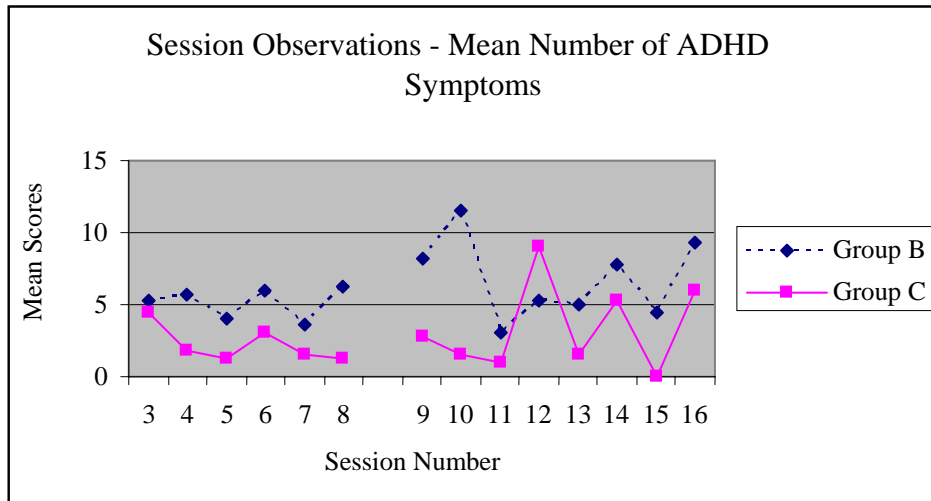


Figure 31 – Session Observations – Mean Number of ADHD Symptoms

DISCUSSION

Both the hypotheses in this study have been supported. There was no statistical difference, on either of the measures used in this study, between the impact of instructional and improvisational music therapy approaches on the level of motor impulsivity displayed by adolescent boys who have Attention Deficit Hyperactivity Disorder (ADHD). Students who were involved in music therapy programmes, regardless of whether an instructional or improvisational approach was employed, significantly improved in their ability to synchronise tapping to a steady beat.

1. Synchronised Tapping Task

There was no difference between treatment groups in the level of improvement across the phases. That is, the relative levels of improvement were similar for each group, regardless of the treatment approach or the order in which they were presented. Group B, who had improved following improvisational sessions, continued to improve following their instructional sessions. Similarly, Group C, who began with the instructional approach followed by improvisation, also improved across both phases. However, although significance was not reached, both groups reduced scores marginally more during the instructional phase of their music therapy treatment. The implications of this for clinical practice will be discussed with other findings in more detail in later paragraphs.

2. Conners' Restless-Impulsive and Hyperactive-Impulsive Subscales

The RSW (Parent) Conners' scores suggest that students who had music therapy remained as impulsive, or became slightly more so, during the period of the study, while teachers reported some improvement, particularly for the more impulsive group. The gains for both groups were made during their instructional programmes. The teacher report is congruent with the STT results, which also show a slightly greater improvement following the instructional treatment.

It appears at first glance that it would not be feasible to determine an association between the within-session presentation of students and their behaviour in class or villa settings with any degree of certainty, due to the variability between Connors' Parent and Teacher reports. However, it is likely that the teachers are in a more direct position to observe impulsive behaviours, such as calling out or grabbing at peer's equipment in class, and to note whether a student has difficulty waiting for his turn in structured group work. Toplak et al. (2003) found that teacher report of adolescents' inattention and hyperactivity-impulsivity predicted performance on time perception measures. They suggested that "Either teacher observations captured the difficulties in motoric behaviours such as calling out in class or jumping out of a seat, *or* the more general types of motoric difficulties described in ADHD samples" (p.900). They posited that motoric difficulties might be more obvious to teachers than to carers because of the need for students to manage a structured classroom environment for extended periods of time.

Further, because the music group has more in common with classroom experiences, it is logical that any change might initially be noticed by teachers. Barkley (1998) predicted that skills learnt in small groups might generalise to other settings in due course, and it is possible that the music therapy did contribute to a small reduction in classroom motor impulsivity, especially for Group B. However the change reported by teachers is not statistically significant and therefore no firm conclusions can be drawn. Nevertheless, there might be some implications for clinical practice when these results are considered alongside other findings.

On the other hand, despite significantly improving STT scores, and report of increasing self-control in music-making, restlessness and impulsivity did not decrease, according to the music therapist's within-session measures. Although Group C maintained a low level of hyperactivity, restlessness and impulsivity during Phase 1, the behaviour of both groups during music therapy in Phase 2 was variable.

The Phase 1 session observations for Group C provide support for a gradual increase in attending behaviour, and a decrease in the already low levels of

restlessness and impulsivity within the music therapy setting for these students. The steady within-session improvement could have been due to the containment that structure and direction provides, rather than a change in the students' ability to control their own behaviour. Restless and impulsive behaviour 'contained' in one setting might be temporarily held, and expressed in other environments. It would seem that if it is possible to provide external controls in a small music group setting that can assist the students to monitor and improve their restlessness and impulsivity, then ongoing rehearsal of those skills might lead to eventual internalisation and thus to improved self control in classroom and villa settings.

Further, the restless, hyperactive and impulsive behaviours observed during sessions occurred predominantly *between* musical experiences. Therefore, the suggestion that students do not have sufficient resources to maintain attention and concentration over extended periods still holds weight – after giving full attention to the musical experience, the students could not continue to contain their restless and impulsive behaviours between activities and without musical support.

3. Interpretation

The significant improvement these students made on the STT trials and the insignificant change on the Conners' Restless-Impulsive and Hyperactive-Impulsive subscales signify the possibility that the STT, particularly with speeds combined, is not a unique measure of impulsivity. Perhaps the results were confounded by the lack of impulsivity displayed by Group C who collectively had very little room for improvement, a research phenomenon known as the 'floor effect'. On the other hand, Group B was regarded by RSW's and teachers as the more impulsive group and this is congruent with other findings from this study. Specifically, Group B

- a. Made more premature responses than Group C on the STT tasks.
- b. Were much more likely to initiate the STT task before the cue to begin.
- c. Were recorded to be more restless and impulsive within-sessions.

During the course of the study, students in Group B improved in their ability to begin the STT trials on cue and to maintain accuracy throughout. However, although they were able to reduce the overall number of errors they were making, the percentage of 'early' responses *increased* in Phase 2. So the questions are; if students were able to improve so dramatically on the STT tasks,

- a. Why are the changes not reflected in the Conners' Restless-Impulsive and Hyperactive-Impulsive and within-session measures?
- b. Why did the percentage of early responses increase during Phase 2?

The following paragraphs will consider possibilities that other factors, especially attention and general cognitive ability, influenced STT scores.

4. Attending Behaviour and the Inattention Subscales

Dramatically reducing error numbers alongside a simultaneous *increase* in percentage of premature responses suggests that the improvement related predominantly to late responses. This in turn proposes that the decreasing error numbers are more likely to be due to an increase in attending behaviour than a reduction in impulsivity. Further, at 40bpm the students made approximately equal numbers of premature and late responses on the STT. The difference between Group C's scores at contrasting speeds was statistically significant as they were *more* likely to be late at the slower speed, and early at 75bpm. This also suggests that at the slower speed at least, impulsivity is not the sole reason for error. When doing the STT at 40bpm, the students were likely to look around the room, to begin to interact with the therapist, or to develop their own diversional or strategic tactic, such as counting the number of taps in the test as they did the task.

There could be several reasons why it might have been more difficult for these students to do the slower task. They might be seeking more stimulation by looking away during periods of delay (Douglas, 1999), and have difficulty allocating adequate attention and filtering competing stimuli (Douglas, 1999) or lack the energy required for the task (Sergeant, Oosterlaan and van der Meere, 1999). The students might have been averse to the slower STT task because it involved an element of waiting (albeit 1.5 seconds only!) and the test took longer (48 seconds

in total compared to 25.6 seconds!). Further, Douglas (1999) alerted us to the likelihood that children who have ADHD are most likely to show distractibility on tasks which could be described as difficult or boring. While it is possible that the music therapy improved students' auditory attention and discrimination skills and thus contributed to improved scores on the STT, all of the above factors are likely to have had an influence on their scores at the slower speed.

However, teachers did report an increase in attending behaviour for both treatment groups during Phase 1, and *continued* improvement for Group C during Phase 2 when they had improvisation sessions. Between group differences were nearing significance. In contrast, the RSW's noted that in Phase 2, students from Group C were significantly *more* inattentive in the residential environment, during the time they were involved in improvisation sessions. If these students were demonstrating improved attention and concentration within music therapy sessions as indicated by the STT data, and in class settings as recorded by teachers, perhaps when they got home they were not able to maintain such high levels of attention to task. The teacher report of an increase in inattention for Group B during the second phase might also suggest that students cannot *sustain* increases in concentration. Despite appearing to struggle with the change of treatment approach, this group continued to make significant gains on the STT, so it seems likely that they were putting considerable effort into music-making and the testing task. They might have put all their energy into the music sessions and were then unable to maintain that same level of attention in the classroom.

Prior to the commencement of the study, it was anticipated that a slightly higher number of errors might be found in the 40bpm data. Previous research has shown that children who have ADHD are likely to have more difficulty judging the longer time interval between beats, and might not be able to attend to the overall longer time span of the task, and/or might act impulsively. Students did make more errors at the slower speed. Smith et al. (2002) suggest that the point at which working memory becomes important in timing tasks is in the region of 1-3 seconds, while Ivy (1996, in Toplak et al., 2003) offers a more precise estimate of 2 seconds. This study does not aim to clarify this point, but anecdotal evidence gathered while watching the students undertake the tasks, and data from the STT,

tentatively suggest that while the STT test at 75bpm might have been an adequate measure of impulsivity, the test at 40bpm (1.5 secs) was challenging for the students in terms of their ability to sustain attention and possibly a much wider range of cognitive skills.

5. General Cognitive Ability and the Conners' Cognitive Subscale

Failure to control for IQ is a limitation of this study, since it is possible that scores on the STT might be associated with general cognitive functioning. Toplak et al. (2003) found that the scores relating to reproduced time estimation tasks from adolescents who have ADHD was associated with reports of Full-scale IQ. This highlights the cognitive requirements of the task and the link with general cognitive ability. Moreover, the researcher in this current study was alerted to the possibility that IQ might influence students' ability to achieve accuracy on the STT when a student who had a moderate intellectual disability had to be excluded from the study because he did not understand the task.

However, neither the time-estimation task used by Toplak et al. nor the STT used in this current study require the understanding of numbers or adult time concepts, as many of the tests of temporal competence do. Although the countdown in the introduction to the STT did use visual numbering to reinforce the auditory cue to begin, the task overall could be considered to be within the capabilities of students who have mild intellectual disability. Nevertheless, an improvement in general cognitive functioning might have contributed to the significant reduction in error numbers on the STT.

Teachers did report an improvement on the cognitive subscales of the Conners' for treatment groups following their improvisation sessions. In Phase 1, the improvement for Group B was highly significant when compared to no change in Group C and the deteriorating scores for control Group A. Some of the work produced in the improvisation sessions elicited immense concentration and commitment from students. It is possible that the music therapy sessions helped these students to attend to a task in class and to maintain concentration over time.

Conversely, the reports from RSW's indicate that students who were having music therapy deteriorated cognitively during both phases, but particularly during Phase 2. When compared with controls, these students were significantly *worse*. It is important to note, however, that the questions on the cognitive subscale relate to class activity and homework. The students are not given homework at this school, and so residential staff would need to obtain this information from the teachers in order to fill out the Conners' forms accurately. The disparity between teacher and RSW accounts on this subscale raises questions about the accuracy of the RSW reporting.

During the initial stages of the study, all students declared that the test at the faster speed was more fun and easier to do. It is interesting that as the study progressed and scores improved, at least two of the students changed their minds about which speed they preferred for the STT. One of them stated that he preferred it slow "when I'm in a bad mood. I can concentrate more. When I'm tired I have more time to concentrate". It appears that this student had an insight into his affective state and is possibly aware that he can attend more readily when his body tires and slows down. Another stated, "the slow one is easier now; it gives me time to think". This is an important statement given the high level of agreement in the literature that children who have ADHD tend to make a rapid response without consideration for accuracy. It suggests that this student might have experienced a major cognitive shift during the period of the study. It also provides an indication that these particular students appeared to be developing an appreciation of the need to reflect and possibly to develop an internal speech strategy in order to complete the slower task successfully.

On the other hand, one student, on one of the days when he was noted to be particularly restless and impulsive, stated that the STT at 40bpm "feels very slow (sic. today)". This statement tends to lend support to the suggestion that children who have ADHD might seek further stimulation in order to increase chronically low arousal levels (Seargeant, Oosterlaan & van der Meere, 1999; Zentall & Zentall, 1983 in Sonuga-Barke et al., 1994) – if the world *feels* very slow, moving rapidly might have a neutralising effect on the child's distorted perception of time.

6. Findings from Other Conners' Subscales

Teacher data reported significant differences between group on both Conners' DSM-IV Total and Conners' Global Index Total Subscales. While controls showed slight deterioration, Group B improved over both phases of treatment. Group C showed an improvement in DSM-IV symptoms during the first phase of the study, when they were involved in the instructional sessions. The ten questions on the DSM-IV Total subscale explore restless, impulsive, inattentive and emotional behaviours, while the Conners' Global Index has eighteen questions which explore the above areas as well as a range of questions relating to cognitive function. A significant improvement for Group B on these subscales is a valuable finding, because the discovery reinforces the suggestion that music therapy might have contributed to improvement in several domains for the students who displayed higher levels of ADHD symptomology. As suggested earlier, because Group C scores were closer to clinical cut-off, i.e. almost within normal range, it would be much harder to demonstrate change at least in the short term.

Teachers reported a reduction in oppositional behaviour in both treatment groups over both phases, which was very near to significance. There is a possibility that developing positive group skills, including awareness of and respect for others, turn-taking, cooperation etc., and engaging in positive activity with peers contributed to a reduction in oppositional behaviour in the classroom.

Teachers and RSW's agreed that Group B were less anxious during their improvisational programme and that Group C were more anxious when they were having the instructional treatment. However, although RSW's also detected a considerable increase in anxiety for Group B during *their* instructional period, teachers did not detect any changes in the classroom. According to teacher scores, group differences at the end of the study were significant: there was no overall change for Group A, 'improvement' for Group B and an increase in anxious-shy behaviours for Group C.

The Conners' results do suggest that students might become more anxious when faced with an instructional programme, and within-session observations of Group B support this. They had particular difficulty responding to a structured programme following the freedom of the improvisation sessions, and they appeared to rebel against the music therapy approach that was 'imposed' on them. It is difficult to interpret the reported increase in anxiety for Group C during the instructional period, when they were doing so well within-sessions. However, it is conceivable that they might have experienced an increase in anxiety during the initial stages of Phase 1 due to apprehension regarding their ability to successfully complete set tasks.

Children and adolescents who have ADHD have a propensity to increases in anxiety, following a history of real or perceived repeated failure, and the general stress of the final term at this school is known to contribute to elevated levels of anxiety for the majority of the students. Perhaps the relatively consistent approach used in music and classroom settings did provide some reassurance for Group B during the fourth term, and closure anxiety was more manifest in the residential villa settings.

Although none of the students had a diagnosable Anxiety Disorder, it is clear from the Conners data that some of them did experience high levels of anxiety. Tannock (1998) suggests that stimulant medication might not be as effective in improving working memory in the more anxious children with ADHD. It is logical, therefore, to assume that anxiety might have contributed to higher error numbers for all students at 40bpm, since at this slower speed it is more likely that working memory is employed.

In this author's previous study (Rickson, 2001), which aimed to encourage students' creativity and autonomy, teachers recorded an increase in anxiety for all three groups while in music therapy treatment, and it seemed that movement between settings which have different levels of structure might be anxiety-producing for this population. On the other hand, in the current study, a reduction in anxiety following the *less* highly structured improvisation sessions was

recorded by teachers. Nevertheless, the possibility that music therapy could sometimes highlight students' anxieties might be deserving of future study.

The RSWs reported a reduction in psychosomatic symptoms for Group B during their improvisational treatment which was nearing significance. The symptoms returned during the instructional period and might possibly be related to the 'performance anxiety' suggested earlier. There was no change for Group C during either of the treatment periods, so it is possible that the music therapy had little influence on psychosomatic symptoms. On the other hand, there were also significant reductions in emotional lability reported by teachers for Group B during their improvisation stage, so perhaps for this group at least, the opportunities for self-expression in a music environment enabled a reduction of pathological expression in other environments.

Teachers reported that the emotional lability continued to reduce for Group B during their instructional treatment phase, and although it seems that the students might have been more anxious at this time, it is still possible that musical expression was able to help reduce the emotional lability. Group C had a very slight increase in emotional lability during their instructional period and a reduction while engaging in improvisational music therapy. If an association with musical expression were to be accepted, this order is logical as the improvisatory approach aimed to draw extensively on creativity, aesthetics and the emotional impact of the music itself.

7. Reliability of Conners' Data

Steps were taken to eliminate experimenter bias with the Conners' forms by asking RSWs and teachers to complete the forms in full, thereby 'hiding' the most relevant items. However, some of the staff were aware of the precise aims of the study because they had directly requested the information. Regardless, these are professionals who are trained in taking objective observations, and confounding of the data due to experimenter bias is unlikely.

However, during the course of the study two of the students changed residential villas. This means the RSWs who were their key workers, also changed. Similarly, two other students had classroom changes and their teachers therefore changed. These factors in themselves can seriously confound a small study such as this, as the changes can have a big impact on the students' functioning. A further difficulty as far as the study is concerned, was the change of staff filling out the forms. Staff do have different perceptions of individual students, and might interpret behaviours differently. One teacher commented that she had no problem with a student since he had been moved to her class, although he had been seen to be highly disruptive before the move. The student might have demonstrated much improved behaviour in a different environment - the teacher's style of working may have suited him better, their personalities may have been more compatible, peer interaction may have been more satisfactory - or she might have had a higher tolerance for his disruptive behaviour.

8. The Synchronised Tapping Task as a Dependent Variable

The literature review for this study determined general agreement among ADHD researchers that there is a link between impaired timing and impulsive behaviour. It seems that children who are impulsive are usually unable to keep a steady beat or to tap consistently on STTs. However, in the author's best knowledge, this is the first time the STT has been used as an independent variable in a music therapy study. Initial plans to measure beat in a musical context (perhaps using video data) were passed over for the computerised STT in order to achieve maximum accuracy in data collection. Further, using a test that is familiar to other researchers investigating timing in ADHD enhances the possibility of establishing links with colleagues in other related fields. The results of the study have provided convincing evidence that music therapy can assist boys who have ADHD to improve performance on STT. However, support for the relationship between this skill and motor impulsivity is less persuasive. Accuracy in a task of this nature also involves attending, time estimation, planning, organising and physically producing the response. The Conners' results described in earlier paragraphs suggest that development in a number of areas might have contributed to the

significant improvement students were able to make over successive STT trials, especially at the slower speed of 40bpm.

However, at the faster speed on the STT trials, i.e. at 75bpm, more evidence of impulsivity, i.e. a higher number of premature responses, was found. This is contrary to the evidence in the literature which suggests that children who have ADHD have a tendency to under-produce intervals as the duration *increases* (Toplak et al., 2003). However, the time-estimation task used in Toplak et al.'s study (albeit a reproduction task) *is* a different measure to the STT, and it is possible that the different finding could be related to the repetitive tapping requirement in the STT. No recent ADHD literature describing the use of the STT as a dependent variable was found, although investigations are currently underway (Tannock, R., personal communication Dec. 2003).

As mentioned previously, during the initial stages of the study, all students declared the test at the faster speed to be more fun and easier to do. At 75bpm, little or no short-term memory is required to perform the task (Barkley, 1998; Toplak et al. 2003) and it is possible to do it 'automatically' using reflexive rhythmic skills. And yet students made a higher number of premature errors at the faster speed. This might have been predicted by Barkley, Murphy and Bush (2001), who suggested that children who have ADHD have difficulty withholding an automatic response, and Stevens, Stover and Backus (1970), who found that children who have impulsivity tap faster than normal controls in a free tapping task. Suggestions that children who have ADHD have a tendency to respond increasingly early to intervals of *longer* duration (as in a slower STT) might apply only when 'speed threshold' for employing working memory has been reached.

Rubia et al. (2003) and Smith et al. observe that this population do not consider alternatives or consequences. Perhaps the STT at 75bpm seemed easier because there *was* no time to think. At that speed the students' may have felt 'excused' from the need to reflect and that they had permission to 'just go!' It is also possible they were seeking further stimulation, perhaps, as Sergeant, Oosterlaan and van der Meere (1999) have suggested, in an attempt to increase chronically low arousal levels. While it is also possible that 'normal' children might also

prefer the faster speed and make similar premature responses, the preference of the ADHD students was certainly predictable given the nature of their difficulties.

At times, particularly later in the study, some of the students were observed to draw on their inherent musicality in order to do the STT task. They were noted to engage in other activity such as making vocal sounds with the taps, or rhythmic activity such as tapping feet simultaneously while continuing with the task. This suggests an improvement in auditory attention and integration. On the other hand, while the ability to attend is likely to impact on students' ability to do the task at either speed, at 75bpm the students' difficulty in controlling impulsive motoric responses does appear to have been highlighted.

It is important to note that the analysis for 'early' (premature response) or 'late' (late response) 'beats' cannot be strictly accurate. If a response was so late that it was closer to the next 'beat' (i.e. the computer sound) it was classed as a premature response³. Similarly if a response was so early it was closer to the previous beat (i.e. the computer sound) it would be classed as an extra beat or late beat. While the analysis might therefore not be exact, it is at least balanced.

9. Students' Ability to Self Correct

When observing the students undertaking the tests, it was possible to detect the difficulties many had with self-correcting. Although they frequently appeared unaware that they were tapping out of time, at other times they did seem aware that errors were being made, and became frustrated that they were unable to adjust their timing. Even so, they did not think to stop tapping in order to prepare a more accurate response. This finding is congruent with suggestions that children who have ADHD are likely to be unaware of how to correct errors, do not slow down after making mistakes (Barkley 1998) and are unable to adjust their speed (Rubia et al., 2003). Two students, in particular, would also comment at the completion of the task that they were aware of errors, or thought they had "done bad". However, examination of individual data and observations of the students doing

³ See diagram on page 35 for clarification.

the STT test also suggest that at least two of the individual students improved in their ability to self-correct during the period of the study.

10. Motor Coordination

The students' general inability to begin on cue is of interest. While explanations for 'impulsive' responding have been posited, some of the students were also consistently *late* responding to the cue to begin the test. While inattention might seem an obvious reason, clinical observations of the students preparing for the task are not consistent with this explanation. They appeared to be concentrating hard, anxious to 'get it right', and this in itself may have had the opposite effect – an increase in anxiety is likely to lead to an increase in errors.

An alternative explanation is that the students' difficulties with *motor coordination* played a part in their inability to begin on cue. In psychological terms, the STT is a repetitive time-reproduction task i.e. the computer produces a durational interval and the student is asked to reproduce that interval 32 times. It involves motor timing, i.e. the students are required to adjust their motor response to synchronise with the computer sounds.

The presentation of the students in this study was congruent with research findings which suggests that children who have ADHD are likely to have difficulty with estimation of time periods (Rubia et al., 1999; Smith et al., 2002; Toplak et al., 2003) as well as in preparing a motor response (Rubia et al., 1999; Zahn, Druesi & Rapoport, 1991), and the execution of that response (Carte, Nigg & Hinshaw, 1996). Toplak et al. (2003) also argue that working memory might inevitably play a role in tasks where cognitive requirement and motor coordination must be integrated.

Further, it is possible that students' difficulty in beginning the task could be related to their poor risk-taking skills. While hesitation to begin contrasts with the impulsivity usually noted with this population, delayed response time does also appear to be related to timing deficits in ADHD (Douglas, 1999). The current study is not designed to differentiate these aspects of the task.

An attempt was made to minimise the variables relating to motor skills by enabling students to access the programme with a single switch rather than the computer space bar. However, on two occasions, students did not operate the switch properly, pushing weight into it instead of allowing it to return to an up position in order to reactivate it. The therapist was watching the switch activation carefully during testing and asked the students to repeat the test if they had responded to the stimulus but not activated the switch properly. This may have influenced these individuals' scores for one particular test, because they had, in theory, had the opportunity to rehearse the task immediately prior to testing.

11. Error Times

Although the primary measure in this study was the number of errors students made on the STT, the *size* of those errors was also measured in order to detect changes in scores outside the tolerance range.

Students who made consistent but small errors in the early tests would have high error numbers but small error times. As they improved on the STT the *number of errors* they made would reduce, but they would not be making a large reduction in error *times*. In contrast, students who had large error *times* might improve significantly without showing any reduction in error *numbers*. It is useful to know if students did reduce the size of their errors even if they did not go below tolerance levels. Conversely, if the size of the errors was becoming larger, i.e. students got worse over the period of the study, this would not be reflected in the error number data either.

Between Phases 1 & 2, there was no significant difference in students' error *number* scores, but there was a significant improvement in error *time* scores. This indicates that at least one student was decreasing the size of his large errors, but did not improve to below error-tolerance levels.

Error times at 75bpm changed little in Phase 2 despite the significant reduction in error numbers across both phases for the treatment groups. It seems that the

majority of the students were able to improve on smaller errors, reducing them below the tolerance level and therefore eliminating them from the error count. The errors they did continue to make were a similar (small) size, and therefore, the mean error time measure showed minimal change. Note that while error times may seem very minimal, a tolerance for error of .1 and .19 secs has already been built into the equation.

In a small study such as this, the data can be examined for individual differences and is therefore clinically useful. It would not be possible to distinguish between the mean error time scores of a student who has a consistent pattern of moderate errors, and another who generally makes small errors but has a tendency to make sudden large 'impulsive' errors, unless ET (Error Time) scores are compared with EN (Error Number) scores.

12. Practice Effect

The results of the current study may have been confounded by a 'practice effect'. This suggestion implies that frequent repetition of the STT may have enabled the students to improve, regardless of the music therapy intervention. The inclusion of a control group of ADHD students in the design was helpful in this regard. At the slower speed the students did significantly reduce error times over the baseline period. However, the control group scores did not improve during the course of the study and this is a strong indication that the music therapy intervention contributed to improvement in the treatment groups.

Nevertheless, the control group had no more than four days (eight tests) in a block of trials in one fortnight, while the treatment groups did the block of trials at baseline and following that were tested weekly. It is possible that continuing and regular periods of testing contributed to the improvement in the treatment groups' scores. Moreover, the control group might not have had the motivation to apply themselves fully to the task. The treatment group possibly saw the STT trials as the beginning and end of a pleasurable music therapy session and had the incentive to apply themselves to the task. The 'reward' of a music therapy programme at the completion of the study was no incentive for control group

students who have ADHD and require immediate reinforcement. This may have contributed to the lack of improvement in their STT scores.

13. Pre-test sensitisation

Pre-test sensitisation can be a confounding influence in some studies. The experience of being tested prior to treatment can change the way the students experience the treatment. In this particular study the concept of pre-test sensitisation would imply that having done the tapping task, the students might experience the music therapy differently. It is possible that there was a two-way influence as students developed the cognitive resources to cope with involvement in music-making and to successfully undertake the STT. That is, although the tapping task is not considered to be a musical experience, there are similarities between the dependent and independent variables that may have led to mutual improvement in both skill areas.

14. Motivation and Reward

The students' motivation to be in the music groups is likely to have contributed appreciably to their overall marked improvement on the STT task. Music is an ideal medium in which to work with children and adolescents who have ADHD because it offers immediate reward. Once initial connections were made, the students in both treatment groups had broken the 'cycle of chaos' in which the behaviours of group members tend to overstimulate others and perpetual confusion reigns. Once engaged, the music held them because it was instantly rewarding, and they were able to experience an 'alternative cycle' of attending and learning, which was also perpetually reinforcing. McInerney and Kerns (2003) cautioned that a child who has ADHD might appear to have more severe deficits than is actually the case if motivation is not taken into account. This was reinforced by this study. The students' presentation before and after music activities was very different from their presentation during music-making.

Furthermore, although they might have perceived the repetitive nature of the task as boring and taking a long time, especially at the slower speed, students very

rarely objected to having to do the STT trials. In reality, the testing procedure was relatively quick and this is likely to have helped them to cope with the ongoing trials. They were willing and even eager at times to engage in the STT, and several of them tried to be early to a session to be 'first' to do the test. Although waiting was hard for them, they rarely interrupted a peer who was doing a test and no boy ever complained of another 'putting him off'.

No contingent rewards were offered for undertaking the STT, but the students were given sweets at the completion of baseline testing. Students were also given an object (a stress ball, soft toy, or plasticine) to hold while they were waiting for peers to complete the tests, were allowed to keep some plasticine at the end of Phase 1, and were given a can of coke and sweets at the end of Phase 2. The majority of the students did not expect or demand external rewards, although they might ask if they could keep the objects that they had been playing with while waiting for their test. It seemed that involvement in music sessions provided the immediate reward that these students coveted.

Occasionally, a student would try to resist doing the slower speed test first. Tossing a coin to determine whether each student would begin with 40bpm or 75bpm resolved this and also added appeal to the process. The students appeared interested in their peers' responses and attitudes towards the test and would make frequent, usually positive or enquiring, comments to a peer about their performance. The computer screen was used to offer reinforcement with the "Great Work" message. This appeared at the completion of every trial and was not contingent on performance, but the students did appear to take pleasure in seeing it.

The equipment used to test the students, the computer and the adapted switch, appeared to be perceived as 'cool gear', similar to the play station and computer games that are very familiar to them. Two of the students from each group occasionally asked to see their scores following the tests, and as the analyses were completed, those who requested to see them had the results explained to them. These students seemed genuinely motivated to improve their scores, again possibly because they saw some similarities with the play station games. So it

seemed, overall, that students did not lack motivation to do the STT task, and significantly improving scores reinforce this suggestion.

15. Arousal

The primary motivation for undertaking this piece of research was to determine whether a particular music therapy approach was more appropriate for group work with adolescents who have ADHD. Specifically, the study aimed to determine whether students' levels of arousal differed between instructional and improvisational music therapy approaches. Before-and-after-session STT testing was therefore done to ascertain whether students were less accurate on the task *following* sessions, possibly because of excessive stimulation.

Errors following sessions were significantly higher than those prior to music therapy. At first glance it appears that students were significantly over-aroused by both the treatment approaches used in the study. However, dramatic differences were also evident for the control group, who were sent back to class between tests. Despite consistently significant differences in 'before' and 'after' scores for all students throughout the study, there were no differences between the three groups, i.e. the control and two treatment groups. This strongly implies that an alternative variable affected the scores. The highest likelihood is that scores were influenced by students' motivation for the task.

Although previous paragraphs have argued that students demonstrated relatively high levels of motivation for music-making and the STT tasks, it is highly likely that motivation for testing *after* the sessions was appreciably reduced. Because the testing took place in the music room, students were able to view all the equipment and were motivated to finish the 'first part of the session', the STT, so they could get on with the music-making. In other words, they were able to anticipate a relatively immediate 'reward', for undertaking the STT task. Following the session, there was no such motivation. They had 'been there and done that' and were ready to go back to class.

This argument might not fully explain the increase in 'after' scores for the control group. However, given the ostensible deficits in time perception experienced by these students, it is possible that they had similar experiences to the treatment group. When they entered the room, they might have been reminded that they were 'going to have music sessions'. They would possibly have little or no understanding of 'when' they would have music. Coming back for a second test on the same day could possibly have served as a reminder that they '*didn't* have music'. Their motivation for the task might therefore be reduced in a similar way to the treatment groups.

Testing took place at 9.00am when students first arrived at school, so it is also possible that they were more settled at that time and became more aroused by the general school environment as the day went on. Although highly trained and experienced staff at the school strive to provide an optimal learning environment, the students all have particular intellectual, social and emotional needs, and it is probable that their interpersonal interactions do lead to progressively higher levels of excitation as the day goes on.

This argument conflicts with the suggestion that those on slow-release medication are more likely to experience gradual benefits from the medication and therefore perform at optimal level around mid-morning. Given that five out of thirteen students were on slow-release medication, the general school environment would have to be highly stimulating to produce such a dramatic change in students' performance on the STT in the one-hour period between trials. Nevertheless, it may have been a contributing factor.

The general school programmes in the fourth term are less structured than the first three, therefore providing less 'containment'. This is likely to have contributed in some way to overall heightened arousal in students, and might also help to explain why during this period some deteriorating behaviour was indicated by some of the Conners' measures, as well as within-session scores.

Alternatively, a higher error rate on second trials could also be the result of students being 'interrupted' during class activity so that they could come back to

the music room for their second test. Sudden interruptions could be disturbing for them and might contribute to higher scores on second trials. If this argument were accepted as a reason for control Group A's increased error, then it is possible that treatment Groups A and B's scores *were* worse because they were over-aroused by the music therapy sessions. It is important to note, though, that despite the scores being consistently worse following sessions, there is clearly a positive carryover effect, which is much *greater* than the temporary deterioration. Besides, some generalisation to classroom behaviour has been suggested, so it seems that some temporary arousal might be acceptable.

16. Ethical Issues

The suggestion that students assigned to the control group in this study did not understand the implications of 'delayed treatment' raises an ethical concern. Despite being offered careful and thorough explanations in language appropriate to their developmental levels, at least one of the students was unable (because of a deficit which is central to the research itself) to understand the time frames involved. Despite regular involvement in STT trials, that particular student asked the therapist on more than one occasion when the "music thing, you know the one we signed the paper for" would start.

'Educated' consent is necessary - 'informed' consent does not always address the ethical concerns it is intended to cover. This finding also reinforces the importance of obtaining informed consent from carers, particularly for vulnerable populations.

17. Treatment Protocol and Integrity

The music therapy plans were carefully considered to ensure that the two treatments that were the independent variables in this study were appropriate for this particular client group, congruent with the music therapist's usual ways of working and acceptable to the school in which the treatment was taking place. Consideration also had to be given to the necessity of consistently differentiating and maintaining the two treatments throughout the period of the study.

However, music therapy *is* client centred and therapists by their very nature will respond to the needs of a client in the moment. Human science is not exact and the two treatments cannot always be clearly delineated in clinical practice. This researcher found, as did Merle-Fishman and Marcus (1982) that it was necessary very occasionally to increase involvement and to give more support and direction during the improvisational sessions. As well, clinical notes do record at least two occasions when the therapist was aware that the instructional sessions were not as ‘structured’ as she had intended them to be.

This having been said, the therapist *was* supervised by both the research supervisor and her psychotherapy clinical practice supervisor, and every effort was made to maintain research treatment protocol. All sessions were videotaped. The research supervisor was able to recognise very easily, when observing video data or live sessions, which approach was being employed.

18. Medication

Tests for differences between groups with respect to medication also support the idea that the STT at 75bpm measured impulsivity more specifically. Because STT trials were done early in the morning it was anticipated that there might be differences between the scores of students on slow release and those on regular medication, since the four-hourly doses of stimulant medication are fast-acting, while the slow release medication takes longer to reach full effect. Although all students made more errors at the slower speed, it was initially surprising to find that those on slow-release medication made significantly more errors at the faster speed than those on regular medication. However, when considered with other findings, it does suggest that the faster speed generally highlighted more of the ‘impulsive’ symptoms.

For example, there were significant correlations between the 75bpm error number scores from the students on slow release medication and several of the Conners’ Parent subscales - including two of the primary measures for this study, i.e. Restless-Impulsive and Hyperactive-Impulsive subscales. As reported earlier,

Toplak et al. (2003) also found significant associations between the reproduced time estimations of adolescents who have ADHD and reports of inattentive and hyperactive-impulsive behaviour on the Conners' measurement tool. However, there are two major differences between the findings in this current work and the Toplak et al. study. Firstly, the correlations in the current study were with the 'parent' i.e. RSW report, whereas Toplak and colleagues found associations with the teacher report. Secondly, this study found that students appeared to be *underestimating* duration i.e. responding early, whereas the participants in the Toplak et al. study were overestimating shorter durational intervals. Therefore, on an STT trial Toplak et al.'s participants would be predicted to respond late rather than prematurely.

Acceptance of the suggestion that students on slow-release medication made more impulsive errors at 75bpm than those on regular medication, in turn implies that scores for all students would be higher in an unmedicated sample. This is not surprising, given the existing support for stimulant medication as an effective medication for controlling impulsivity (Gadow et al., 1990; Ialongo et al., 1993; Jenson et al., 1999; Kaplan et al., 1990). On the other hand if the STT at 40bpm is measuring, to a certain degree, the students' ability to attend, less-medicated students might be predicted to have higher scores on this measure because of inattention. Perhaps the preliminary evidence to suggest that stimulant medication might have differential effects on children who have specific subtypes of ADHD is relevant. For example, stimulant medication might not be as effective in reducing motoric activity in more aggressive children with ADHD (Matier, Halperin, Sharma et al., 1992, in Tannock, 1998). Given the special nature of the school, it is likely that the students in this study, as a whole, would be classed as a more aggressive ADHD population. So perhaps the medication does assist some of these students more with improving attention than reducing impulsivity.

The small numbers in this current study prevent conclusions being drawn - perhaps those on slow-release were simply more impulsive than those on regular medication. Nevertheless, for the main hypotheses in this study it was helpful that randomisation resulted in the numbers of students on slow release and regular medication being evenly spread among the treatment groups. The medication is

likely overall to have assisted students to reduce levels of within-session impulsivity and improve STT results. However, it is important to stress that this study is not designed to measure the effects of medication.

While research findings provide convincing evidence that stimulant medication is a highly useful treatment in ADHD, there is also strong agreement that simultaneous remedial and/or therapeutic intervention is necessary for these children to continue to develop cognitively, socially and emotionally. From a clinical perspective, it was apparent that the level of improvement achieved by these students would not have been possible without stimulant medication. The medication gave the students the opportunity to *begin* the process of attending and concentrating, developing working memory and internal speech, and the self-control necessary to be part of a group and to engage in successful music-making with peers. Being involved in a music therapy programme then gave the students the opportunity to *develop* these skills.

Occasionally a student would arrive in a hyperactive state and it was immediately obvious that medication had been dispensed late, or the student had failed to take (and hidden) the medication. Because of the small number of students in each group and their tendency to become easily over-aroused, this had a considerable effect on group dynamics. It took a great deal of control for others not to respond to the mood of their peers.

On the other hand, one of the students who had taken a long time to become actively involved in the music therapy sessions, appeared to be much more enthusiastic about music-making and more able to engage in creative expression when his medication had not taken full effect. He requested to have his medication after rather than before music therapy sessions so that he could more easily become fully involved. However, this was not possible for a variety of reasons. The impact of stimulant medication on students' levels of involvement in improvisational therapy programmes might be worthy of further study.

Several of the students had medication changes during the course of the study. This involved one student changing from slow-release tablets to regular dose; one

changing from Methylphenidate to Dexamphetamine (another stimulant); one having a 50% increase in dosage late in Phase 1; and another stopping medication shortly after the study began and its being reintroduced early in Phase 2. Changes in medication and the time of dispensing same are two factors that are also likely to have had an impact on the results of this study.

19. ADHD and Comorbid Diagnoses

Only three of the students in this study had a diagnosis which attempted to differentiate an ADHD subtype. This might have had a confounding influence on the study as students were not screened for clinically significant impulsivity prior to inclusion. The results of the study appear to indicate that Group C collectively, did not present as a highly impulsive group. They might have always been the more 'inattentive type', could have been less impulsive as a result of developmental maturation, or might have had a better response to medication. Researchers have indicated that the presentation of ADHD is likely to change as children get older (Barkley, 1998; Tannock, 1998) and these students might simply have been becoming less impulsive as they moved into adolescence. Not all of the students in Group C displayed the persistent impulsiveness those children with ADHD Combined or Hyperactive-Impulsive subtypes usually present. For instance, one of the students in Group C also had a comorbid diagnosis of Intermittent Explosive Disorder and was prone to sudden and extreme acts of unprovoked violence - not the constant impulsiveness usually evident in ADHD.

The students in this study sample have comorbid diagnoses that reflect the high levels and wide range of conditions that have been found to co-exist with ADHD (Barkley, 1998; DSM-IV, 1994; Tannock, 1998). While coexisting conditions are likely to have a high impact on students' response to treatment, the small number of students eligible for a clinical study of this type makes it unrealistic to control for comorbidity. Nevertheless, Tannock (1998) argues that failure to characterise comorbid conditions adequately may explain inconsistent findings across studies, and stresses the need for clinicians to provide comprehensive assessments that

determine the presence or absence of other disorders so they may be considered in the treatment plan.

20. Group Dynamics and Within-session Measures

The students were relatively easily engaged in group music, and opportunities for rehearsing timing tasks were subtly contained within this culturally acceptable youth context. Students were given the opportunity to learn and practise new skills and behaviours in a supportive and encouraging environment and were able to get important feedback about how their behaviours affected others. The success of the music groups was important, as staff reported that many of these students were rarely able to engage in other types of group activities in the school and residential environments.

The differences in the way the groups progressed could be a result of the individual and collective levels of ADHD symptomology and individual personalities within the group, as well as the order in which the two treatments were introduced. In response to cautions that group work may not be appropriate for children who lack impulse control (uncited quote in Malekoff, 1997) it seems that clearly specifying group goals, establishing firm ground rules, the structure provided by therapist's mode of facilitation and/or the music, and maintaining small group numbers increased the likelihood that the students in this study were able to gain benefits from the music therapy groups.

In contrast to Montello & Coons' (1998) suggestion that active rhythm-based therapy might not be appropriate for adolescents whose need for structure and security is paramount, it appears that being involved in active music-making with a music therapist can hold, contain, and assist them to gain a level of integration that enables improvement on a cognitive task such as the STT. During music sessions, students' self-organisation and the resulting group synchronisation was progressively evident. However, some of the students who demonstrated well-developed musicality and could synchronise their music with that of their peers during music-making sessions, still made a surprising number of errors on STT.

This suggests that instinctive response to musical stimuli can enable perception and production to become automatically synchronised.

The success of group work with students who have ADHD might depend on giving the students time to assimilate what is required of them and to explore different ways of responding - it seems that more than eight sessions of improvisation might be required for some students to benefit from this method. On the other hand, the students in Group C were able to make positive within-session gains when involved in a programme with a high degree of structure followed by a programme of group improvising. Nevertheless, although they appeared to be 'contained' by the music, they were not able to demonstrate the same level of control *between* activities. A longer programme might allow for more generalisations to occur.

21. Order of Treatments

Although the STT results suggest that the order of treatment does not affect the level of change, as both groups improved similarly over both phases, there were differences in the way the groups progressed. As suggested earlier, the personalities of individual group members, the collective levels of restlessness, hyperactivity and impulsivity of the group, and the order of the two contrasting music therapy treatments may have had an impact on group dynamics and therefore confound any discussion regarding the order in which treatments are presented.

On the other hand, small variations in group STT scores between the different treatments signalled that perhaps the instructional programme might be more effective for students collectively. It seems logical, given evidence from previous research (Barkley, 1998) and the group dynamics data from this study, that it might be advantageous to begin with structured treatment. Group C did make more progress in Phase 1 and settled easily to the improvisation during Phase 2. In contrast, even though Group B also made a little more gain during their instructional programme in Phase 2 they appeared to struggle with the change of approach. The continuing progress of both groups during Phase 2 might have been

associated with already established relationships, the treatment they had already had, and/or an ongoing testing effect.

A longer study could reverse treatments yet again to ensure that each group had the opportunity to experience improvisation following an instructional approach, and vice versa, to counterbalance order effects.

22. Number of Treatment Sessions and Length of Programme

The excellent progress the students made on the STT trials is surprising given the brevity of the programme. Even though the groups remained constant over the period of the study, the change of treatment approach at the end of Phase One meant that students were to a certain extent ‘starting over’ by learning to interact in different ways, albeit with group members with whom they had begun to build relationships. Each phase therefore mimicked two music therapy programmes, each of eight sessions.

The group dynamics data suggests that if the treatment approach is to be improvisational, a longer period of treatment, with regular weekly sessions is important for this population. On the other hand, closure issues aside, sixteen sessions did seem to be comfortable for Group C, who began with the instructional approach and moved to an improvisational phase of music therapy. It is important to consider, however, that this group collectively displayed few ADHD symptoms – a more restless and impulsive group would be likely to need a longer period of treatment with regular sessions to achieve their goals.

It took several sessions for students to gain confidence and to begin to build the trusting relationships with the therapist and their peers that enabled them to work effectively with others and to move forward on cognitive goals. The premise that motor impulsivity is related to a specific cognitive dysfunction in ADHD suggests that an improvement in this area, particularly once a student has reached adolescence, is likely to depend on intensive and regular rehearsal of specific tasks.

However, in this residential school setting, particularly in the fourth term during each year, it was unrealistic to attempt a more intense therapy programme. Even though each school term covered a period of ten weeks, it was only possible to offer eight sessions in each phase. Very full timetables ruled out the possibility of ‘making up sessions’ when schedules were disrupted.

23. Normal Controls

The absence of a ‘normal’ control group is a limitation of this study. This study does not attempt to determine how deviant the students’ scores are, and because they continued their medication throughout the study period it is possible that their scores are approaching normal range for children of the same developmental age. However, the study aim was not to use the STT to determine specific levels of impulsivity, but as within-group and between-group comparative measures.

Regardless of *how* high their error rates were, or even whether the responses were premature (i.e. impulsive) or late, given the strong suggestion of a relationship between impaired timing in ADHD and impulsivity (Barkley, 2001; Rubia et al., 1999; Smith et al., 2002), an improvement in scores on the STT was highly desirable. If the skills students developed in order to successfully complete the STT could be maintained over the long term, the positive impact on other developmental domains is likely to be considerable. Any future study would benefit from a follow-up period which measures students’ ability to maintain their ability to sustain a steady beat, i.e. to successfully undertake the STT.

24. Sample Size

The very small sample in this study strongly limits the possibilities of generalising results, as group scores are easily influenced by individual differences and specific events that affect each individual. On the other hand, the number of data points on the STT, the testing at various speeds, the analysis of data from error number and error time perspectives, and the precision of those measures, increases the prospect that other researchers might replicate findings on those aspects of the study. Further, the extensive collection could enable the data for

each of the eight students to be viewed from a single case perspective. This, and the fact that the researcher was fully involved in the study and able to observe the students during their STT trials, in addition to facilitating the music therapy sessions, provides valuable evidence for ongoing individual clinical treatment and education plans.

Response to treatment for this population can be highly contextual and many other factors influence the impact of therapeutic intervention. In a study of this size, individual responses to treatment can highly influence group results. For example, in this study members of Group B were highly influenced by the presence of a creative and enthusiastic student who was able to motivate other students to make the most of the music therapy experience. In a larger sample the impact of an extraordinary group dynamic such as this is likely to have less consequence. On the other hand, in this study there did appear to be a balance of ‘personalities’ in each group which helped to offset individual differences.

25. Implications for Clinical Practice

There were no significant differences between treatments, and therefore no firm conclusions can be drawn from this study. However, the finding that the instructional approach might have had some impact on the level of impulsivity students displayed in the classroom suggests that this might be more appropriate for adolescents who have ADHD, at least in the initial sessions. If the specific goal is to reduce restless, hyperactive or impulsive behaviours, it seems that it would be beneficial to begin with a programme that offers a high level of external containment, i.e. more direct assistance and facilitation for the students.

On the other hand, the results of this study suggest that an improvisational music therapy approach might be more effective in addressing the social and emotional needs of students. The Conners’ data does indicate that during their improvisational programme both groups were less oppositional, less anxious, less emotionally labile and experiencing fewer psychosomatic symptoms. However, it seems likely that a reduction in restless, hyperactive and impulsive behaviours would be necessary in order to realise the full potential for gain in other areas.

The students in this study who transitioned from structure to improvisation did so easily, while the reverse was not so comfortable. This suggests that it would be advantageous to begin with the structured programme, even when working toward social and emotional goals.

In a longer term programme of instructional music activity, group members would learn a variety of instrumental pieces and have more opportunity to express emotion, release energy and gain strategies to help with motor impulse control. In addition, in a longer term programme it is likely that the music therapist would gradually relinquish some of the control to the group members, giving them the opportunity to rehearse different ways of interacting and expressing themselves in music-making.

Beginning with improvisational music therapy has not been discounted by this study, but it seems that a longer period using this approach might be necessary to maximise benefits. Adolescents who have ADHD, like other humans, will seek structure from chaos (and order in music) and eventually 'find the beat' as a group. The therapist might support that intrinsic human drive rather than lead it, and patiently accept that the process might be longer and a little more difficult for adolescents who have ADHD. Rickson (2001) reported that children who had ADHD were not always able to settle and concentrate and perhaps were not able to take full advantage of the potential benefits of the music group. At times during the current study it seemed that a similar conclusion might be drawn. However, the regular and increasing periods of cohesion were evidence that students were making progress. The results of this study do indicate that it is possible for integration and self-control to develop spontaneously in music-making, and for students to make significant progress in their ability to succeed with a synchronised tapping task.

The small group numbers are likely to have contributed to the success of these groups, and it seems that four is a comfortable number for a group of adolescents who have ADHD. However, with such small numbers, individual personalities have more significance and can have considerable impact on group outcomes. For example, dynamics for Group C were strongly affected by the absence and

return of their 'group leader'. This is important because the improvisational music therapy relies more on group process to promote change than the instructional approach does. While the influence of individuals is likely to be fluctuating and to have both positive and negative aspects, evaluations of group dynamics can aid the clinician in determining goals for individuals and timeframes for the overall programme. The descriptions of the students' interpersonal interactions during music therapy sessions reinforces Kraft's (1966) argument that group work in some ways mirrors the adolescent world. The mutual development of interpersonal relationships and musical communication were evident as these students increasingly used their improvisations as an expression of themselves.

Adolescents' social and emotional needs have a huge influence on their ability to take advantage of group therapy programmes. Adolescence is a period of accelerated physical, psychological, and social growth (Malekoff, 1997) and the students' progress needs to be considered within the context of normal adolescent developmental processes. ADHD is related to multiple interacting factors which cannot be understood in isolation (Tannock, 1998). Historical as well as current interactions with family and carers, school and community contribute to the students' abilities to adjust and progress over time.

There may also have been very positive developments for individual students in this study, which are not directly related to the research hypotheses. For example, to develop a sense of belonging would be an important achievement for many students who have ADHD. The impact of a psychosocial background which has left individuals with a sense of failure and isolation can be balanced to a certain extent, as the group works together to achieve positive outcomes for the whole group, as well as individuals within it.

Restless and impulsive behaviour increased between activities, suggesting that verbal instructions should be kept to a minimum, even when using an instructional approach, and that modelling might be more effective in assisting students to develop musical skills. Observations of the students in this study suggest that it is helpful for them to have an experience of what they are working towards, i.e. to

have heard the whole piece, sections of the piece and phrases from the piece played or recorded by other people. Although they still have a tendency to want to go straight to the 'end product' before they begin working on a piece, 'parts' (i.e. musical exercises and phrases) can be modelled and rehearsed in interesting and musical ways.

Findings suggest that students who have ADHD are likely to want to play too rapidly at a fast tempo, and that they might also find slow music less interesting to play. It therefore seems important when beginning work with this population, to give special consideration to the tempo at which music is introduced, and further, to the length of the piece. This would give the adolescents opportunities to grasp the concept of the whole piece, and, if it is short and repetitive, to master it successfully.

The length of each session is an important consideration too, but one that cannot necessarily be determined by the therapist prior to commencement. In this study, 45 minutes was allowed for contact time with students each week. However session length varied from 25 to 45 minutes depending on what the group were able to cope with. Flexibility is crucial.

Time estimation and reproduction difficulties are considered to underlie impulsiveness (Barkley, 1998; Barkley, Murphy, & Bush, 2001; Smith et al., 2002; Toplak et al., 2003). The results of this study therefore suggest that music therapy could play an important role in the remedial treatment of ADHD.

Because both approaches used in this study were successful in assisting students to improve their timing, it might seem logical to encourage children and adolescents to take opportunities to be involved in a variety of school music programmes. However, music therapists are skilled in understanding and communicating with adolescents who have ADHD, in providing the immediacy of musical support and encouragement required during improvisation sessions, and have the spontaneous, eclectic music skills to respond to the variety of experiences that the adolescent might request. They have special training in group work, which includes the ability to recognise what is happening within the

individual and the group, and skills to build and maintain empathic relationships with the adolescents. Further, they take regular supervision to maximise the psychological safety of their clients and themselves. It might be possible for other professionals to facilitate programmes similar to those used in this study, but further research would be required before it would be possible to determine whether similar gains could be made.

26. Future Study

No convincing evidence was found to suggest that music therapy was able to reduce motor impulsivity in students who have ADHD. However, there were some differences between the groups' responses to treatment which suggest that the instructional approach might be slightly more effectively in reducing restless-impulsive behaviours in the classroom. The small sample size might have contributed to the occurrence of a Type II error. A study employing a simple before-and-after (pre and post-treatment) design with a control group might confirm or refute this suggestion. If all 16 sessions were instructional, students might have time to internalise the containment provided by external controls, and to make gains to a level where any treatment effect might become measurable.

Because the findings of this study suggest that the STT at 75bpm might be a more accurate measure of motor impulsivity, testing at 40bpm could be eliminated from future studies. Also, future research might also aim to find more convincing evidence of a relationship between the STT at 75bpmn and motor impulsivity.

The results of this study also suggest that a combination of approaches might be effective in reducing overall symptoms of ADHD in the classroom, and there were also some indications that it might be preferable to begin with the structured approach. Further examination of instructional followed by improvisational programmes is warranted to determine whether the same results can be found in a different, larger if possible, group of boys. Again, a simple 'before-and-after' design might be adequate to confirm or refute the current findings, and if enough participants were available, both of the above studies could be run concurrently, using the same control group.

If it could be determined that an instructional approach led to a reduction in restless-impulsive behaviours and the combined approaches led to a reduction in ADHD symptoms in the classroom, further research might examine whether any specific differential effects of improvisational treatment could be identified. For example, it might be possible to clarify whether a programme of improvisation might contribute to the emotional wellbeing of students who have ADHD.

Future studies would be strengthened if follow-up measures were employed to determine whether any gains could be maintained following a period of no treatment. However, students are unlikely to be highly motivated to take part in STT tasks when no obvious reward is offered, and incentives such as a can of soft drink following each day of testing would probably be necessary. It would also be helpful to know whether students might improve on the STT due to a practice effect, but the lack of intrinsic reward in the task raises ethical concerns about the amount of repetitive testing that would be required simply to clarify this.

The lack of a 'normal' comparative control group for this study means that it is not possible to determine any deviance in the STT scores of the students who have ADHD. However, variability from the norm would only seem to be relevant if scores had *not* improved and the researcher was left wondering whether anticipating a reduction in error numbers was reasonable. The significant reduction in error number scores on the STT alongside a reduction in ADHD symptomology suggests there might be a relationship between the two measures. A larger study might be able to detect more convincing correlations between the STT scores, especially at 75bpm, and specific Conners' subscales.

The benefits of medication during the music therapy sessions were observable. However, one participant suggested that he would prefer to be able to engage in music activities without the support of stimulant medication. A single case study to determine whether medication might affect his levels of involvement in creative activity is possibly warranted. Any convincing differences in a single case study might lead to further investigations into the effect of stimulant medication on creativity.

Several references have been made to the small number of participants in this study and the limits that this places on interpretation and generalising of results. Nevertheless, all students who were eligible were invited to participate in the current study. Given the total school roll, numbers who fit inclusion criteria will always be small. On the other hand, the amount of data collected for each student increased the statistical power of the group study, while the small number of participants also enabled single case examination.

SUMMARY AND CONCLUSION

There was no statistical difference between the impact of instructional and improvisational music therapy approaches on the level of motor impulsivity displayed by adolescent students who have Attention Deficit Hyperactivity Disorder (ADHD) on either of the measures used in this study. However, the results provided some evidence to suggest that an instructional music therapy programme might contribute to a reduction in motor impulsivity in the classroom.

Regardless of whether students were involved in instructional or improvisational music therapy programmes, they significantly improved their ability to synchronise tapping to a steady beat. Improvement on STT was slightly greater during the instructional treatment periods for both groups. During these same periods, again for both groups, teachers reported a small decrease in restless and impulsive behaviours. While there does appear to be some relationship between motor impulsivity and students' STT scores at 75bpm, findings suggest that there are many more skills needed to do the task at 40bpm. Consequently, this test, especially at the slower speed, might not be an adequate measure of impulsivity.

The descriptions of group process suggest that restless and impulsive behaviours were not noted as often during music-making experiences as *between* activities. It seemed that the music 'held' the students and was able to help with internal organisation. There were, however, considerable differences in the way the groups progressed. This is likely to be due to personalities of individual group members, the collective levels of restlessness, hyperactivity and impulsivity of the group, as well as the order of the two contrasting music therapy treatments. Nevertheless, the findings do suggest that it might be advantageous to begin with a more highly-structured approach, and to keep group numbers small.

Although RSW and teacher Connors' reports were generally disparate, the results cautiously imply that skills developed in music therapy programmes might have generalised to the classroom environment. Teachers reported significant improvement for treatment groups on the DSM-IV Total Subscale and improvement nearing significance on the Oppositional subscale. Further, there

are some indications that students were able to improve listening and sustained attention during music therapy sessions, and that these skills also generalised to a certain extent to the classroom environment.

Classroom improvements on five other subscales (Cognitive Problems, Anxious/Shy, Psychosomatic, Emotional Lability and Inattentive) were recorded for each group during their improvisational phase. For Group B, who displayed higher levels of ADHD symptomology, the difference was significant. These findings tentatively suggest that the improvisational treatment had more impact on students' social and emotional development than the instructional approach.

The students generally made more errors, and larger errors, when tested on the STT a second time on the same day, regardless of whether they had been involved in instructional or improvisational music therapy, or had no music therapy treatment. It is possible that students who have ADHD are easily aroused by the general school milieu and classroom or music room interactions with peers. However, it is also likely that they were less motivated to do the synchronised tapping tasks a second time in one day.

Nevertheless, despite significant 'deterioration' post session, gradually decreasing error numbers overall indicated that while students may not have done so well immediately after treatment, the positive carryover effect of treatment, as measured by the STT, was much greater than the temporary deterioration. Further, while the instructional approach appeared to assist in the reduction of restless and impulsive behaviours in the classroom setting, there was no change during the improvisational programme. The study therefore provides very little support for the suggestion that students exhibit over-arousal in the classroom following music therapy treatment.

CONCLUSION

There was no significant difference between the impact of instructional and improvisational music therapy approaches on the motor impulsivity of adolescents who have ADHD. However, while no firm conclusions can be drawn, there are some indications that the instructional approach might have contributed to a reduction of impulsive and restless behaviours in the classroom. During each phase of the study, i.e. with each different approach, both music therapy treatment groups significantly improved accuracy on the STT. Over the whole period of the study, teachers reported a significant reduction in total DSM-IV symptoms. These findings tentatively suggest that 1) a reduction of errors on the STT might be related to improvement in several developmental areas and 2) music therapy might contribute to a reduction in a range of ADHD symptoms in the classroom.

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Information Sheet

Date:

A Comparison Between the Impact of Direct Teaching and Improvisatory Music Therapy Treatment Approaches on the Level of Motor Impulsivity Displayed by Adolescent Boys who have ADHD.

Researcher

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Nash Road,
Halswell,
Christchurch.

Supervisor

Dr Robert Krout,
Music Therapy Programme Leader,
Massey University,
College of Design, Fine Arts, and Music,
Wellington.

Dear.....

My name is Daphne Rickson, and I am the music therapist at Halswell Residential College. I would like to invite to take part in a music therapy research project at school. This research is being undertaken as part of a Master of Music Therapy under the supervision of Dr R. Krout, Music Therapy Programme Leader, Massey University, Wellington.

I am trying to find out whether using direct teaching of rhythm activities is more helpful than improvising music for reducing motor impulsivity with adolescent boys who have ADHD. The rhythm activities will involve practising rhythm exercises with body percussion and other musical instruments. When improvising music, the boys will use musical instruments to create music according to a 'title' chosen for the piece.

From the Halswell Residential College roll, I have selected fifteen boys with a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD), and are taking stimulant medication. The boys who consent to take part will be randomly assigned to three research groups with four students in each group. If more than twelve boys want to be in the study, I will offer some of them music therapy sessions that will not be part of the research project. The boys will have one, two, or three terms of music therapy at school, depending which group they are assigned to. It will be considered to be part of the school programme and will be provided at no cost to the student.

Most of the students will have half hour music sessions each week for two terms, i.e. twenty sessions, and then will be able to choose to have another ten sessions in Term One, 2004. Group A will be different. They will form a waitlist control group and will not be offered music therapy treatment until Term One, 2004, but will still be asked to do a rhythmic test on the same days as Groups B and C. If one music therapy approach is found to be better than the other during phase 1 & 2 of the study, then this is the approach that will be used for Group A.

The boys in Group B will receive ten sessions of improvisation during Term Three followed by ten sessions of direct teaching and modelling during Term Four, 2003. Group C will receive ten sessions of direct teaching and modelling during Term Three, followed by ten sessions of improvisation during Term Four, 2003. After a six-week school holiday break the boys in both these groups will be given the opportunity to be involved in a further ten week programme during which I will use the approach that has been found to be most effective during phases 1 & 2.

School staff will measure the students' behaviour using the Conners' Rating Scales as well as the school points systems, and the sessions will be videoed to measure the boys' ability to keep a steady beat. Other people may be asked to view the videos to ensure the researcher's interpretations are accurate. No material, which could personally identify your child, will be used in any reports on this study. The records will be stored in a secure room at Halswell Residential School during the period of the study, and thereafter, for a period of five years they will be stored securely in Massey University's premises by the Supervisor before being destroyed. If the caregivers of all the boys grant the additional permission, some of the material may be used for music therapy teaching purposes.

It is anticipated that the students will benefit from being involved in a music programme, as I will be working to help them to develop their self-control and communication skills. There is a risk that boys could use the music equipment in hazardous ways. This will be minimised by keeping the group to a small size, and staff will be readily available to assist the music therapist if necessary.

In the unlikely event of a physical injury as a result of participation in this study, your child will be covered by the accident compensation legislation with its limitations. If you have any questions about ACC please feel free to ask me for more information before you agree for your child to take part in the study.

Participation in the research project is entirely voluntary, and your child will be able to withdraw from the research project at any time. The Principal of Halswell Residential School, acting in *loco parentis*, will be responsible for the welfare of students participating in the study and will help them make any decisions relating to the research, including withdrawal from the project.

If you wish to see the results of the study a summary will be provided, but note that the results may not be ready for publication until mid 2004. I will be willing to discuss outcomes relevant to your child during and/or after the study.

This study has been reviewed and approved by the Massey University Human Ethics Committee, WGTN Protocol 03/106. If you have any concerns about the conduct of this research, please contact Dr Pushpa Wood, Chair of Massey University Human Ethics committee: Wellington, telephone 04 801 2794 ext 6723, email P.Wood@massey.ac.nz. If you need more information about the study, please contact me or Graeme Daniel (Principal) at the above address. If you have any queries or concerns about your child's rights as a participant in this study you may wish to contact a Health and Disability Advocate, telephone 0800 11 22 33.

Daphne Rickson, **Researcher**



Consent Form (Parent/Guardian)

A study to compare the impact of two contrasting music therapy treatment approaches (1. Direct Teaching / Modelling, and 2. Improvisation) on the level of motor impulsivity displayed by adolescent boys who have Attention Deficit Hyperactivity Disorder (ADHD).

1. I have read the information sheet dated.....for volunteers taking part in a study to compare the impact of “Direct Teaching and Modelling” with “Improvisation” on the level of motor impulsivity displayed by adolescent boys who have ADHD.
2. I understand that it is my choice to allow my child to take part in this study and that I may withdraw my child from the study at any time.
3. I understand that any information relating to my child’s participation in this study is confidential and that no material that could identify him will be used in any reports on this study.
4. I understand that the investigation will be stopped if it should appear harmful to my child. The Principal of Halswell Residential College, acting in *loco parentis*, will be responsible for the welfare of students participating in the study and will make any decision to withdraw from the study, with and on behalf of the students.
5. I have had time to consider whether my child will take part.
6. I know whom to contact if I have any questions or concerns regarding the study.
7. I understand that the study will be presented by the researcher as a thesis towards the qualification of Master of Music Therapy, Massey University, and may be used at a later stage for music therapy teaching purposes.

Please go to page two (2) to sign consent forms

8. I give consent to my child's music sessions being videotaped
YES / NO
9. I wish to receive a copy of the results of the study
YES / NO
10. I would like the researcher to discuss the outcomes of the study with me
YES / NO
11. I give permission for video data of my child's music therapy sessions to be retained by the researcher for teaching purposes, for a period of time to be at her discretion. I understand that the data will remain in the control of the researcher at all times.
YES / NO

I.....(full name of parent or guardian) hereby give
consent for(full name of student) to take
part in this study.

Signature:.....

Date:.....

Signature of Witness.....

Name of Witness.....

Researcher

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COLLEGE OF DESIGN, FINE ARTS AND MUSIC

Information Sheet For Students

Music Programme to Help with Self-Control

Daphne is going to offer a music programme for some of the boys at Halswell Residential School. She will write a story about the boys and their music and give it to her university teacher to mark. The story may get into a book for other people to read. The story will not have our real names in it.

The story will be about how boys learn to keep a slow, steady beat on a drum. It will also be about how boys who go to music get on with staff and students in class, in the playground or at the villa.

You are being invited to join the music group. Music will be once a week for one, two, or three terms. We will be using the musical instruments each session, but sometimes we will be playing our own made up music and sometimes we will be playing beat and rhythm games.

There is a video camera on the wall in the music room. To help Daphne remember what happened in the music sessions for her story, the video camera will usually be turned on. Daphne will remind you that the video camera is turned on.

You don't have to be in the music programme. You can discuss the music programme with Mr Daniel at any time. He will help you decide if going to music is a good thing for you to do, or if you should stop.

Daphne thinks you will like the music and it will help you to work more slowly when you need to. To make sure that all boys are safe and don't get hurt, Daphne will have another staff member readily available at all times.

The story is for teachers, therapists and doctors. However, your mum, dad, or carer can have a copy of the story if they would like to.

You can take some time to think about being in the music group or not. You can talk to Daphne, or Mr Daniel, and ask questions about the music before you sign this paper. If you would like to be in a music group, please sign the "Consent" page.

Read and explained to(full name of student)

By.....(name of teacher)

Signature.....

Date.....



Consent Form for Students

1. I understand what my teacher has explained to me about being involved in Daphne's music sessions. I know Daphne will write a story about the sessions for other people to read. I have asked any questions that I might have had and I am happy with the answers.
2. I know that I don't have to be in the music sessions and that I can talk to Mr Daniel at any time about pulling out.
3. I know that the music sessions will be videoed sometimes.
4. I know that my real name will not be in the story that Daphne is writing.
5. I know that the music sessions will stop, if anyone is getting hurt.
6. I have had enough time to think about whether to take part in the music sessions.
7. I know I can talk to Daphne or Mr Daniel if I have more questions or I am worried about the music group.

Iwant to be in Daphne's music group.

Student Signature:.....

Date:.....

Project Explained to Student and Signature Witnessed by:

Name:.....

Signature:.....

Date:.....

Appendix 5

ADHD Symptoms Observed During Session No.:.....

Name:

Date:

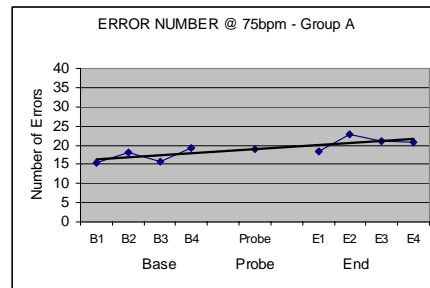
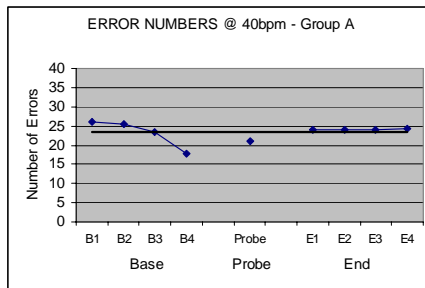
<u>Behaviour Noted</u>	<u>Never</u>	<u>Occasionally</u>	<u>Often</u>	<u>Very Often</u>
Restless/Fidgety				
Moving around room				
Does not appear to be listening to others (speech or music)				
Touching equipment inappropriately				
Blurting out answers before questions are completed				
Can't keep instruments still/quiet between activities or when waiting for turn				

Appendix 6

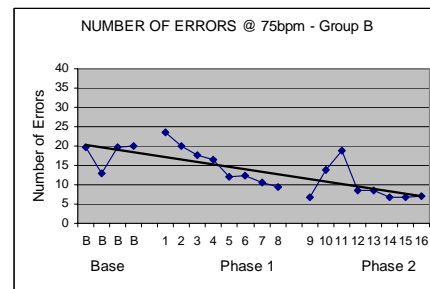
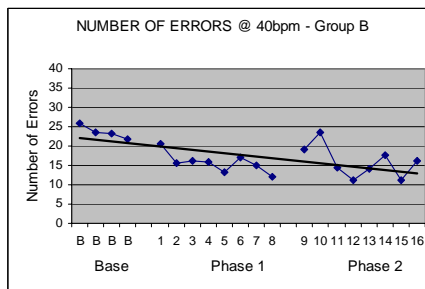
Key to Line Graphs: Line graphs show mean number of errors (or error times) for two tests on each testing day (for Group A this includes four baseline days, one 'probe' day, and four 'end' days; for Groups B & C four baseline days and eight sessions per phase). All graphs include trendlines.

NUMBERS OF ERRORS

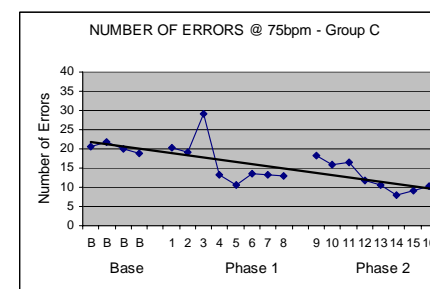
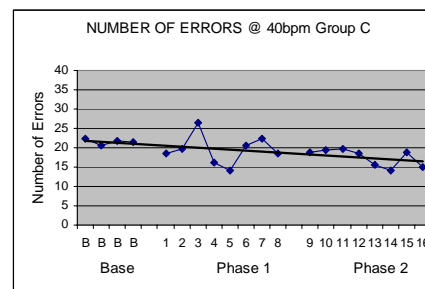
GROUP A



GROUP B



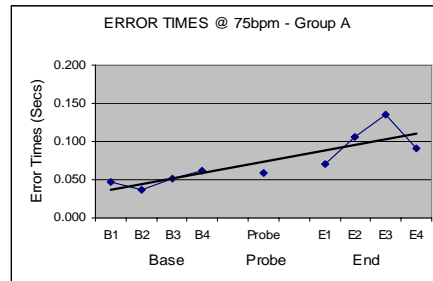
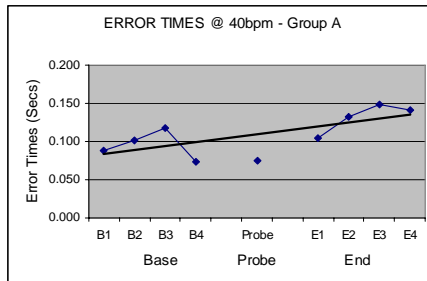
GROUP C



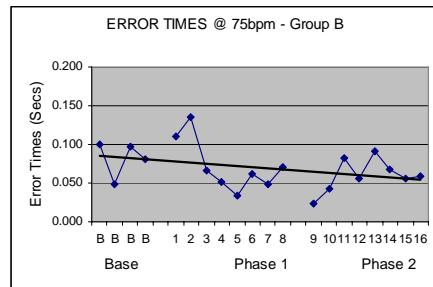
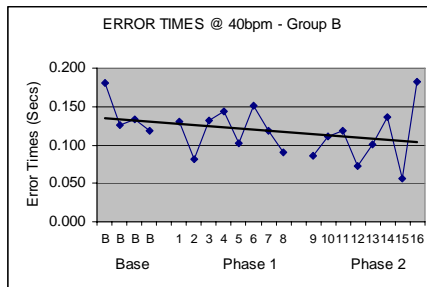
Appendix 7

ERROR TIMES

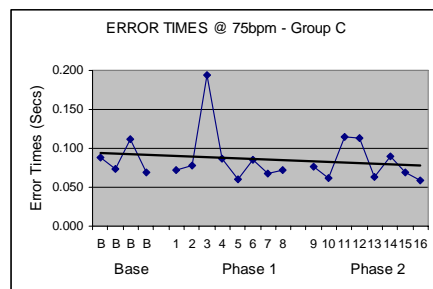
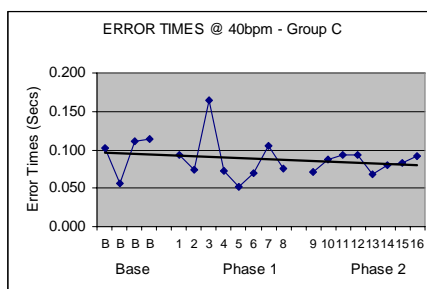
GROUP A



GROUP B



GROUP C

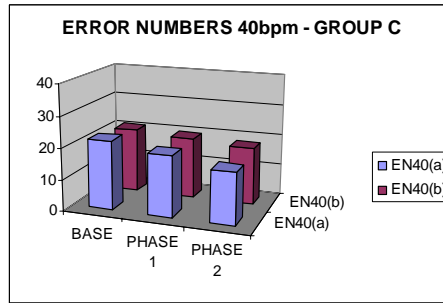
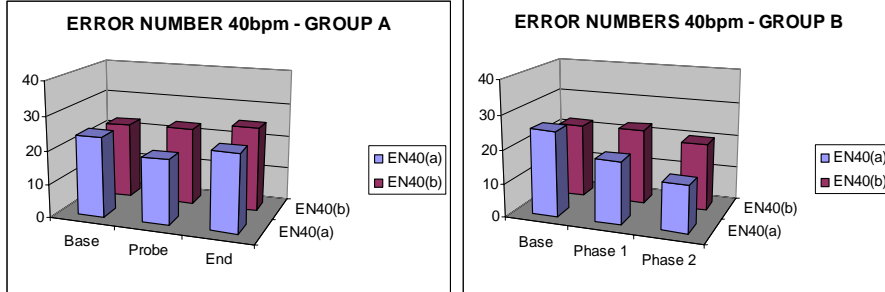


Appendix 8

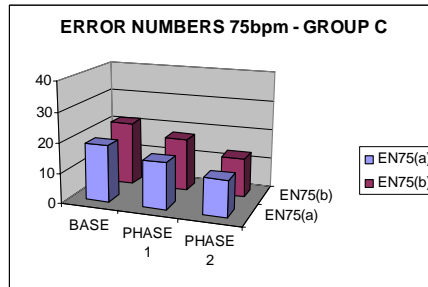
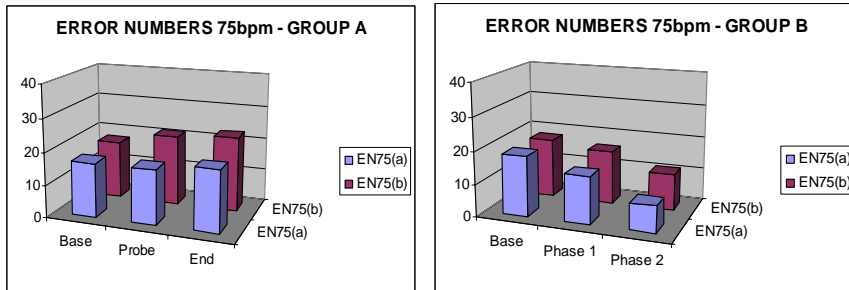
ERROR NUMBERS –

DIFFERENCES BEFORE AND AFTER SESSIONS

ERROR NUMBERS AT 40bpm



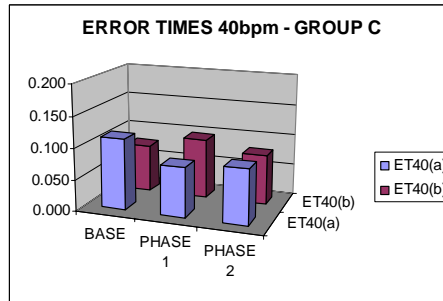
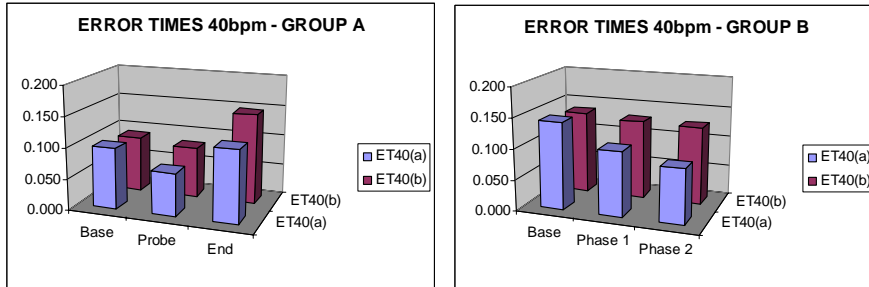
ERROR NUMBERS AT 75bpm



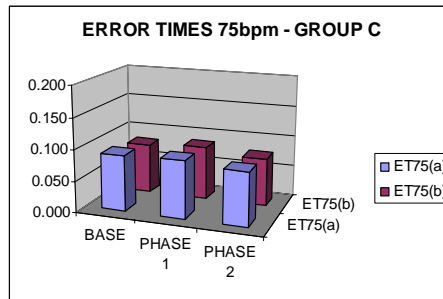
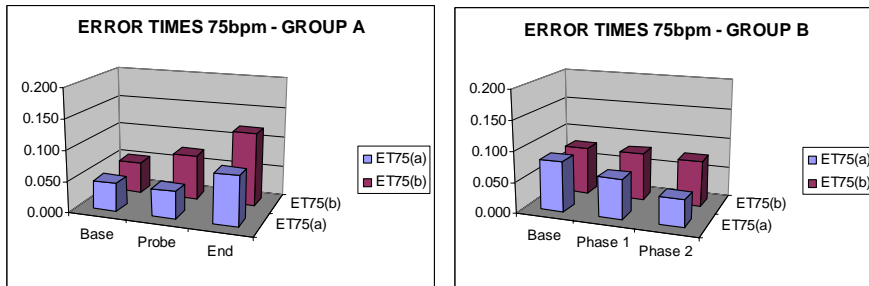
Appendix 9

ERROR TIMES –
DIFFERENCES BEFORE AND AFTER SESSIONS

ERROR TIMES @ 40bpm

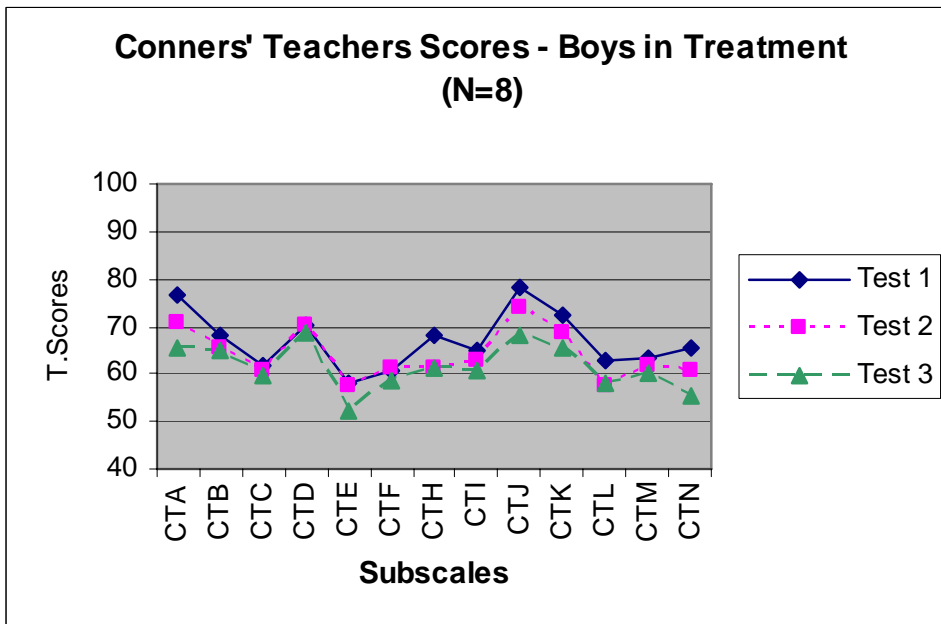
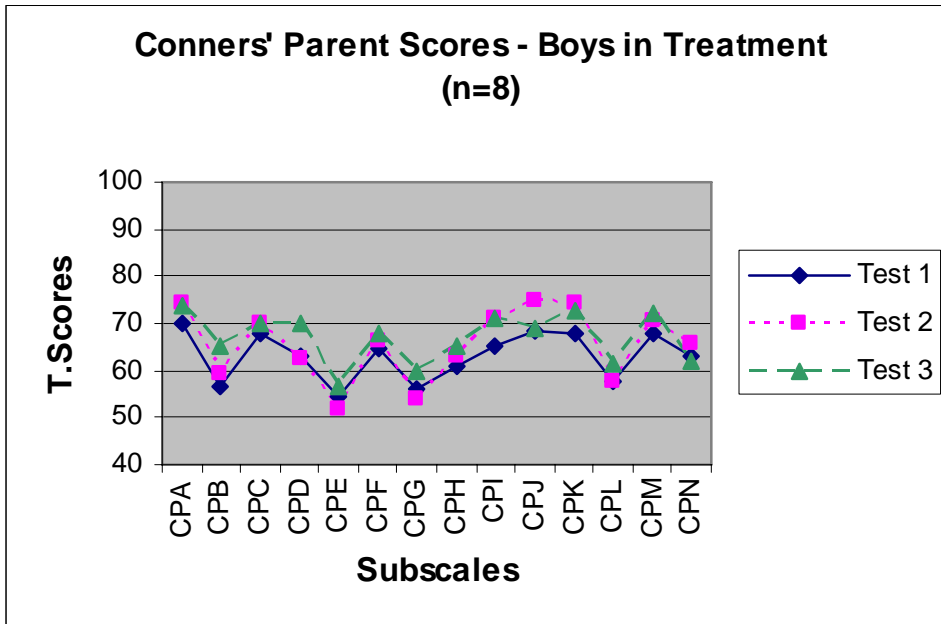


ERROR TIMES @ 75bpm



CONNERS' RATING SCALES – ALL STUDENTS IN TREATMENT

(n=8)



Appendix 11

GROUP DYNAMICS

a. Group B, Term 3 – An Improvisational Approach

Initial sessions included relatively long periods of quiet as boys looked at each other questioningly, seeking to find a leader, plucking up courage to contribute, trying to think of a creative idea for music-making, unable or unwilling to take risks. In contrast, these uncertain periods alternated with loud and chaotic music-making as boys gave way to individual expression. They wanted to use the larger louder instruments and they generally played for themselves, with little reference to the music of their peers. Two of the boys had strong rhythmic patterns that they consistently employed, regardless of what other group members were playing. It was difficult for me, as the facilitator, to believe that these boys would eventually seek structure and order in the music, that they would be looking to find a communal beat, or that they would be able to do this without direct input from me.

Ideas for the improvisation were taken from choice cards and regularly included Blues and Rap styles. The blues form provided encouragement for the boys to listen to others and I observed them beginning to show appreciation for peers' music, especially when we incorporated solo 'spots' into the improvisations.

In week three, when we looked to weekend activities for an idea for an improvisation, one of the boys shared that he had been to the beach and had spoken to Tangaroa, God of the Sea. Taking their lead from me when I picked up the guitar and began to pick quietly, the boys chose instruments that could express the sounds of the ocean. These included the rain stick, pocket shakers and maracas. To provide the musical containment that the boys needed I improvised a simple song on the suggested theme. The boys were ready to recognise and work within musical structure and gained confidence from the supportive accompaniment. Each boy was sensitive to the musical needs of others and the improvised song was truly a group creation.

By week four, the group had favourite activities (especially rap and blues improvisations) they were asking for regularly. They recalled and repeated their original composition “Tangaroa” which had developed from the improvisation. During the fourth session, the choice cards did not have to be used at all, as the boys were able to build on previous experiences as well as to develop a rhythmic improvisation as it moved through several different styles and tempi. Although they did begin to make suggestions regarding the music they might play by relating it to sounds of instruments – “can we have tambourine music?”, at this stage there was still no group member who was able to make (or willing to risk) an original idea without significant prompting.

Musical cohesion continued to develop. When one particular member perseverated on specific musical patterns the group were willing to follow and use his lead to ensure the music was organized. By week five (with one group member absent), the three boys present were really working hard to listen to each other and to alter their rhythms to ensure group cohesion. There was a real sense of group developing as the boys demonstrated overt support for individual members, gently prompting each other, negotiating with and passing peers instruments as well as mutual sharing and playing together on one instrument.

In week six, the boys asked for and were given a microphone to use during their rap improvisations. At this point, the boys began to take considerable responsibility for running the group themselves. However, they still had limited self-control and organisational skills – and chaos continued to reign at times! Real friendship seemed to be developing between two boys in particular, but while all group members were sharing and supporting each other, it was all done in a busy loud way! Nevertheless, boys were RECOGNISING the chaos and trying to think of solutions – negotiating different ways of playing, using different instruments, drawing attention to the volume of specific instruments. And they were receiving this information from each other positively – they appeared to be seeing the value of ‘improving’ the group activity and were not taking any comments personally. Some boys were ‘sitting out’ or offering very gentle accompaniment so peers could be heard.

The last two sessions seemed less comfortable, and this may be due to several factors. School holidays were looming and this can be a difficult time for boys who return to homes that offer less security and predictability than the residential school setting. The general atmosphere in the school prior to holidays is one of unrest. Secondly, the boys were aware that although the music sessions would continue next term, they would be taking a different approach and this may have also unsettled them. Finally, because the holidays brought significant change, the music therapy group was brought to a definite close, and these particular boys may be especially vulnerable to all the issues that group closure brings.

b. Group B, Term 4 – Instructional Approach

This phase got off to a very chaotic start for Group B. In session 1, three of the four boys were hyperactive, and unable to keep verbally quiet or instruments still. It was difficult for this group to change from a creative approach to more structure, and they were resistant to being told what to do. They had become used to being encouraged to offer ideas and wanted to have input into how the structured exercises might be done. The resistance for one boy in particular bordered on oppositional behaviour, and he was whiny and unenthusiastic. All students showed some degree of anxiety; two appeared very concerned that they would be unable to do what was asked of them and thus employed a strategy of ‘not wanting to do the boring task’. Avoidance strategies included playing instruments constantly. Two of the members were musically creative, and wanted to contribute complicated rhythms of their own rather than playing/rehearsing the specific motifs requested. Despite the difficulties, the group did engage in some musical activity, and during the first session were able to begin the task of learning a structured instrumental ensemble.

The chaos continued into the second session, with three group members unable to keep instruments quiet between activities. They were clearly having difficulty with attending and impulse control, and were unable to listen to instructions, or to successfully engage in the simplest of beat activities in a group setting. I was concerned this would have a cyclic impact on the future of the group development. The noise of the group meant they were unable to concentrate. I

thought this experience would have been more likely in an improvisation group, and had not anticipated loud and disorganised sound-making for long periods of the session, with no time to calmly recap or move on.

The third session was fraught from the impact of external events. A number of disruptions left only two boys prepared for music. We expected the other two 'at any moment' and delayed starting without them as long as possible. However, it was very difficult, when the programme for these boys this term is designed to be highly structured, to keep them waiting in the music room for what was eventually almost 20 minutes, without playing. So they used the instruments relatively freely, and were becoming over-aroused. This session is therefore not a true indication of a structured programme. When, after 20 minutes waiting, all boys had still not returned to the music room, the session was held with just two boys.

These remaining two began the session well, given their long wait and free play. Although they did not appear keen to engage in rhythmic exercises and one of them declared it boring several times, they both continued to interact willingly and demonstrated good timing skills in the early stages of the formal session. They were only able to maintain this concentration for a period of approximately seven minutes before their beating became uneven. When questioned individually about the session, both boys stated that the activities were not really that boring. It does seem that the use of the comment continues to be flippant and/or habitual to a certain extent and need not always be taken literally..

All boys attended the fourth session. They were very settled and engaged quickly. We rehearsed the structured ensemble in parts and were able, for the first ten minutes at least, to work cooperatively and to concentrate in order to be able to achieve accurate and successful participation. However, their short attention spans limited on-task behaviour and the session was not long.

The fifth session did not feel as satisfying as the previous one for me. Although the boys engaged in musical activity appropriately, they were quickly unsettled between activities. One of the boys was especially provocative, playing loudly and disrupting the group whenever instructions were being given. Even though

what was being asked of them for each individual part was within their capabilities, the task of playing with others while concentrating on a specific part was very difficult. The boys wanted to revert to natural music-making, and this was possibly also due to their experience of a term of improvisation.

The anxiety levels of two of the boys became raised during this session. They seemed reluctant to try activities at times and withdrew from interaction. I wondered if, despite my best efforts to explain and model the task, they were perhaps unclear of expectations. However, it is important to note that when I viewed the video, the levels of anxiety I sensed in the boys during the session were not as evident. I would still argue that the anxiety I perceived in the actual session was a projection of the boys' insecurities, but I could accept that the session overall was reasonably cohesive. I was aware that the boys were anxious due to the prospect of performing their ensemble at a school function. However, when Bert asked if the performance would go ahead and was advised that it might not if we were not ready or desiring of it, two of the boys gave a disappointed "oh!"

The next was a very mixed session. Two of the boys appeared very anxious on arrival. Bill was quiet and sad-looking, while Bert was grumpy and irritated, declaring 'school sucks!'. We began immediately with the activity from last week, and I had made a minor amendment (taken out some movement) to ensure that they felt they could achieve well (therapist support). Bill remained involved for several task rehearsals but did not look any more relaxed. Bert, Lee and Toby, however, become demonstrably relaxed and increasingly enthusiastic about the work. It seemed that they were becoming aware of the piece as a whole and their part in it. They were predominantly able to maintain their parts, although they liked to add extra rhythms at times. They could see and hear that the changing intensities (increasing energy and dynamics, as parts were added or taken away) gave excitement to the music. The boys were enthusiastic about undertaking a number of repetitions and asked if they could add specific parts to the piece, or to change to another instrument. Two of the boys began spontaneously moving and changing instruments with each other and that worked well. When asked to discuss the possibility of performing for the school function

the group's enthusiasm went up even another notch! They *were* keen to perform their work, and Bert wanted a videotape of his music for his uncle for Christmas! Bill had earlier distanced himself from the group. He remained in the room and appeared to be listening but could not be encouraged to play. He did want to play for the school function but was not to be drawn back into a rehearsal. He asked for an audiotape to copy songs from the radio. When I attempted to check with him whether there was room on the last one he was provided with, he became upset and left the room in a highly agitated state. It is, however, very positive that although he had been vulnerable throughout the session he did not stop the others from having an enjoyable and productive time rehearsing the ensemble.

In the following session, the group continued to rehearse the ensemble with enthusiasm. One student, who appeared very anxious about an issue outside of music, was reluctant to participate and complained that he did not like the piece. He was, however, encouraged by his peers and seemed motivated by the music – he was not only able to stay for the full session but was moving spontaneously to the beat, and tapping sticks together while waiting. He did have a period early in the session when he played extremely hard and fast, breaking a drumstick. But again the other group members joined me in encouraging him to try again and he was able to participate in several more successful rehearsals of the ensemble. Review of the video material revealed a young man who seemed to be getting a lot of therapeutic value from the sessions. From being a detached and distant client (doing the right thing) he has developed the ability to complain and express his frustration in the music while maintaining the ability to control himself to an extent. He was able to take advantage of music as a medium for self-expression.

I had begun to notice considerable improvement in concentration, self-control and the ability of the group to remain on task. However, it was very necessary to keep the music going – between repetitions the boys were much more likely to become disorganised and lose focus. The music clearly organised them and now that they knew the piece, could hear it as a whole, and could appreciate the musical experience, they were motivated to work harder at it.

The ensemble was performed at dress rehearsal, and on community night with superb results. Despite a natural nervousness, each group member was committed to supporting the others and there was no suggestion that any of the boys would withdraw. They applied all the attention and concentration they could muster, and once the performance had begun, at least one group member was even able to contribute with enthusiasm. Certainly, after the performance, the students were able to take pleasure in their success, and interacted positively with friends and supporters of the school.

However, having one more session after the performance was difficult. Our research assistant was not available, and one of the boys appeared to be quite affected by the closure.... lowering his head and unable to play towards the end of the session. It seemed important not to revisit the work that had been completed and had come to a conclusion, and yet the research protocol for this group required a 'structured' approach – they needed to be working on directed activity. We therefore attempted a 'new' piece that incorporated similar patterns to those they had learnt for their performance and they were able to learn a new ensemble very quickly. Nevertheless, the difficulties that go with beginning a new activity with this population were still evident – they did not attend well to instructions and again appeared resistant until they could 'see' the end product. The session was therefore chaotic at times, and without an assistant it took some time to bring the group together. However, the students attended well during the actual rehearsal and playing of the piece, and they engaged well in the ensemble work when prompted musically and cued verbally. Further, the boys were requesting some favourite activities and because it was the last session it felt appropriate to allow a little flexibility – this session was a little less structured than outlined in the 'Direct Teaching and Modelling' protocol. As well, one student had had his medication late, and all the end of term excitement and anxiety for the group led to a relatively disorganized closing session. We attempted a final rhythmic improvisation but it was necessary to stop the playing because of the disorganisation and to frame the work in the blues form. This enabled the boys to successfully reintegrate and to finish the session on a positive note.

c. Group C, Term 3 – Instructional Approach

Because this group involved a high level of structure, group process was directly influenced by the considerable input of the therapist. For example, while initial sessions paralleled that of the improvisation group in that the boys demonstrated a reluctance to fully involve themselves in music-making, the clearly-defined tasks gave group members the opportunity to push against the boundaries, to express their anxiety by denying interest or enthusiasm for the activities they were asked to do. Because they were not asked to initiate or contribute ideas, the uncomfortable silences which punctuated the early improvisational sessions for Group B were replaced in this group by throwaway comments such as 'this is boring' or 'stupid'. Like their peers in the improvisation, group these boys wanted to use large and loud instruments, but were allowed only to choose from a limited range until listening skills had improved. However, because the specific goal of the activities was for the boys to improve their listening, cognitive timing and motor response skills, instruments offered were those that were struck with a beater or hand, and which offered a moderately loud sound when struck cleanly. These gave the player strong kinaesthetic and auditory feedback.

One student refused to actively participate for the first two sessions. However, his subliminal interest was evident as he remained with the group and appeared to be particularly interested in the activity of his peers. While he was gradually able to increase his own contribution to the musical process, he continued throughout the programme to be reluctant to attempt new activities or to extend what he was able to do, without considerable prompting. Regardless, he was often noted to answer questions accurately, to prompt others to play on time, to identify and to correct inaccuracies in the group's playing. Further, his scores on the 40bpm STT during this phase of treatment improved considerably. He began the treatment period with consistently high error numbers and error times and was not able to reduce error numbers. It seemed, however, that he was able to improve his perception of time intervals to reduce his mean error times, particularly at the slower speed.

This student's reluctance to participate brought the best out in his peers. The others, but one student in particular, continued to be very supportive of him until he felt comfortable enough to contribute actively. During turn taking activities, they consistently left an appropriate space for him to play. They encouraged him gently, using phrases such as "you can do it", and offered him their favourite instruments in the hope that he would join. By session five, all group members had really come on board with the activities, and were arriving with relatively positive attitude and their enthusiasm for the music increased as sessions progressed. Our 'reluctant' participant was receiving one particular drum, had begun to play occasionally and was clearly enjoying the music-making of his peers.

The structured activities involved learning and rehearsing specific rhythmic motifs that were incorporated into a pre-composed percussion ensemble. As the boys' confidence grew, it was difficult at times to contain their creative enthusiasm. They offered innovative ideas about how we could rehearse the rhythms, and as they became more familiar and competent with each phrase, they began to use a greater range of percussion instruments. While the final performance of the ensemble involved the four boys each taking a specific part, during 'rehearsals' the boys learnt to play each part and even to play *all* parts as a solo performance.

Students were naturally keen to play at the drum kit. I was confident that at this stage the boys were able to listen and display enough self control to ensure that their music not be chaotic, and the drums were therefore offered as reward at the end of sessions five to eight, to boys who had worked well during the rehearsal time. Their use of the kit was interesting. In contrast to an anticipated attempt at energetic 'rock performance', which in this researcher's experience is typical for this clientele group, the boys asked for help in learning simple rhythms that they could incorporate into the goodbye song. They played these with considerable concentration and control. The boys accepted each decision regarding who should play at the drum kit and respectfully showed appreciation for peers' achievements.

Closure for this group was also interesting. One of the group members had broken his arm and his mother was visiting him at the school following his discharge from hospital. The boys were keen for her to be the ‘audience’ for their ensemble performance, and although it is unusual to have visitors during group therapy sessions, it seemed entirely appropriate for this particular group to close with a recital for a supportive and understanding ‘audience’. Their happy and animated departure from the session confirmed that closure for this group was satisfactory.

d. Group C, Term 4 – An Improvisational Approach

I was amazed at how enthusiastically and immediately these boys embraced the opportunity to be creative in their music-making, and the ability of one group member, in particular, to acknowledge and support the ideas and music of his peers. During the first improvisatory session, the boys chose one theme from the suggestion cards, i.e. “Car Racing”, and offered two original ideas – “The Rain” and “Dracula”. They seemed to be accepting of sound-making as a communicative expression and were less concerned for ‘accuracy’ of familiar sounds. They engaged in long discussions about the sounds they would need and the instruments that could make those sounds. Vocal sounds were freely introduced – initiated by one boy in particular, but continued and developed by two others. The group played “The Rain” improvisation with sensitivity – the music was predominantly quiet but even when a thunderstorm grew, the increase in dynamic did not precipitate a loss of control. A poignant silence followed the work. The boys were listening well enough to be able to identify specific sounds/motifs heard in the music and to offer other occasional thoughtful comments. When offered the opportunity to discuss their musical experience, students’ initial responses were predominantly single word and/or very general descriptors e.g. “Good” but they were willing and able to add more information about specific parts of the improvisation with gentle prompts. Each of the improvisations came to satisfactory closure without verbal or gestural prompts. The whole group dynamic – being together and knowing each other as a group made for a positive beginning. The group ‘leader’ had high levels of enthusiasm that had an impact on the whole group, and they were ‘raring to go’.

I was wondering how the experience could relate to improvement in time perception – it seemed incredible to think that if this creativity continued, it could have any impact on this specific cognitive function.... I was confident that it would be valuable for other aspects of development, but the irregularity of the improvisation, the ‘soundscape’ and arrhythmic nature of it, rather than the strong musical structure, led me to feel that it was unlikely to be helping the boys with the beat test.

Although during the second session one student was not well and the group followed his generally subdued mood, all boys contributed to the improvisations and overall the atmosphere was one of calm relaxation. The boys suggested two improvisations – “Rain” and “Hunting” – the latter involved walking in the bush, and so both were predominantly gentle and quiet without strong rhythms. Students laughed when the “Hunting” improvisation gradually reduced in volume to silence and a sudden loud bang was produced at the piano – bringing the improvisation back for another section. When the boys were having difficulty coming up with the theme for the third, I suggested a blues improvisation to give them the opportunity to experience a stronger rhythm. All boys were able to contribute a solo, and to play without accompaniment, but maintained a steady beat rather than introducing rhythmic play.

One student was absent during session three. Without him, the group had lost their leader, their gregarious creative confident musician who was able to lift the mood of the group and get them quickly engaged in music-making. It was necessary for me to offer firm suggestions during this session because boys were anxious and reluctant to engage.... one of them had been violent and aggressive in the villa setting immediately prior to music, and it was important to get on with the music to prevent his anxiety from increasing. I also sensed that until the music-making began, the group was at risk of verbal taunting which was more likely to lead to further incidents. The mood of the group was low and the music reflected this. At this point I felt that it was necessary to give the group more direction, and suggested that we build on grounded beat work, familiar from the structured sessions, playing percussion improvisation with no theme.

Surprisingly, the student who had been aggressive chose instruments such as guitar, and piano and played with gentle sensitivity – the music sounded mournful as he gently plucked open strings or played single melody lines in the low register of the piano. The other two supported with quieter percussion instruments, until during the final improvisation the volume grew, and there was a sense of strength and hope developing.

During the fourth improvisation session, the student who had been reluctant and/or unable to participate in earlier sessions and was gradually gaining confidence, was extremely lively and engaged that day. When questioned, he confessed to having medication later that morning, just prior to the session. Although one student was away, the remaining three boys were all active and enthusiastic. It was difficult to get them organised to begin music, as they were restless and chatty, fiddling with instruments. However, they were enthusiastic about beginning a percussion improvisation without a theme, as they had experienced it last week. The improvisation had moments of arrhythmia – the ‘group leader’ who had been away last week was using strong instruments and maintaining specific beats without paying attention to what others were doing. It seemed that he wanted to express his return and his wish to continue leading the group, but that they had developed more confidence in his absence and were not looking to imitate him. The ‘reluctant’ student played energetically and even sang during the greetings song! He explained that although the medication helped him to concentrate for maths etc., he wished that he could have it later on Friday so he could enjoy music without the Ritalin. During the discussions, I advised the boys that many group improvisations go for a long time without stopping, and they decided to play for 15 minutes and to time it with a stopwatch. We completed this piece, and during the music-making only one student spoke, making a brief (indiscernible) comment to a peer towards the end of the improvisation. Attention to task was much better and motor restlessness considerably less during the music-making and between music activities.

By session five, we were confident and had enough trust in each other to include the drum kit in our greetings music. The student who was nominated by the group to play beat steadily and at moderate volume, enabling the others to make a

positive contribution on their instruments. The group continued to develop their improvising without themes. One student, in particular, was egocentric in his playing at times and the others became tentative as he played, listening and looking for space. At other times, excellent group cohesion developed, with each student employing all the skills that that entails. They were clearly listening well, employing visual referencing skills, and responding to eye contact and facial expression of other group members. During this session, three of the boys smiled at least once during an improvisation. Each group member waited for a period while they listened to a musical communication between other dyads. Call and response, imitation of rhythmic patterns, a variety of dynamic and tempo changes were all present in the work. Each student took the opportunity to lead, and this was an achievement for one of the students who had previously always held back when he heard himself solo in the music.

I began to suspect that the student who was more reluctant to let himself go in the music was affected by the presence of the video camera. I had seen that he was able to contribute with more commitment and enthusiasm when it was off (initially an oversight) and when it was turned on his playing became more 'awkward'. He was able to confirm this verbally. The red recording light was disconcerting, and in subsequent sessions was covered over. The boys were reminded that the camera was on for most sessions and although they had given permission to video, they were able to ask for the camera to be turned off at any time. Following this discussion and the covering of the red light, the impact of the video camera seemed negligible.

Our dominant 'group leader' had begun to use multiple instruments and continued to engage in a dominant pattern of music-making that often did not allow enough space for others to be heard. Two or three improvisations had become almost continuous over a 30 minute period, and although boys did not take the opportunity to discuss them between pieces, in their quiet changing of instruments or attentive silence, they were able to communicate that the music-making was a powerful experience for them.

During session seven, the first improvisation was a little disjointed, as two of the boys began the session fidgiting and teasing each other in mock battle with the instruments. While this seemed like good-natured banter the interactions were at risk of going ‘over the top’. They also began to engage in verbal communication during the music-making. The improvisation was stopped and the ground rules regarding improvising were reiterated. For this particular population, “no talking”, “listen to others”, and “leave enough space for others to be heard” needed reinforcing.

Following the recapitulation of the ground rules for improvisation, the boys engaged in a twenty-minute improvisation without interruption with speech. The students began to communicate with each other musically, interacting with their peers rather than the therapist. In earlier sessions, the boys’ visual focus was most often on me, and they were concerned predominantly with their own ability to play/contribute. The more passive student, who had always been a little more interested in other boys’ music, was particularly fascinated with dyadic interaction between peers and appeared to enjoy watching and listening to parts of the improvisation immensely. The music became playfully challenging. Three of the boys smiled broadly during the work, and while the fourth was less overt, he still appeared to be comfortable, perhaps even happy in the music-making. This particular student simply seemed to be more serious about his music-making and could not yet allow himself to see it as a potentially funny or playful experience.

I was able to withdraw musical support for long periods and the boys continued to communicate very effectively in the music. The subtle communication, i.e. nonverbal and musical communication skills that these boys had developed was comparatively superb. For example, in this session one of the boys enquired, with a facial expression and tip of his head, whether he could have the maracas from another boy, who in turn declined, nodding towards another pair on the instrument table. The therapist was able to pass the other maracas and the music continued without a pause. The group had developed the ability to allow improvisations to come to a very comfortable close.

When offered opportunities for verbal debrief, students used words that were not congruent with my observation of the improvisations. They continued to declare that parts of an improvisation were boring although they had not demonstrated any boredom during the work. One student said he was tired; perhaps the concentration involved in the intense experience was being underestimated.

During the penultimate session, there was evidence of possible closure issues for the students. They were reluctant to contribute to a discussion regarding what they might do to celebrate the group's success, and were unenthusiastic about rewards (can of coke or lemonade) suggested by the therapist. They engaged in a twenty-minute melancholy improvisation. Each group member was quietly contributing. There were many moments when the music almost closed and a member would reintroduce a theme. Much of it was gentle and slow, and boys were looking tired and even bored at times. However, they remained with the group and seemed to be taking the music very seriously. They were visually referencing with each other and responding when a musical invitation was put. When the music did gain in tempo or dynamic, each responded with a little more energy. The work could not be described as enthusiastic, but was accepting and comfortable. It seems that the boys had gained an awareness that it was OK to just 'be' – to express how one feels in the music, or to 'withdraw' musically and to listen.... They were so much more comfortable with quiet periods and silence.

When this poignant improvisation finished, nobody wanted to speak, and the goodbye song followed. Two of the boys immediately 'debriefed', with one asking the other if he was tired and why – this very appropriate discussion was likely to leave both feeling positive about the appropriateness of the session and the support that is available in this setting.

During the final session, the group was generally hyperactive and restless. One student had taken his medication late, and all had been out to a school function the night before. Another had become excited and motivated by the previous night's programme and had asked in the corridor "can we do what they did last night?", and "I want to be in the (school) band!" In contrast, one boy was very negative about peers' musical performance at that function. He began play fighting,

teasing, and being generally very active and provocative, utilising comments including “boring” and “it sucked last night”. It seemed important to address boys’ general use of the word “boring” when they don’t know what else to say, or how to describe something. I facilitated a discussion based on the value of supporting others and making positive comments, and boys were able to acknowledge that there had been good things happening in the performance, and that it was not necessary to talk about the things they enjoyed less in derogatory terms that might hurt others.

However, the verbal interaction took a big part of this session, and students took a very long time to settle. Once the music began, the two boys who had engaged in the play fighting prior to improvisation, continued to interact as a dyad and predominantly disregarded the rest of the group. One had produced two buttons that they used as “sound makers” on their drums – this creative use of equipment was incorporated into the music until they became too visually focused on flicking the buttons at each other and around the room and were not part of the group music-making. The boys appeared comfortable with me picking up the buttons and pocketing them without interrupting the music.

The improvisation had many periods of loud, energetic and at times arrhythmic sounds, but without verbal prompting the group was able to come to cohesion; before again building into another loud, fast, expressive cadence. Throughout, the music went from quiet call-and-response moments, and periods of cohesive beating, to building into an energetic frenzy. The two boys who had developed strong interaction prior to the improvisation continued to interact verbally as well as musically throughout, especially in the first five minutes, moving from dyadic play to group cohesion and back to dyadic play. At these times, they often appeared unaware of the rest of the group, but could be drawn in to the group music when a strong beat or rhythm re-emerged. In the final seven minutes, all students were performing well as a group. I was able to contain this improvisation from the piano, using steady chords at the bottom register of the instrument. The group consistently fell in with the beat and might have been able to sustain their organised play for longer periods, but I was eager to give choice and control back to them. They had progressed to a point where each

member was able to take the opportunity to initiate a musical idea with the confidence that peers would follow and/or support the contribution. The last five minutes of the improvisation provided an excellent background for ending the programme, and a student punctuated the closure with a powerful cymbal crash. The following dialogue ensued.

Brian played hard out with the back of his right hand on the drum

You've broken it (*hand*) yuk! – John to Brian

If it was broken he would cry – Geoffrey

I'm used to things broken. – Brian

Any body want to say anything about the last 10 minutes (improvisation)? –

Daphne

The music was quite good – Geoffrey

It was a crack-up – Brian

(I liked) the drum roll? When I played the bongos – Mark

My hands were really slippery – John.

Tell me how you feel about the music group, all the time we've spent together.

It's been OK – I won't say good, but I can say OK - Geoffrey

Good – Mark

I want to go in the band – John

Got funner⁴ (and sorer) - Brian

What do you think about your own work?

I suck! - Geoffrey

I think he has to try more – John (about Geoffrey)

Do you think you've improved – Daphne to Brian

I'm not sure (because I've got a lot of pain in my hand!) – Brian

Yes you have! - Geoffrey

I need more instruments to play, like a whole drum kit! – John

If I did go in the band, what would I be playing? – John

⁴ Direct quote! Meaning – “it became more fun”