

# School Based Research Project

## Final Report

Functional Communication Training  
with students with autism  
spectrum disorders

Woodbury Autism  
Education and Training



# **Best Practices for Functional Communication Training; Monitoring Teacher Adherence to Procedures in a School Setting**

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*Research has shown that individuals with more developed speech skills often show less challenging behaviours than those with impaired speech skills (Mancil & Bowman, 2010). Simple procedures, specifically tailored to the individual, can address communication deficits and decrease challenging behaviour. In the field of Applied Behaviour Analysis (ABA), Functional Communication Training (FCT) is one of the interventions used for this purpose. FCT is built on the theory that all challenging behaviours have a function and therefore serve a purpose for the individual. The behaviour may be a way to escape or avoid a less preferred activity or to get a response or reaction from others. Often challenging behaviours present when an individual does not have the ability to communicate their wants and needs and as such, the challenging behaviour itself is an inappropriate means of communicating. Teaching the student an appropriate form of communication will allow them to gain access to the same outcome without the need to engage in challenging behaviour. There are a number of research papers which demonstrate the efficacy of FCT, however, the majority have been conducted in clinical settings with 1:1 (teacher to student) ratios. There is limited research demonstrating the implementation of FCT within school settings and insufficient research on best practices for training staff in its implementation. In this research project, we examined adherence to FCT intervention procedures implemented by teaching staff in an independent school for children with Autism Spectrum Disorder (ASD) (ages 4.5-12 years). Results demonstrated that high procedural integrity was associated with improved student outcomes. The results will be discussed in relation to the broader topic of teachers' adherence to interventions and curriculum.*

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The goal of most special educators is to equip their student with the necessary skills to learn and participate within their school environment (Koegel, Matos-Fredeem, Lang & Koegel (2011). For many students, the main barrier to learning is challenging behaviour. Engagement in these behaviours not only disrupts the individual's learning opportunity but interrupts the learning opportunity for the entire class. Challenging behaviours can occur in many forms ranging from simple non-attendance or lack of compliance to more intrusive behaviours such as aggression and property destruction. While the range of behaviours can vary hugely from individual to individual, each poses its own unique challenges in relation to classroom management and teaching practices. Without appropriate intervention, these behaviours tend to persist (Oliver, Hall & Murphy, 2005) and can lead to exclusion from education and community based services.

Applied Behaviour Analysis (ABA) is a scientific approach to understanding behaviour and learning. ABA applies a range of different strategies and techniques, based on the principles of behaviour, to teach new skills and reduce challenging behaviours. Rather than focusing on the appearance of the behaviour, ABA practitioners look at the function or reason for the behaviour. Behaviours can be classified into one of four functions of behaviour:

- To gain attention from others; for example shouting loudly in class to gain attention from peers,
- To escape or avoid an item or activity; for example requesting the toilet to avoid math class,
- To gain or maintain access to an item or activity; for example taking lunch money from a peer to buy lunch,
- To gain access to intrinsic motivation, for example humming a song or flicking a pen in class because it feels good.

Research has shown that children with developmental delays engage in more severe and frequent challenging behaviour than typically developing children (Matson, Wilkins & Macken, 2009). One of the most common reasons for challenging behaviours is lack of communication skills or appropriate coping strategies. This is evidenced by the finding that interventions which focus on establishing effective

communication strategies show reductions in a variety of disruptive behaviours (Koegel, Koegel & Surratt, 1992)

The motivation to avoid less preferred tasks or gain attention from others is a normal, healthy desire and most typically developing students have developed ways to appropriately gain access to such events. For example building in frequent breaks to more difficult tasks or asking for help, talking to friends during scheduled lunch times, or earning pocket money to buy a new iPad. In contrast a student with developmental disabilities or deficits in social and communication skills may not have the appropriate means to gain access to such events. Without an appropriate means for such communication challenging behaviours can be seen to arise to meet an otherwise absent need. Understanding why behaviour is happening will allow the special educator to identify areas of deficit which can be addressed to minimise the occurrence of challenging behaviours in the future.

Functional Communication Training (FCT) was one of the first proactive approaches researched in relation to decreasing challenging behaviour. To address both communication and behavioural needs of children with autism, several researchers developed the intervention of FCT which can be applied to a variety of students of varying ages, disabilities and communication styles (Carr & Durand, 1985; Mancil, Conroy, Alter & Nakeo, 2006; Heath, Ganz, Parker, Burke & Ninci, 2015).

Prior to the research into FCT, the focus had been on reactive measures and punishment procedures utilised to decrease challenging behaviour. While these types of procedures may be effective in decreasing challenging behaviours, they do not address the reasons why the person is engaging in the challenging behaviour. Reactive measures often result in short term changes to behaviour which is only evident for the length of the punitive strategy. Not only does this type of intervention pose a number of ethical issues, it does not address the underlying reason for the behaviour happening. Decreasing a behaviour without consideration of the function is likely to result in the cessation of one challenging behaviour, in favour of another, while the individual attempts to fulfil the still unmet need.

In contrast FCT is a function based intervention which focuses on teaching an appropriate, alternative, form of communication which meets the needs of the individual while rendering the challenging behaviour ineffective and obsolete.

Researchers have consistently shown the effectiveness of FCT with children on the autism spectrum in clinical settings (Mancil et al., 2006). Durand and Carr (1987) indicated an increase in communication with a simultaneous decrease in challenging behaviours. These positive results continue to be shown across behavioural topographies and language levels for the past 40 years. The behavioural categories FCT has helped ameliorate include aggression (e.g., hitting, hair pulling), self-injurious behaviour (e.g., hand biting), property destruction, tantrums (e.g., yelling), body rocking, hand flapping, oppositional behaviour (e.g., refusing to do work), and walking away (Mancil et al., 2006). While FCT has a large body of supporting research for its implementation within 1:1 therapy sessions there is limited research of its efficacy within a classroom setting. Despite the current lack of research, FCT has the potential to make a positive impact on student learning and success in school settings.

An important component to the success of any teaching strategy or intervention is the teachers' ability to effectively implement the strategy as planned (Fiske, 2008). To evaluate treatment adherence to a certain intervention or curriculum, a consistent and reliable form of data needs to be collected. This data can provide an objective reflection of what is occurring during the teacher-to-student interaction within the classroom. In order to do that, Greer (2002) utilised the learn unit as a measurement of instruction. Teacher-student

interactions were broken down into discrete, observable components which can be recorded in the moment and analysed or evaluated at a later date.

Research has indicated that the presence of discrete learn units within a teaching session resulted in an increase in correct responding by students. By isolating each response opportunity, teachers have the potential to manipulate their interactions with students in order to sustain and improve their responding. The learn unit can be utilised to analyse the successful components of a teacher-student interaction it can also be used to identify areas of the interaction which were less successful. Analysis of the teacher-student interaction, via the learn unit, can provide valuable information on areas of the curriculum or intervention which need amending or adapting to improve student outcome.

The Teacher Performance Rate and Accuracy (TPRA), developed by Ross, Singer-Dudek and Greer (1994) builds on the concept of the learn unit as a measurement of active student responding in relation to teacher instruction. The TPRA allows the monitoring of student-teacher interaction by breaking it down into smaller, measurable components. Breaking down the back and forth interaction that is integral to student learning allows teachers and their supervisors to improve student learning opportunities. Consideration of what happened before, during and after the learning opportunity allows the teacher to analyse all aspects of learning. The TPRA recognises that any student-teacher interaction is reliant on the teacher's ability to learn from and respond to the student in an appropriate manner.

This research project aimed to address the research gaps identified in this literature review; specifically how to successfully train and implement FCT within a school setting. The focus of the study is on quality intervention as measured through adherence to procedures and student outcomes as measured through acquisition of skills and decreases in behaviour challenges. In order to implement FCT effectively within a classroom environment a measurement tool was created to measure teacher adherence to FCT procedures. A multi-component training package was created providing staff with the theoretical knowledge and practical skills required when adhering to the FCT teaching procedure. The theoretical knowledge was delivered through a training module providing background information, specific step-by-step procedures and opportunity to practise in role play scenarios. The practical skills were coached and monitored within the classroom using a modified TPRA tool to give constructive feedback and praise.

The design of this research project started with two hypotheses.

1. The use of FCT in a school setting can have positive outcomes for students with an autism diagnosis.
2. Teacher adherence when implementing FCT procedures has a measurable effect on student outcomes.

Specifically, our research addressed the following three questions regarding students with ASD:

1. What are the measurable outcomes of students when receiving FCT?
2. Is adherence in FCT implementation important to these student outcomes?
3. If adherence is important to student outcomes, which dimensions of adherence seem most important?

Our goals for this research are:

1. to provide further evidence for the efficacy of FCT in increasing appropriate student communications while decreasing inappropriate behaviours;
2. to provide new evidence for the use of FCT with students with ASD in school environments;
3. to provide new evidence regarding treatment adherence for the implementation of FCT, and;
4. to provide new evidence regarding what specific dimensions of FCT must have high treatment adherence in order to be maximally effective.

# Method

## Participants, Setting and Ethics

Participants were 19 teaching staff, including teachers and therapists, and 20 students all of whom attended Woodbury Autism Education and Research school. Woodbury is an independent day school for children 4-12 years of age with a primary diagnosis of Autism Spectrum Disorder. Woodbury follows a specialised curriculum based on the principles of Applied Behaviour Analysis; students are instructed in both 1:1 and small group settings with the aim to provide them with the pre-requisite skills required to attend a less intensive teaching environment. Students at Woodbury attend the school for 2 – 6 years during which time an individualised education plan is utilised to focus on each students' specific learning needs with an emphasis on behaviour management, language and communication, group learning skills and social skills.

Consent for participation was sought from each student's parent or guardian and informed consent for participation was received for all students attending the school during the research project. Case study one represents a 9 year old male with a diagnosis of Autism Spectrum Disorder. The student commenced his education at Woodbury in 2013 at which point he was non-verbal and displayed a variety of challenging behaviours. The student was functioning at a level 1 (0-18 month) as per the Verbal Behaviour Milestones Assessment and Placement Program (VBMAPP) (Sundberg, 2008). At the time of the research study the student was making verbal requests using 2-3 word phrases and was working at VBMAPP level 2-3, (18-48 months). The behaviour targeted for reduction was verbal protesting. The student would engage in high pitched screaming, yelling, crying, over-manding (repeated requesting) at a level that was louder than acceptable for the current classroom noise level. Following a functional behaviour assessment the behaviour was determined to function as Automatic reinforcement; the student engaged in the behaviours as a means to regain control over scripted activities, ritualised routines and rigid behaviour patterns. The functional communication phrase "stop" was taught as an appropriate replacement for verbal protesting; the student was reinforced for verbally making the request "stop" by allowing him to complete the ritual, routine or script uninterrupted.

Case Study two represents a 5 year old female with a diagnosis of Autism Spectrum Disorder and Epilepsy. The student commenced her education at Woodbury in 2017 at which point she utilised a speech generating device to make single word requests and was functioning at level 3 (36-48 months) on the VBMAPP. The behaviour targeted for reduction was elopement. The student would leave the work area, without permission to do so, during a work based task. An initial functional assessment determined that the behaviour functioned as tangible access; the student would leave the work area to access preferred items and activities. The functional communication phrase "one more minute" was implemented as an appropriate means to escape the table or avoid work tasks; the student was reinforced with continued access to a preferred item for making the request "one more minute" using her speech generating device.

A quasi-experimental design was used to measure the effect of increased procedural integrity on student outcomes. Based on the nature of the school (in which a variety of teaching staff work directly with any one student) and the ethical considerations surrounding withholding effective education, all students participated in the study across both groups.

Teaching staff were split into two equal groups of 9 participants, group 1 took part in a 20 week training and coaching intervention over the course of two school terms from April 2016 through

September 2016. Group 2 received no intervention during the first 20 weeks and entered into the training and coaching intervention for a 20 week period from January through June 2017. No formal baseline data was taken prior to intervention however comparison can be made for each student in relation to their challenging behaviour before and after the functional communication training.

## **Procedure**

A multi-element training and coaching package was designed to provide teaching staff with the relevant theoretical and practical knowledge to implement Functional Communication procedures. Training commenced with a one day presentation during a professional development day at the beginning of the school term. The training included a review of the functions of behaviour as well as specific components of FCT and the teaching phases of FCT. Video examples were utilised within the training and time was allocated for teaching staff to practise using role play scenarios. Directly after the training an FCT knowledge test was administered to all staff to test their understanding of the theoretical knowledge. The knowledge test was also used throughout the study as a tool for comparison between theoretical knowledge and practical application.

Teaching procedures for each student were individualised based on the target behaviour, its function and the students individual learning needs. To ensure the accurate collection of data, adequate teaching strategies and consistent implementation from staff, clear procedures need to be outlined and reviewed prior to intervention. We defined three distinct and different teaching phases; guiding the teaching process from learning the new phrase through to independent use of the phrase and thinning of reinforcement schedules. These different teaching phases utilised and apply principles of ABA which are already evidence-based methods. Each student worked through the three phrases at their own pace and instructional methods were monitored and amended based on individual needs. The three phases were Errorless, Thinning and Intermittent.

Errorless teaching procedures were utilised to teach the student to utilise the chosen communication phrase. Students were taught to use the phrase in a mode that was appropriate to their individual communication style. Most common communication styles included picture exchange, augmented communication or verbal requesting.

By definition errorless teaching is a procedure which utilises a prompting hierarchy to ensure correct responding (use of the communication phrase). Activities or events which typically trigger the behaviour were set up and presented to the student and supports were used to prompt the request. The aim of this learning opportunity was to provide practice and prompt the new communication phrase before engagement in challenging behaviour. Use of the phrase was differentially reinforced on a 1:1 schedule of reinforcement with the amount of reinforcement directly relating to the independence of the communication. Errorless phrase was considered complete once the student could independently (without prompting) utilise the communication phrase in absence of challenging behaviour with 80% accuracy across 2 sessions with at least 2 teaching staff.





Figure 1: Errorless Phase: Instructor provides an icon prompt for the student so that she successfully makes the correct response (the appropriate functional communication phrase) to get what she wants.



Figure 2: Instructor establishes student's motivation to use functional communication phrase by taking away something he wants to maintain access to. He will only regain access to the item if he communicates "one more minute" appropriately first (instead of hitting).

Thinning, in this instance, refers to the reduction of reinforcement from a fixed ratio of 1 (FR1) to a fixed ratio of 5 (FR5). Meaning instead of being reinforced for every use of the request the student was reinforced for the first 5 requests and then redirected to the task with the use of visual supports. The schedule of reinforcement was gradually faded from a FR1 to an FR2, FR3 and so on. Visual supports were utilised to demonstrate to the students how many requests they could make and what would happen after the requests had all been "used up". Reinforcement during this teaching step was provided for the appropriate acceptance at the end of the activity. For example when a request for "one more minute" was met with refusal of the request and redirection to a new activity the student was reinforced for doing so without engagement in challenging behaviours. Thinning phase was considered complete once the student accepted the end of reinforcement in the absence of challenging behaviours on a fixed ratio of 5 with 80% accuracy across 2 sessions with at least 2 teaching staff.

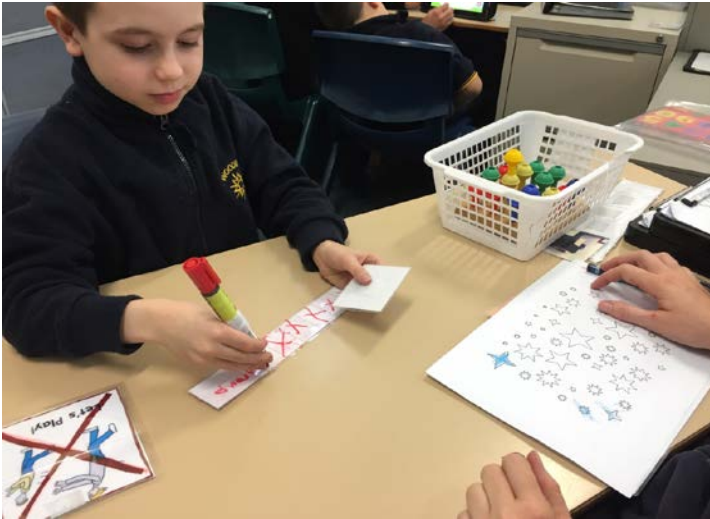


Figure 3: Thinning Phase (with visual): Student asks for “one more minute” to do what he wants to do before he has to go do work in a group. He was allowed to ask 6 times for one more minute and this is the last minute he can ask for as he crosses it off.

Intermittent, in this instance, refers to the further reduction of reinforcement from a fixed ratio to a variable ratio. Thinning schedules of reinforcement is an important element to any teaching procedure. While continuous reinforcement is an essential element to teaching any new skill (errorless phase) it is not a sustainable schedule of reinforcement. Within everyday life requests for access to activities or specific items are not granted (reinforced) every time they are made. In everyday life we learn to continue to make such requests because they are granted often enough that the request is “worthwhile”. . The intermittent phase in this procedure involved fading out the visual supports used within the thinning phase and teaching the student to independently maintain the use of the request while utilising appropriate coping strategies on occasions when the request cannot be granted. Due to the nature of this teaching phase the phase itself is never truly mastered, this phase will continue for as long as the student still requires the use of the functional communication phrase.

Using the knowledge provided within the theoretical training teaching staff implemented the teaching procedures within their everyday teaching practises. As part of the training intervention teaching staff were given regular video and coaching sessions to review their implementation of the procedures and provide constructive feedback where necessary. The coaching process required teaching staff to submit a video of themselves, implementing FCT within the classroom, once every three weeks. The researchers watched these videos and provided behaviour specific feedback on elements of the procedure that were correctly implemented as well as those which required changing. Feedback was typically given in verbal format along with a written summary, where necessary additional follow up and support was provided in the classroom to work through areas of weakness.

To facilitate the coaching process a measurement tool was created based on the teacher performance rate and accuracy (TPRA) literature. The measurement tool allowed the researchers to score teaching staff on their adherence to the FCT procedures within a specific teaching session. Each teaching opportunity within an FCT teaching session was broken down into a discrete learn unit. Within each learn unit we identified nine different dimensions of the procedure upon which a teacher could be scored on their successful, or unsuccessful, implementation of FCT procedures. These dimensions were as follows:

- Instructor Setting Event
  - Contrives or recognizes appropriate teaching opportunities based on student motivation
  - Identifies correct function of behaviour in the moment
  - Identifies correct precursors to target behaviour
- Instructor Antecedent
  - Uses appropriate communication phrase to match the function of the behaviour
  - Uses appropriate timing and type of prompts when teaching communication phrase
  - Fades prompts appropriately to promote student independence with use of phrase
- Instructor Consequence
  - Uses appropriate reinforcement schedule for the teaching phase
  - Implements appropriate reinforcement for correct student responses
  - Follows the student’s BIP in using the correct reactive procedures for the target behaviour

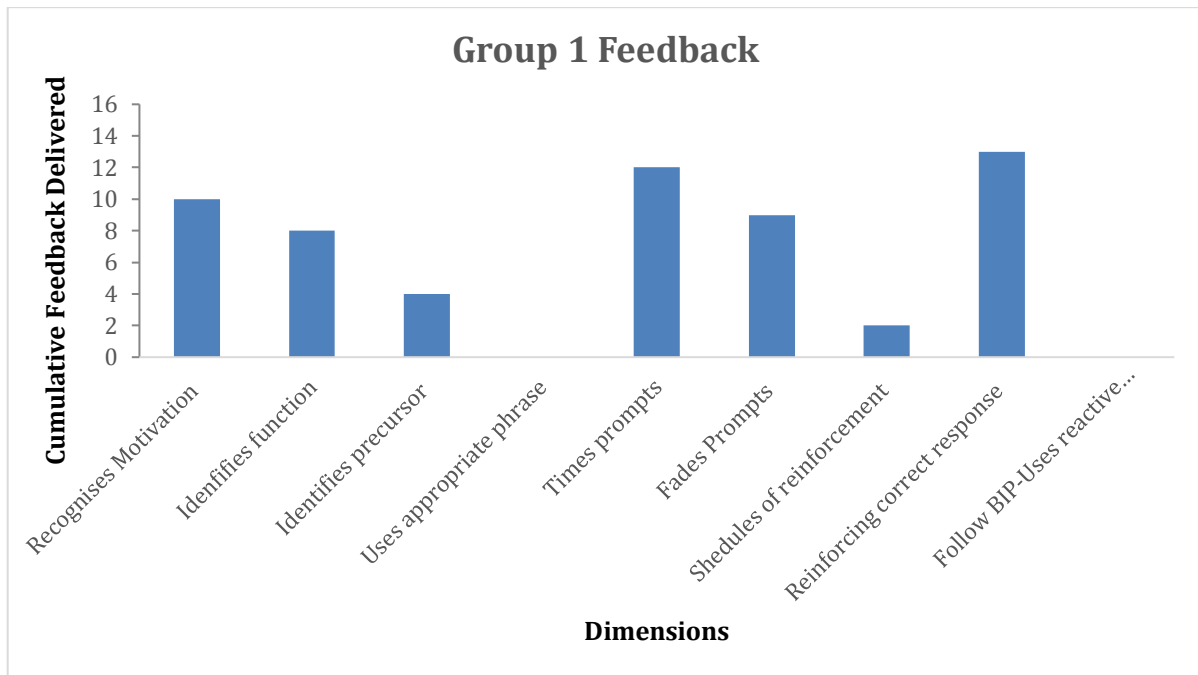
While watching the videos, as part of the coaching process, the researchers scored the teachers on their implementation of the above procedural dimensions. These dimensions were broken down even further and lists of various types of errors were defined. A separate coding system (see Appendix B) was created to allow the researcher to specifically identify specific errors within the dimension and therefore provide descriptive. See sample below.

# of Learn Unit	Time of Learn Unit (during video)	<i>Instructor Setting Event</i>	<i>Instructor Antecedent</i>	<i>Student Behaviour</i>	<i>Instructor Consequence</i>	<i>Instructor Consequence #2 (score only if student response is – or NR)</i>	Data collected as needed? N/A or Y or N
1	1:03	MO+	P+	+	R+	N/A	Y
2	2:35	MO+	P-	B-	B+	P+	Y

**Figure 4: Sample from Errorless Phase Adherence Data Sheet**

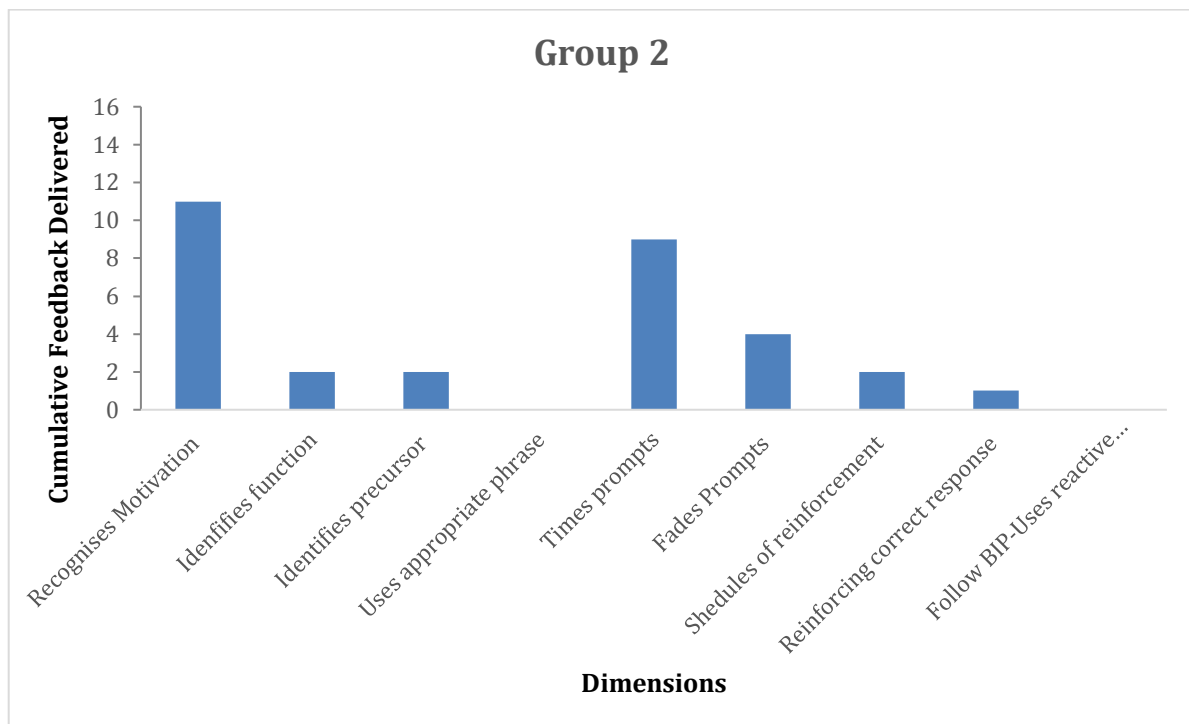
After the intervention was complete for group one, data was provisionally analysed to assess the effectiveness of the intervention. Specifically data was reviewed to determine if the training package was effective in improving teacher’s procedural integrity. During this analysis it was noted that there were a few specific and consistent errors made within the nine dimensions that were being measured. The researchers then modified the FCT theory training to include more information, video examples and practice regarding these problem areas. The goal was to see if more effective or specific training was provided prior to FCT implementation, would the teachers demonstrate better overall FCT adherence scores? These additions were included in the theoretical training for group 2 and were provided as a “top up” refresher to group 1 to ensure all therapists were equally effective in their work with the students.

# Results



**Figure 5: Cumulative feedback delivered to group 1**

Figure 5 represents the cumulative amount of feedback delivered within each dimension for all teaching staff in Group 1. This data were collected during the twenty week observation period from April 2016 through September 2016. Out of all the feedback sessions that occurred during this period, feedback was required the most within the dimension of reinforcing correct responses and least for uses appropriate phrase and follow BIP-uses reactive procedures.

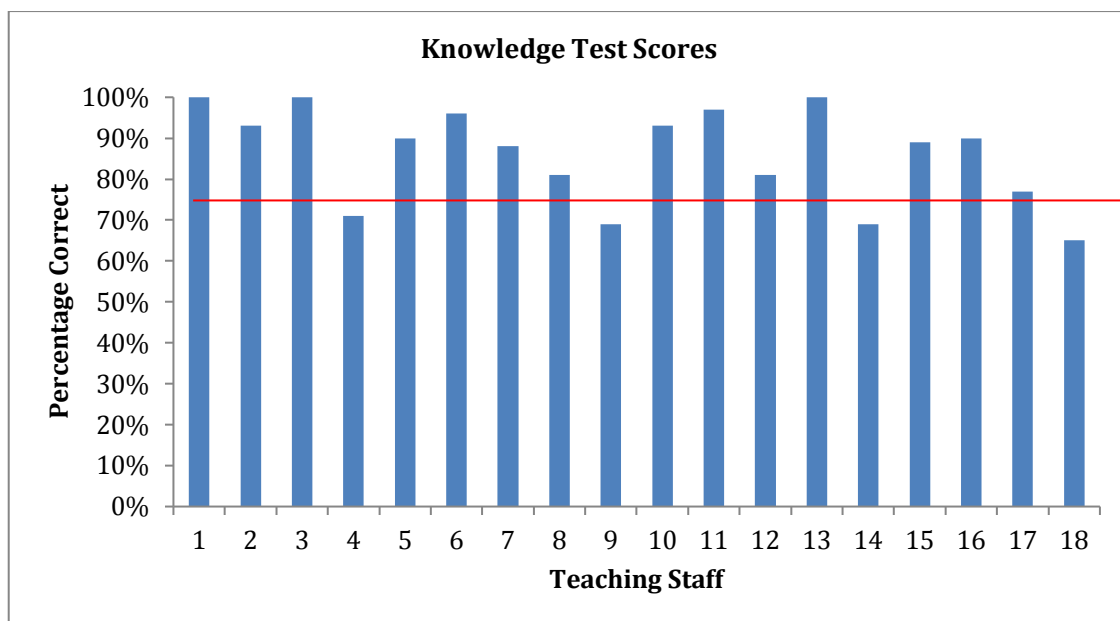


**Figure 6: Cumulative feedback delivered to group 2**

Figure 6 represents the cumulative amount of feedback delivered per dimension for teaching staff in group 2. As mentioned before, group 2 received an amended training package which aimed to increase treatment integrity across all dimensions. Feedback reduced or stayed consistent for 7 out of the 9 dimensions that were measured. Feedback was consistently required across group 1 and group 2 for recognises motivations and times prompts.

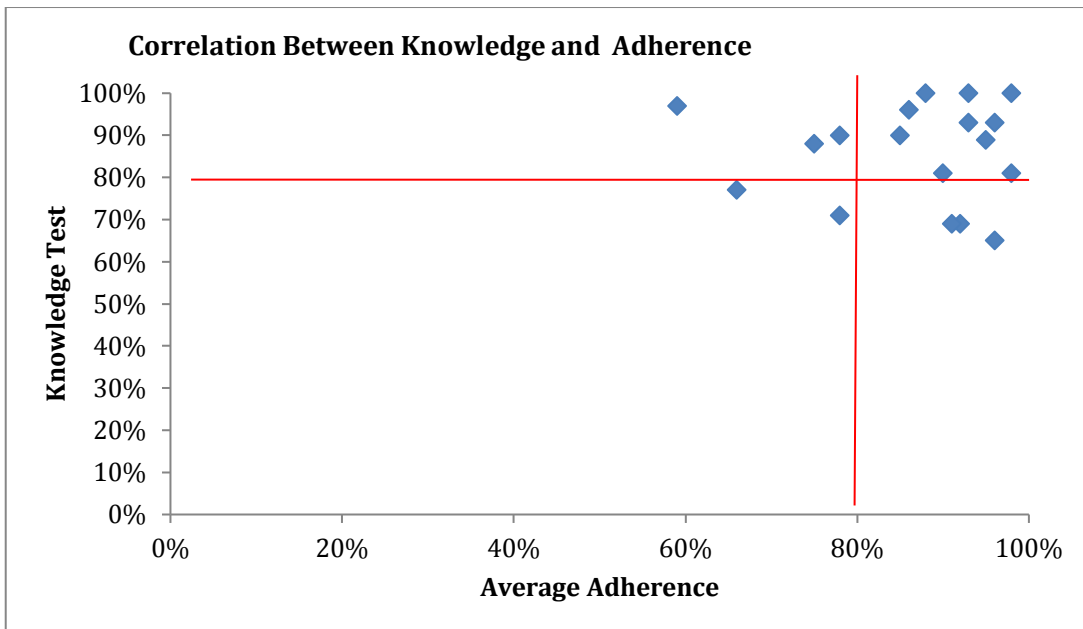
When comparing figures 5 and 6 we can see that feedback for group two was overall less than for group one with cumulative totals decreasing from 57 to 32 feedback provisions. Specifically the areas amended show a decrease in feedback; reinforcing correct responses decreased from 13 to 1 for groups 1 and 2 respectively, fading prompts decreased from 9 to 4, and timing prompts decreased from 11 to 9.

It is hypothesised that these decreases were a result of the amended training and that therefore the amended training resulted in improved treatment integrity as evident by lower levels of feedback.



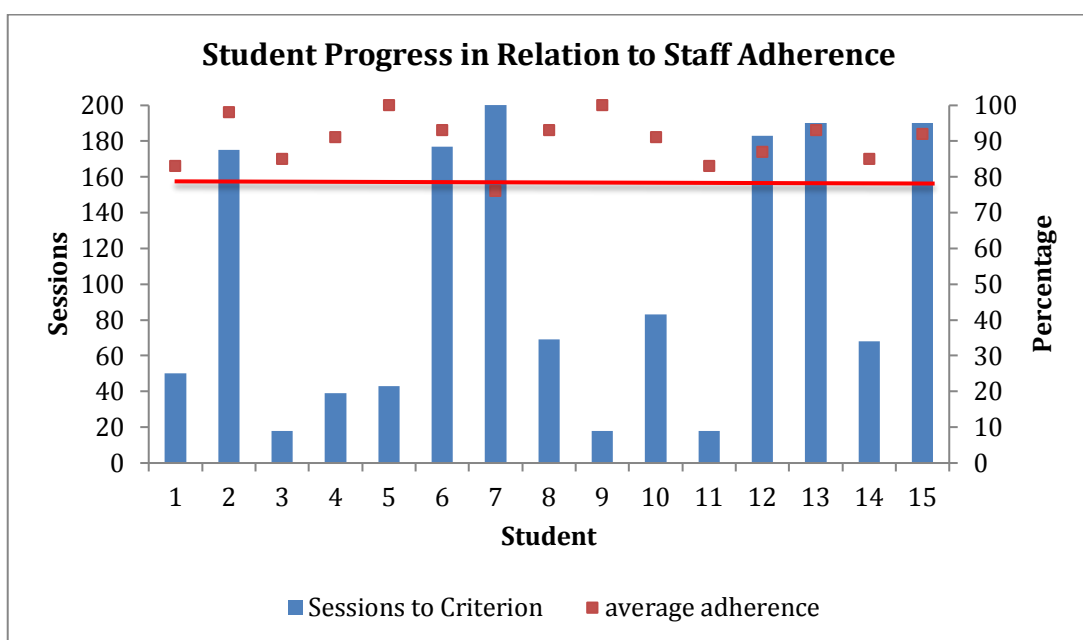
**Figure 7: Results from knowledge test post training**

Figure 7 depicts that following the 1 day theoretical training the majority of staff demonstrated competency in the area of FCT through a knowledge test. 72% of teaching staff scored 80% or higher demonstrating the ability to answer multiple choice and short answer questions in relation to the training provided.



**Figure 8: Correlation between theoretical knowledge and practical application**

Figure 8 shows correlation between high scores on the knowledge test and improved adherence to procedures within the classroom. 56% of the teaching staff scored above 80% on the knowledge test and demonstrated an average of 80% or above in adherence to procedures within the classroom, this is represented by the top right quadrant on the graph. 12% of staff failed to score above 80% on the knowledge test and demonstrated average adherence to procedures at 80% or less, this is represented by the bottom left quadrant. There are a few outliers; 16% of therapists achieved 80% or more on the knowledge test yet failed to meet an average adherence of 80% or more, represented by the top left quadrant on the graph. Conversely a further 16% of staff scored below 80% on the knowledge test yet successfully demonstrated average adherence to procedures at or above 80%, represented by the bottom right quadrant on the graph.



**Figure 9: Relationship between student progress and staff adherence**

Figure 9 shows two sets of data. The bar graph in blue represents the number of teaching sessions each student within the study required to meet criteria for their functional communication phrase. Criteria for the purpose of this graph are defined as criteria for the thinning phase. As noted in the procedure section the intermittent phase has no set mastery and continues to be implemented as long as the functional phrase is required. The intermittent data is not included in this data to ensure criteria for all students are comparable and equal in measurement. The students who have completed the thinning phase are able to use the communication phrase independently, in the absence of challenging behaviour and accept when this phrase cannot be reinforced with the support of a visual. The red dots represent the average treatment integrity for all staff working with each individual student. For each adherence check with a specific student the percentage accuracy was totalled up and divided by the number of adherence checks to provide an average adherence per student. All of the students, except 4, successfully achieved criteria for their specific FCT phrase. Students required an average of 47 teaching sessions, with 80% or higher treatment integrity, ranging from 18-177 sessions. The 4 students whom did not meet criteria were students 7, 12, 13 and 15 in the above graph. Students 7 and 12 transitioned to a new school setting before meeting the prescribed mastery. For student 13 the FCT procedures were put on hold to focus on the pre-requisite skills of communication and requesting. This student displayed significant, intense, challenging behaviours and had minimal spontaneous communication; based on the slow progress (this student did not meet criteria for errorless phase despite 190 training sessions) the FCT was put on hold while basic requesting was worked upon. Student 15 is in the intermittent phase, she has nearly met criteria however variability in her behaviour means she requires more consistent success in accepting the end of reinforcement before this can be considered achieved.

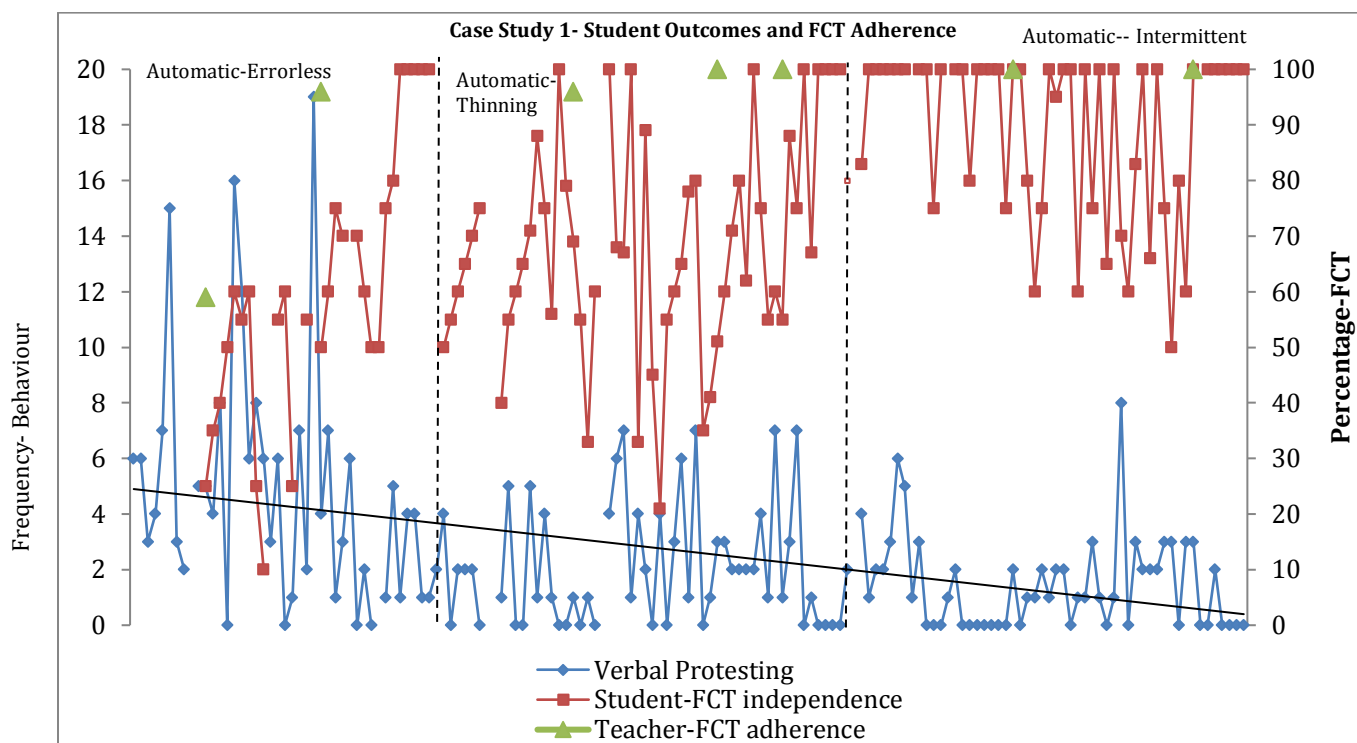


Figure 10: Case Study one

Figure 10 shows a sample case study for one student within the research project. Data were collected from April 2016 through to November 2017 on frequency of behaviour engagement and achievement of FCT mastery.

The blue line represents engagement in the target behaviour of verbal protesting. Engagement in challenging behaviour can be seen to decrease from an average of 6 instances per day, ranging from 2-15, in April 2016, to an average of 1 per day ranging from 0-2 in March 2017. The trend line on this graph represents the reduction of the target behaviour.

The red line represents correct usage of the FCT phrase “stop”. Phase one, errorless teaching, represents the students’ independent use of the phrase as a percentage of correct responses. Phase two represents the students’ appropriate acceptance of a denied request at the end of the reinforcement period. Data is graphed as a percentage of appropriate acceptances; the student was taught to accept when “stop” cannot be granted with the use of visuals and proactive supports for the teaching of flexibility and coping strategies.

Phase three represents the students’ maintained levels of appropriate acceptance once the visual supports were removed. Data is graphed as a percentage of appropriate responses to being told “no”, “not yet” or similar. The student can be seen to steadily and slowly move through each phase to criterion.

The green data points represent adherence checks for teaching staff working with student 1 during this teaching process. Adherence for FCT implementation with Student 1 averages 93% accuracy over 7 observation sessions.

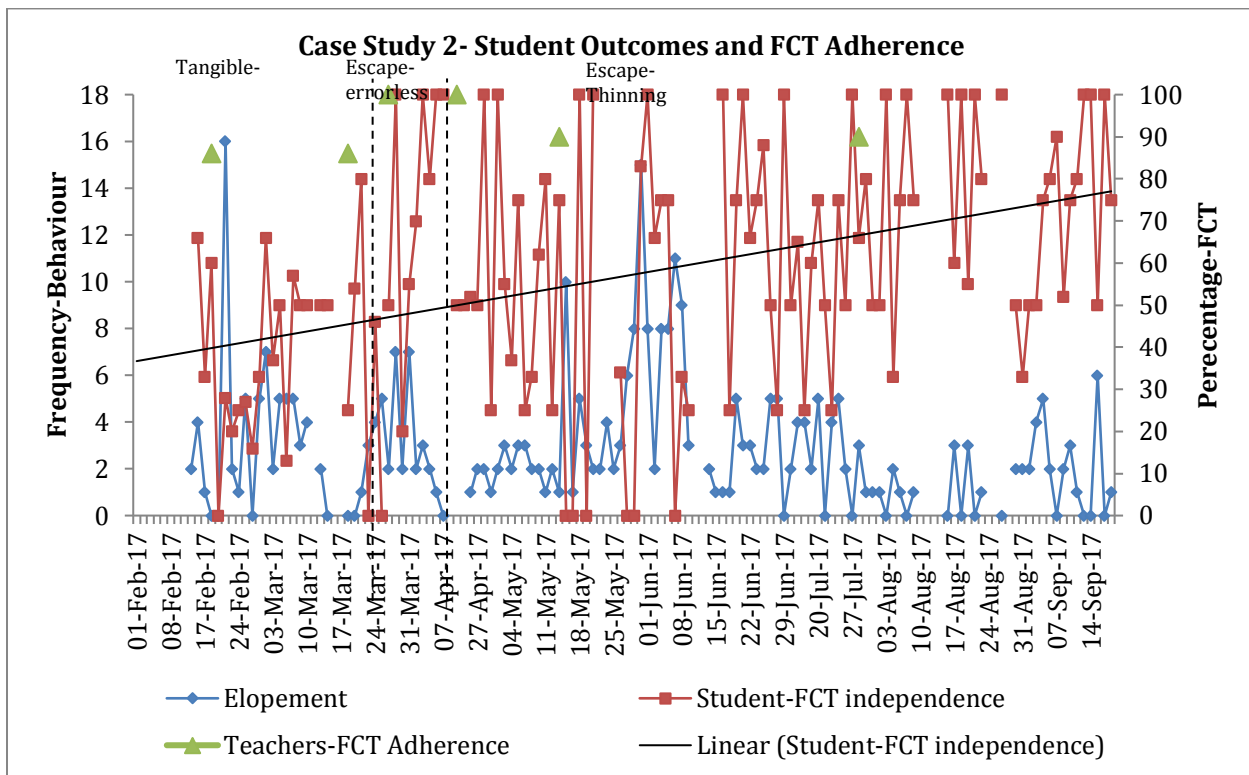


Figure 11: Case Study two



Figure 11 shows a sample case study for a second student within the research project. Data were collected from January 2017 through to November 2017 on frequency of behaviour engagement and achievement of FCT mastery.

The blue line represents engagement in the target behaviour of elopement. Engagement in challenging behaviour remains variable however does show an overall decrease from an average of 4 instances per day in January 2017 to an average of 1 instance per day in November 2017.

The red line represents correct usage of the FCT phrase. Phase one, errorless teaching, represents the students' independent use of the phrase "one more minute" as a percentage of correct responses, mastery criterion for this phrase was not met. Since the student was not progressing through the errorless phase as expected the function of behaviour was reassessed. Initially the function of behaviour was believed to be tangible; to access a specific item or activity. However, further analysis revealed the function was not tangible but attention; the student was leaving the desk to join in fun activities with her friends. Based on the new identified function the request "one more minute" was not functionally equivalent; it did not give access to what the student was seeking.

Phase two represents a change in procedure to focus on a different functional communication phrase, a new phrase "let's play" was introduced and the student quickly met criteria. Data represents the percentage of correct responses. This quick acquisition of the new phrase supports the hypothesis that the original request was incorrect/ did not meet the same needs for the student. In contrast the new phrase provided the student with the outcome she was seeking and was therefore a functionally equivalent replacement to the target behaviour.

Phase three represents the students' appropriate acceptance of a denied request at the end of the reinforcement period. Data is graphed as a percentage of appropriate acceptances; the student was taught to accept when "let's play" cannot be granted with the use of visual supports. The student is still working on this phase. As depicted by the trend line correct responding for FCT continues to slowly increase however the designated mastery criterion is yet to be achieved. The green data points represent adherence checks to teaching staff working with student 2 during this teaching process. Adherence for FCT implementation with Student 2 averages 92% accuracy over 6 observation sessions.

It is important to note in both case studies one and two the relationship between challenging behaviour and communication. For both case studies as the students' communication increases through the FCT process their challenging behaviour can be seen to decrease. This supports the hypothesis that challenging behaviours are related to deficits in communication skills; learning a new functional communication phrase decreased the engagement in challenging behaviour. It is also important to note that teacher adherence was high in both case studies. In case study one the first teacher adherence score was lower (59%) and that after this feedback teacher adherence for the rest of the measures was at 90% or above. Case study two represented 80% and above adherence throughout the project. This supports the research hypothesis that high levels of teacher adherence are related to improved student outcomes – teachers' ability to implement the procedures as designed will have improved the students' ability to learn the new skill.

# Discussion

The original aim for the research project was to answer the following three questions:

1. What are the measurable outcomes of students when receiving FCT?
2. Is adherence in FCT implementation important to these student outcomes?
3. If adherence is important to student outcomes, which dimensions of adherence seem most important?

The measurable outcomes of FCT, for students, are the acquisition of the new communication skills and the associated decrease in challenging behaviour. All students whom participated were measured on their ability to learn the new communication phrase and on the corresponding decrease in the challenging behaviour. Data shows that 75% of students learnt the new communication skill. This supports the hypothesis that it is possible to implement FCT procedures within a school setting and demonstrates that this implementation has a positive impact on student outcomes; specifically reducing challenging behaviours.

Interestingly of the students who met criteria, those with the most significant challenging behaviours, (students 2 and 6 in figure 9) required the most training sessions to learn the FCT phrase. For these two students behaviours were high in frequency, long in duration and often intense in nature. It is possible these students took longer to learn the new phrase because the behaviours were so disruptive to their overall learning and engagement in the classroom.

Challenging behaviours are often cited as a reason students with disabilities cannot learn within a regular classroom environment. Challenging behaviours inhibit the students' ability to learn and participate within that environment and are disruptive to their peers learning. The ability to support students with disabilities within the regular classroom, reduce their challenging behaviour and increase their learning opportunity opens to door to greater integration and inclusion of student. A simple tool, such as FCT, could support such aspirations within the educational system.

Case study one demonstrated a negative correlation between increased communication skills (achievement of phrases taught within FCT) and decreased challenging behaviour (reduction of verbal protesting). This supports previous research and findings that students with improved communication skills exhibit less challenging behaviours. By teaching the new communication skill the researchers were able to effectively and consistently decrease the challenging behaviour. Adherence scores for teaching staff whom worked with this student were consistently above 60% with an average of 93%. The high teacher adherence for this student means procedures and teaching strategies were consistently implemented. It can be assumed that the students' ability to learn the new skill is a result of the consistency and integrity in teaching. However, it is not possible to definitively support this claim as we do not have a low adherence comparison group; this will be discussed in more detail later.

Case study two further demonstrated a negative correlation between increased communication skills and decreased challenging behaviours, however these scores were more variable for this student As noted previously the FCT phrase required amending for this student at the beginning of the teaching process. The inaccurate assignment of the function initially may have resulted in the slower progress in phase one of intervention. This is supported by the data showing that as soon as the new phrase

was identified the student quickly made progress and achieved mastery for phase one with the new communication phrase. Other extraneous variables associated with this student in particular include the introduction of a new speech device and the commencement of a new school placement. The student began her attendance at Woodbury in January 2017 when the research project was introduced. It is common among many students to experience a period of adjustment during a new school placement and slower learning and increased challenging behaviours during this time can be expected. Additionally the student was provided with a new speech device during the first term of schooling; while the device in the long term offers a larger vocabulary and better user-friendly interface it did require the student to learn how to use and access this device and this may have impacted the learning of the functional communication phrase too.

The hypothesis that teacher adherence to procedures has a positive impact on student outcome is supported within these findings. Adherence to FCT procedures is important to student outcomes. Data shows that the training procedures were successful in providing the teaching staff with the relevant knowledge to implement FCT procedures effectively. 72% of staff achieved a score of 80% or higher on the post-training knowledge test which suggests a good understanding of the basic principles of FCT and how it is implemented.

Overall, 93% of students received FCT procedures with an average adherence of 80% or higher. Of these students 78% were able to successfully learn the new skill. There was only one student who did not receive an average adherence of 80% or more and this student did not meet criteria for FCT (student 7 on figure 9). However, there were also 3 other students whom did not meet criteria and all of these students received teaching opportunities with 80% and above adherence to procedures. It is not possible to separate individual student differences from treatment integrity within this study. A formal control group with low treatment integrity or no treatment at all would be required to compare student outcome for this group in comparison to a high treatment integrity group. While some students who had high treatment integrity failed to meet criteria others moved quickly through the teaching phases.

For the purpose of this study it was assumed that high adherence to procedures was dependent on high knowledge test scores and vice versa; you need to understand the procedures to implement them effectively. However, high scores on a knowledge test did not always relate to high quality adherence when putting the theory into practise. Theoretical training and the provision of knowledge alone is not enough to ensure high quality intervention and teaching. Using the measurement tool provided valuable information in relation to the teachers' ability to effectively implement their knowledge within the classroom. This evaluation can then be used to identify areas which require further support and coaching therefore allowing supervisors to ensure consistent and effective application of their procedures.

The measurement tool was most valuable during the feedback process as supervisors were able to identify specific errors which allowed for more individualised coaching and changes to training. Improved adherence of group two, in comparison to group one, is evident by the decreased feedback provided for group two. This suggests that the amendments made to training were effective in improving adherence. However, it is not possible to isolate the changes in training from other extraneous variables. While the staff were randomly assigned to groups one and two it is possible that individual differences between the groups would have meant group two scored better, required less feedback or had higher adherence regardless of the changes made to the training.

In addition to demonstrating the importance of adherence in general, the measurement tool allowed the researchers to pinpoint which dimensions of adherence are most important. Some consistent errors in implementation were highlighted during the group one adherence checks and resulted in changes to the training for group two. Figure 6 and 7 show that recognising a student's motivation required most feedback. Teaching staff need to be able to deduce the student's motivation in the moment, set up opportunities to teach *and* prompt the new communication skill. This one dimension of FCT could be considered the most important in relation to learning the new communication strategy quickly, effectively and efficiently. The measurement tool provided valuable information in this dimension, specifically in the common errors teaching staff were making within its implementation. Identifying these errors allows for discussion, collaboration and adjustments to be made to ensure high quality learning opportunities for students.

This point was highlighted in the difficulties faced within case study 2. The measurement tool was valuable in picking up the procedural error, allowing the researchers to analyse the problem and make changes accordingly. Despite 80% adherence to the written procedure for phase one with this student the student was still unable to learn the new communication phrase. This highlights another use for the measurement tool, the ability to rule out procedural inaccuracies with the tool allowed the researchers to further analyse what the problem was within the learning environment and to make changes accordingly.

While the treatment tool was used for FCT within this study the tool could be adapted to provide a measurement for treatment integrity across a variety of interventions and teaching strategies. Further research into the application of the measurement tool to other interventions would be beneficial. Specifically a focus on how to improve the correlation between knowledge and adherence would be valuable; potentially looking into self-evaluation or self-monitoring alongside the measurement tool would provide opportunity for greater personal reflection and improvement.

## Conclusions

As one of the first research projects in the field of treatment integrity and classroom application of FCT this study has made some valuable findings in relation to best practices for FCT. However the research does pose some limitations and identifies areas for future research.

Firstly, as an educational setting (rather than a clinical setting) the research design was not as well implemented as it could be. Based on the schools ethical and moral responsibility to provide the best educational opportunities to its students there is no real baseline for comparison within this study. It is not possible to draw comparisons between student outcomes (improved communication and decreased challenging behaviour) for high adherence interventions, low adherence interventions and no interventions at all. It would be unethical to withhold intervention for the sole purpose of providing a sound research outcome; However it would be interesting to compare student outcomes across these comparisons to allow significant correlations to be drawn in relation to the importance of high treatment fidelity.

It is also not possible to draw comparisons between staff knowledge before and after training as no pre-test was provided. Therefore it is not possible to determine how much of this knowledge the trainees already possessed.

Future replication of this study could benefit from a pre-test as it would allow comparison to be drawn between pre and post test scores therefore demonstrating the efficacy of the training in provision of knowledge. Also a pre-test could help guide the theory training and would allow a trainer to select the relevant sections of the training (i.e. those that were consistently scored lower in the pre-test) allowing the training to be time efficient and tailored to individual needs.

Secondly, the sample size within this study is small and not representative of the general Australian education system. As a small school with only 16 students and 19 teaching staff the sample size was limited making it difficult to draw conclusions and generalisations for the findings.

Not only was the sample size small it was limited to a specific set of students and teachers. Students who attend Woodbury often present with significant impairments in communication and social skills as well as intense challenging behaviours. The teaching ratio in Woodbury is typically higher than other special education settings and the teaching procedures and interventions utilised to teach these students will vary greatly from procedures used to teach other students with developmental or social delays.

The teaching staff included in this study present a unique set of skills as a direct result of the intensive in-house ABA training provided to all new employees. The outcome of this study will have been impacted by the existing ABA knowledge which all teaching staff possesses; the way in which the interventions were implemented could be affected by the teaching staff's prior knowledge of the intervention and their intervention style may differ from those with other educational backgrounds.

These limitations raise the question; if the measurement tool was trained and utilised in a different, special education setting, would similar outcomes be achieved? The research team hopes to expand the current study through connections with other special education providers. It is our aim to provide the FCT training and measurement tool to other schools within the area to allow us to broaden our research and to provide a positive teaching opportunity for other students and teachers. Applying the measurement tool and training to other settings will allow us to analyse how the teaching practises may need amending for different client groups, how the training procedures may need amending for different teaching styles and pedagogies and how the intervention procedures may need amending based on different staffing ratios and classroom environments.

Thirdly the ability to isolate and manipulate dependent and independent variables within a school setting is difficult. Within our setting individual students are taught by at least three teaching staff in any one day meaning it is not possible to isolate the high quality adherence and knowledge of one staff member in relation to the improved learning of a specific student. While most of our staff showed adherence and knowledge rates at 80% or above there were a few whom did not meet this criteria. Those staff with below 80% accuracy worked directly with the students on the same schedule as those with higher accuracy meaning each student will have received a combination of high and low treatment integrity. Additionally there are multiple factors, aside from the treatment integrity, which could affect student learning. These include but are not limited to; learning style, intensity of challenging behaviours, communication abilities, motivation, age, cognitive ability and the overall focus of the individual's education plan.

As an ABA school a variety of proactive strategies are implemented within a student's positive behaviour support plan to ensure quick and effective decrease in challenging behaviours. This

practise provides the best possible outcome for students but places limitations on the scope of this research study since multiple independent variables are implemented simultaneously. Most students in the study had attended Woodbury for 2 or more years meaning multiple interventions had been put in place prior to this research study.

It is not possible to determine if this research study alone was the reason for improved outcomes or if other proactive strategies, accumulation of strategies and intervention over time or individual student differences had an impact upon student outcomes.

The researcher's intention to broaden this study to other school environments will support in answering some of these questions. Implementing FCT in non-ABA environment will allow the researchers to isolate the impact of FCT, without other proactive ABA interventions, on student outcomes. Implementing FCT in a pre-school or kindergarten class would allow for the opportunity to isolate FCT without accumulation of intervention over time in relation to student outcomes.

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