

Intensive Behavioral Intervention in a School Setting for Ten Years

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The current study presents case studies of two children diagnosed with autism spectrum disorder (ASD) who received an intensive behavioral intervention in a school setting for ten years. The participants received intensive applied behavior analysis within the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) system following curricular objectives from an empirically validated assessment tool and curriculum, the Preschool Inventory of Repertoires for Kindergarten (PIRK®). An initial PIRK® assessment was carried out when the children entered the school setting and this was followed-up at three years and ten years. Progress was measured by the completion of PIRK® objectives and was described in terms of academic skills, communication skills, social skills, self-help skills, play skills and physical development skills.

Key words: CABAS®, PIRK®, assessment, learn unit, TPRA, autism spectrum disorder, repertoire

There have been many studies demonstrating the effectiveness of early intensive behavioral intervention for children with autism spectrum disorder (ASD) (e.g., Matson, Benavidez, Compton, Paclawskyj & Baglio, 1996), but fewer that focus on older children with a diagnosis of ASD and even fewer longitudinal studies that review children's progress over many years. The main exception is the follow-up study by McEachin, Smith and Lovaas (1993) which reviewed the progress of the children that were involved in Lovaas's (1987) study. Questions have arisen whether applied behavior analysis (ABA) continues to be effective for a longer period of time. Therefore, schools that use ABA can provide an insight into whether progress continues to be made over a child's school life.

Different ABA providers and schools use different assessment tools for their pupils. CABAS® settings use the PIRK® to carry out initial assessments on pupils, to indicate where instruction is needed and to guide the writing of individualized curricula for each pupil.

The PIRK® was developed by Greer and McCorkle (2003) and comprises curricular objectives for teaching repertoires believed to be necessary for a child to succeed in a mainstream reception class. The PIRK® is an empirically validated assessment tool and curriculum which improves outcomes for children with ASD and prepares them for mainstream integration (Waddington & Reed, 2009).

Waddington and Reed (2009) investigated whether using the PIRK® as a teaching curriculum had an impact on outcomes for children with ASD in special schools and on the ability of children to transfer from special to mainstream schools. The first part of their study aimed to test whether children who were taught through the PIRK® curriculum in a special school were more successful, and made better progress, across a range of measures of behavioral and social functioning, than those who were not taught a curriculum based on the PIRK® in a special school.

Two groups of children with ASD participated in this study. The PIRK[®] group consisted of 35 children, aged 5.8-12.4 years, who attended CABAS[®] special schools. The non-PIRK[®] group consisted of 18 children, aged 5.1-17.2 years, who attended special schools that did not use the PIRK[®] curriculum. There was no statistical significant difference between the groups in terms of autistic severity. Participants were assessed at baseline at the start of the school year and a follow-up occurred 9-12 months later (average 10 months) at the end of the school year. The study demonstrated that the children following the PIRK[®] curriculum improved in areas of behavior management whereas children in Local Authority specialist schools made improvements in areas of socialization. Gains were centered on social skills and communication for the non-PIRK[®] children, and in behavioral measures for the PIRK[®] children.

The second part of Waddington and Reed's study aimed to ascertain whether children who had followed the PIRK[®] curriculum performed better or worse when entering mainstream education compared to those children who had not followed this curriculum. Two groups of children diagnosed with ASD participated in this study. Assignment to a group depended on whether the child had been taught previously using the PIRK[®] curriculum. Those who had been taught using the PIRK[®] curriculum were assigned to the PIRK[®] group (12 children), and those who had not been taught this curriculum were assigned to the non-PIRK[®] group (15 children). All participants attended a mainstream school as their primary provision. The results suggested that children who had followed the PIRK[®] curriculum improved in communication skills, behavior and daily living skills (as measured by the Vineland Adaptive Behavior Scale), whereas some children without PIRK[®] preparation made no improvements.

Waddington and Reed suggested that, in terms of potential success in mainstream

schools, some of the skills acquired by those children who follow the PIRK[®] curriculum may be critical. To maintain an inclusive placement, having made improvements in adaptive behavior, suggests that the child is less likely to be excluded from school (Waddington & Reed, 2009).

McGarrell, Healy, Leader, O'Connor and Kenny (2009) presented case reports of six children diagnosed with ASD who received 30 hours per week of intensive applied behavior analysis for 3-4 years within the CABAS[®] system and successfully integrated into full-time mainstream education. The participants' interventions followed curricular objectives from the PIRK[®]. The participants ranged in age from 3 years 10 months to 6 years at onset of intensive behavioral intervention. All had been assessed using the PIRK[®] and had individualised education programmes based on curricular objectives from the PIRK[®]. All participants successfully integrated into mainstream school settings and no longer receive intensive behavioral intervention.

The current study reviews the progress of two children with ASD who also attend a CABAS[®] school and who were also assessed using the PIRK[®]. Their progress is measured by the completion of PIRK[®] objectives across the areas of academic skills, communication skills, social skills, self-help skills, play skills and physical development skills.

Method

Setting

The current study took place at a CABAS[®] school in England. CABAS[®] provides a system-wide application of behavior analysis to all of the components of education for teaching all aspects of curricula. The system has accrued an extensive data base for developing and maintaining quality applications. Some of the components of CABAS[®] include: performance standards of teaching as applied behavior analysis, curricula for teachers and other professionals, research-based tools to train and monitor professionals and curriculum-revisions for

pupils occasioned by the research (Greer, Keohane & Healy, 2002).

Greer (2002) describes the CABAS® teaching system in detail. His focus is on viewing teaching as a science, rather than an art, and therefore replicating teaching across many professionals in a reliable fashion. CABAS® has researched and identified procedures that provide a system for teaching teachers, parents, supervisors and graduate students the repertoires of teaching and the supervision of teachers as a science. The CABAS® system is also used in general education in the USA where the general education applications are referred to as the Accelerated Independent Learner Model or CABAS® AIL.

The Learn Unit

There are several school-wide procedures that are relevant to all the teaching at Jigsaw and are basic components of all CABAS® schools. All instruction in CABAS® schools are measured in learn units (Greer, 2002; Greer & McDonough, 1999). The learn unit is the most fundamental component of teacher-student interactions. It is comprised of interlocking 3-term contingencies between teacher presentations, pupil responses, and teacher consequence of pupil responses. A learn unit does not exist unless all of these components for the pupil and the teacher are present. They are termed learn units because they are the basic units of teaching. That is, unless the appropriate antecedent is learned together with the appropriate response and consequence then the function of the behavior is not learned. Learn units can be scripted by teachers; they can occur incidentally or can be captured across settings. In addition there exists a context in which the learn unit occurs. The context includes variables such as setting events and motivational variables, the instructional history of the individual and what the individual possesses both phylogenetically and has acquired ontogenetically.

Assessment of Quality of Teaching

A performance monitoring procedure is used in CABAS® schools to collect data on pupil and teacher responding and to convert responses to rates of teacher and pupil behavior. This procedure termed Teacher Performance Rate/Accuracy (TPRA) (Greer, 2002; Ingham & Greer, 1992) provides both procedural integrity and inter-observer agreement to the delivery of instruction. The supervisory staff record data on the teacher's antecedent, the pupil's behavior, the teacher's consequence and rate of learn unit presentation. Data are recorded on whether the teacher's antecedent was accurate or inaccurate. To begin, the teacher must ensure that the student is attending (i.e. an establishing operation must be in place) to the teacher before the antecedent is presented and the correct discriminative stimulus is to be presented for it to be counted as a correct antecedent. The supervisor then independently records the pupil's responses to obtain inter-observer agreement on the pupil's responses. Data are then recorded on the teacher's consequence, whether it was accurately reinforced or corrected. Basically, the supervisory staff simultaneously record data on whether the instructional presentation results in an actual learn unit. The 20-learn unit presentation is also timed to convert the responses to rates of teacher and pupil behavior. Ingham and Greer (1992) found that when these performance monitoring measures were in place an increase in both the total number of learn units presented and correct responses to learn units occurred.

A Research-Based School

Alongside these three main tenets of the CABAS® system there are a multitude of tactics in place in CABAS® schools. All tactics draw on the basic principles of behavior and are implemented vis-à-vis the moment-to-moment analysis of student responses. Furthermore, there are several protocols in place that

have accrued an extensive research base in the applied literature (Greer, 2002; Greer & Ross, 2008).

Dependent Variable

Outcome measures of the two participants were determined by progress through the PIRK[®] assessment tool. This is an assessment tool used in CABAS[®] schools to determine which behaviors are present, or otherwise, in a child's repertoire and results in an individualised curriculum being written for that child based on the results. The PIRK[®] is subdivided into six categories: Academic Literacy; Communication; Community of Reinforcers; Self-Management; Social Skills and Physical Development. Table 1 provides a description of each of these repertoires, the number of components that make up each repertoire and some examples of objectives in each repertoire.

Case Study 1: Lee

Lee entered The Jigsaw CABAS[®] School at the age of four. He was diagnosed with ASD at the age of 2.5 and he had been on a full-time ABA home programme prior to entering the school. The PIRK[®] assessment was carried out with Lee at baseline and he did not meet any of the criteria for the objectives in the academic literacy or communication repertoires. He met two components of the community of reinforcers repertoire, i.e. Lee arrived at school without protest and he cried or expressed pain if injured or ill. Lee met nine of the objectives in the self-management area. He could hold a peer's hand in activities requiring hand-holding, put away items and assist in cleaning activities, use a spoon and fork to eat, drink from a cup and use a straw and he could pour liquids without spilling. Significantly, Lee was not toilet-trained on entry to school. Within the social repertoire, Lee met one objective at baseline which was to interact with property appropriately, i.e. he was not destructive. Lee's strength at baseline was the physical development repertoire where 23 out of the 50 components were completed.

Some of these targets met included making marks on paper with a pencil and holding a pencil in standard fashion, manipulating puzzle pieces independently, building a tower with blocks, walking backwards, hopping on one foot 3 times, jumping up and down 10 times and walking on a balance beam for 3 metres.

Three years later, Lee had made progress and completed a number of the PIRK[®] objectives, as shown in Figure 1. He had now met 28 components of the academic literacy repertoire, including matching objects, pictures, abstract shapes, letters, words, numbers, quantities and non-identical pictures. Lee was now able to draw lines to match letters and numbers and he could write letters and his name. He could point to numbers 1-10 and tact 15 common objects at home and school.

In terms of communication, he was now able to follow the direction to sit still, he could follow one-step directions in a group and respond to the question, "How are you?" with "fine."

Over this three year period, several new activities were successfully conditioned with Lee. The stimulus-stimulus pairing procedure, as described by Nuzzolo-Gomez et al. (2002), successfully increased the duration of time Lee played with different resources. He was now able to play with puzzles, play with blocks and look at books for a duration of five minutes. He could imitate teacher behavior therefore providing him with the prerequisites to learn many new play skills. He could also listen to a story in class for a duration of five minutes.

Within the area of self-management and social skills, he would stay in the play area for up to 10 minutes without wandering away, he participated in structured play activities and he could dress himself independently. Significantly, Lee was now fully toilet-trained.

Thirteen further components of the physical development repertoire were mastered over this three year period including being able to use a stencil, draw the outline

Table 1. *Overview of the Six PIRK® Repertoires*

Repertoire	Description	Number of Components	Examples
Academic Literacy	This repertoire includes responding either by classifying relationships between phenomena or by following steps involved in simple or complex operations.	126	Matching objects, discriminating between stimuli, recognising letters, words and numbers, writing name, completing sums and duplicating block structures
Communication	This repertoire is based on a verbal behavior model focusing on listener repertoires, such as following vocal directions, and speaker repertoires, such as responding verbally to either verbal or non-verbal stimuli.	42	Following directions, retrieving objects, manding, tacting and engaging in conversational units
Community of Reinforcers	This repertoire involves expanding a pupil's community of reinforcers	13	Participating in song activities, looking at books, playing with toys and completing colouring activities
Self-Management	This repertoire includes skills that a pupil will require to enter a mainstream school, including self-help skills such as dressing, eating and toileting skills	31	Following the classroom rules and being able to use a fork appropriately
Social Skills	This repertoire refers to the behaviors and the controlling stimuli between the pupil and the teacher or the pupil and his or her peers	28	Turn-taking, sharing and emitting appropriate behavior towards others
Physical Development	This repertoire includes both fine motor skills that are important for school and gross motor skills	50	Holding and using scissors, throwing a ball, jumping

of a person and simple pictures, hold scissors in standard fashion and use a ball appropriately (rolling, throwing, catching, bouncing and kicking).

Figure 1 shows the overall progress Lee has made over the ten-year period. Most progress was made in the area of academic literacy and Lee, aged 14, was able to match words to pictures, points to shapes, add up to 10 and point to a picture of himself.

A further six components of the communication repertoire were mastered including pointing to action pictures, requesting for items using the sentence, "I want ___ please" and he could say "thank-you" appropriately. In addition, Lee mastered a further objective from the social repertoire and ten further objectives from the physical development repertoire.

Figure 2 shows the rate of learning over this ten year period. At baseline, Lee had

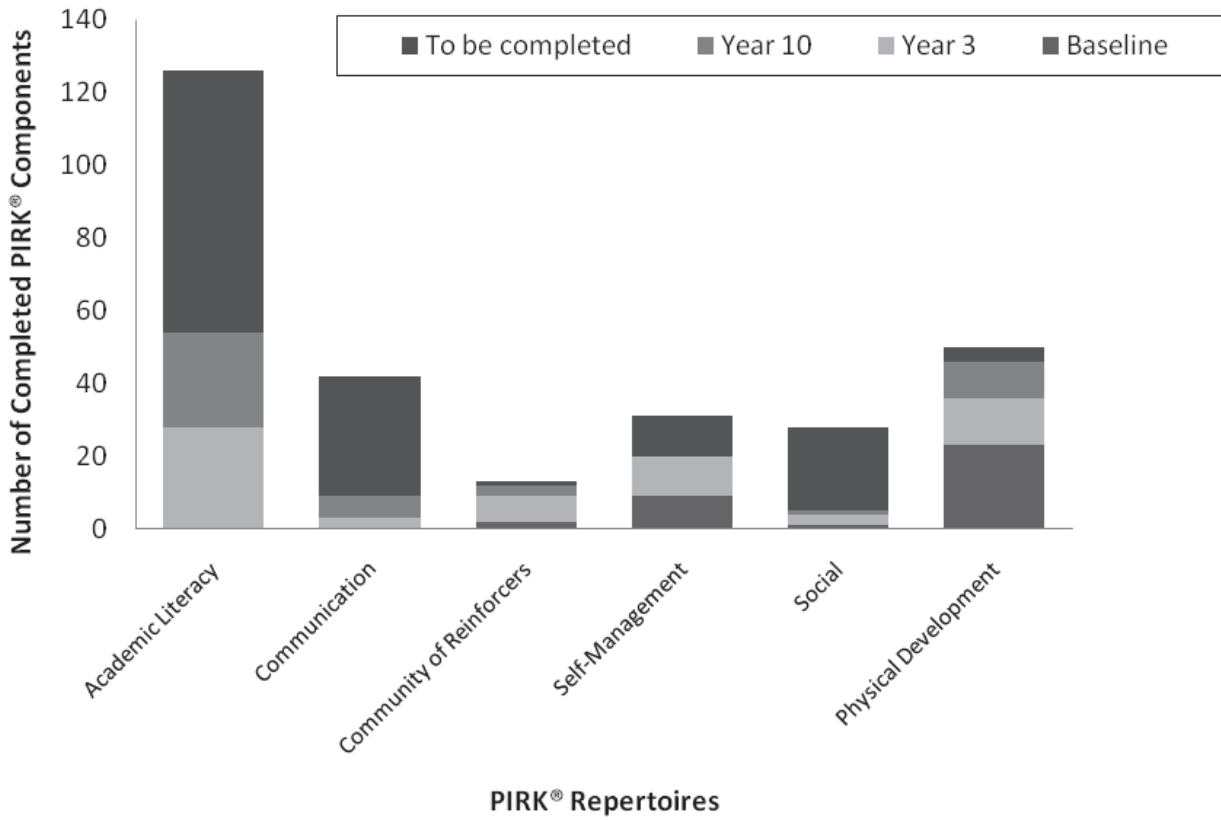


Figure 1. Completed PIRK® Components at Baseline, at Year 3 and at Year 10 for Lee.

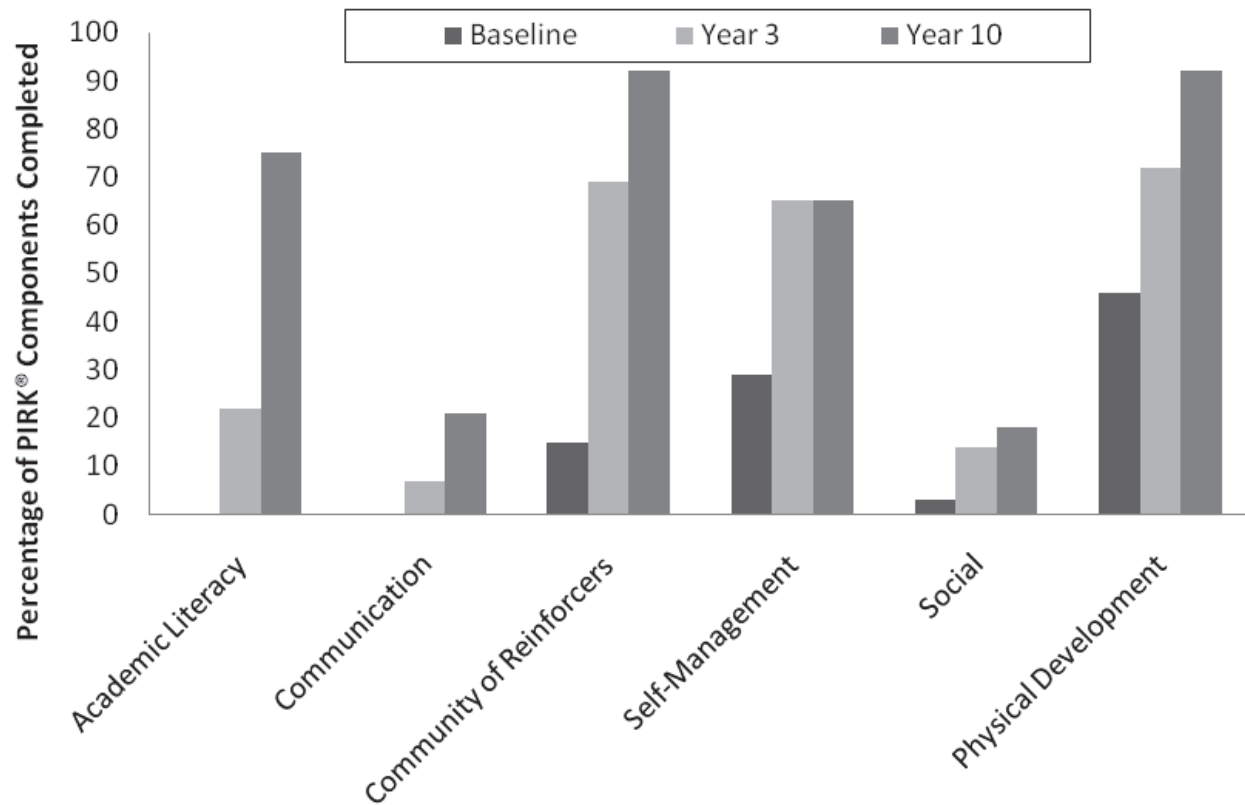


Figure 2. Graph to show the rate of learning across each PIRK® repertoire for Lee.

completed 12% of the PIRK® in total. This increased to 34% at three years and 50% at ten years. The graph shows the rate of learning across each of the repertoires. Most significant progress was made in the areas of community of reinforcers, academic literacy, physical development and self-management. Lee's weaker areas were his communication and social skills.

Case Study 2: Gabriel

Gabriel was a school year older than Lee when he entered The Jigsaw CABAS® School at five years. He has also been on an ABA home programme prior to entering the school setting. At baseline, Gabriel had completed 11 of the objectives in the academic literacy repertoire. He was able to match non-identical pictures, letters and numbers, duplicate block structures and look for hidden items. He could also tact ten common items in a picture and respond to intraverbal questions about animal sounds. Gabriel was fully toilet-trained at baseline and had met 14 of the objectives in the self-management repertoire. He was able to dress himself and feed himself independently. He did, however, emit a high level of self-injurious behavior in the form of hand-biting and a high level of screaming which impacted the learning of other pupils in the school and also interrupted his own learning.

Three years later, as Figure 3 shows, Gabriel had mastered a further 61 components of the academic literacy repertoire, 19 components of the communication repertoire, 10 components of the community of reinforcers repertoire, 3 of the self-management repertoire, 9 of the social repertoire and a further 18 of the physical development repertoire. At this point, Gabriel could write letters and words, to match pictures and on dictation. He could match numbers to quantities, recognise numbers up to 100, read simple stories, add, subtract and tell the time by half hour. He could follow 3-step directions, retrieve objects, mand for help, tact with autoclitics, emit sequels and say common nursery rhymes.

He sat quietly during group activities, interacted appropriately with property, wrote his name and threw, caught, rolled and kicked a ball during physical education activities.

Figure 3 shows the progress made at 3 years and at 10 years. By ten years Gabriel had completed the majority of the PIRK®. He had completed 117 out of 125 objectives in academic literacy, 25 out of 40 in the communication repertoire, 12 out of 13 in the community of reinforcers repertoire, 27 out of 31 for self-management, 16 out of 28 in the social repertoire and 38 out of 50 of the physical development repertoire.

At ten years, Gabriel had met all the reading and writing objectives on the PIRK®. He could answer vocal questions about a story read to him, tell the time to the minute and tact gender. He could use plurals and pronouns appropriately, tact emotions, tie shoelaces and fasten buttons, tact and accurately count target behaviors, identify own personal goals and reinforcers related to these target behaviors, and reinforce himself accurately for personal goals. Most significantly, at ten years Gabriel was no longer emitting any self-injurious behavior or screaming.

Figure 4 shows the rate of learning over this ten-year period. At baseline, Gabriel had completed 8% of the PIRK® in total. This increased to 50% at three years and 82% at ten years. The graph shows the rate of learning across each of the repertoires. Gabriel had completed most of the PIRK® objectives but, similar to Lee, his weaker areas were the communication and social repertoires.

Discussion

Progress was clearly demonstrated for both Lee and Gabriel over this ten-year period. It is worth pointing out that other assessments were used over this time period, e.g. U.K. national curriculum levels, but not for the full ten year period. Long-term objectives were also targeted that were not part of the PIRK®. Therefore lists of long-term objectives met also clearly demonstrated progress made.

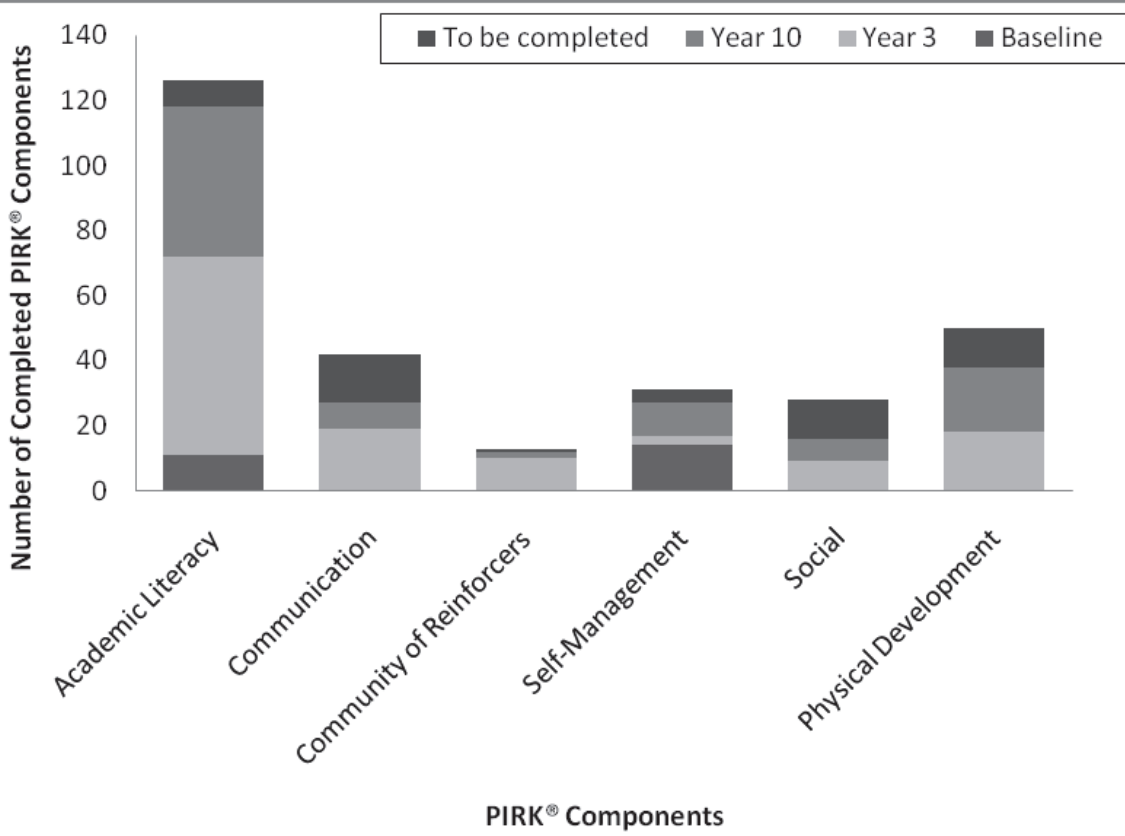


Figure 3. Completed PIRK Components at Baseline, at Year 3 and at Year 10 for Gabriel.

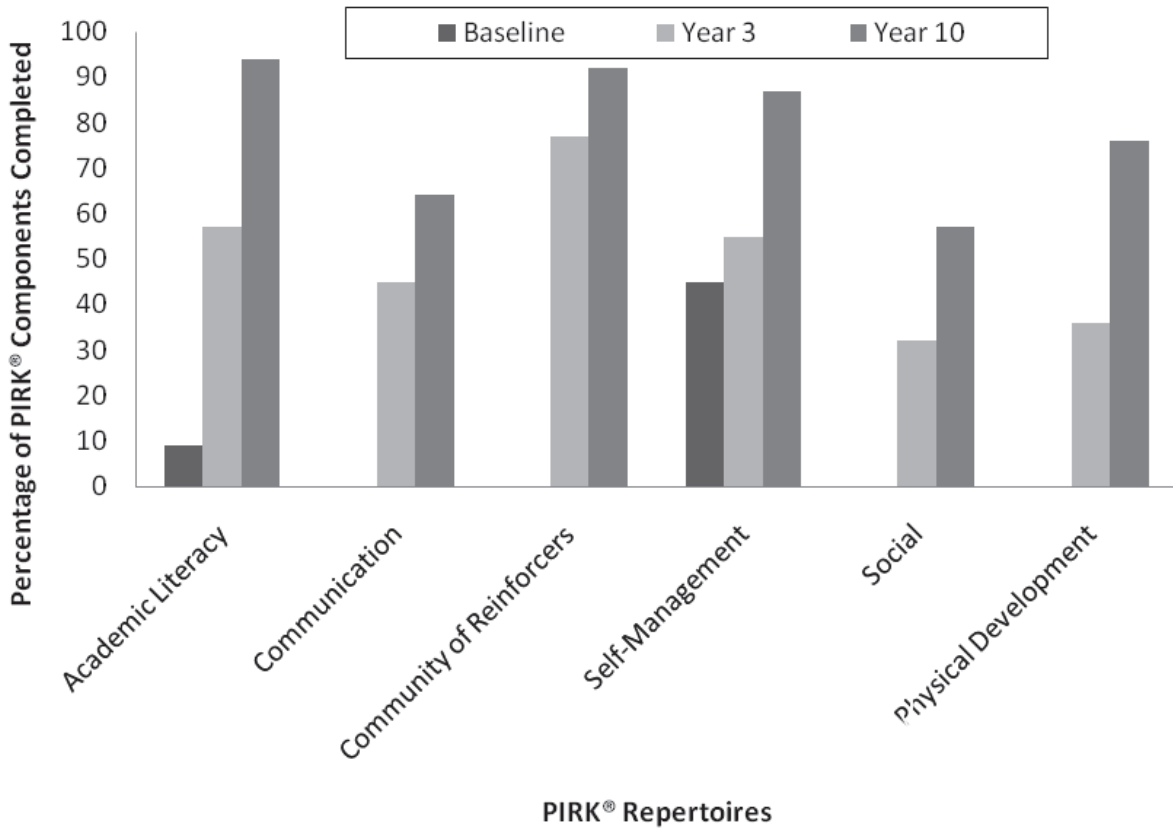


Figure 4. Graph to show the rate of learning across each PIRK repertoire for Gabriel.

All of the pupils in a CABAS® setting are also assessed according to verbal capability pyramids (Greer & Ross, 2008) and both pupils made progress with these as well. The PIRK® assessment was the assessment that was used consistently from baseline to ten year follow-up. As it is also a criterion-referenced objective assessment tool it was deemed the most appropriate measure for demonstrating clear progress.

It has always been difficult to predict how much a child will progress with an intensive behavioral programme and at what age an intervention should begin. These case studies demonstrate that progress can be made and continues to be made over a period of time.

Limitations of this study include the fact that there were only two participants and the data were presented as case studies rather than experimental studies with sound design. The data still adds to the research and shows that progress can be made over a long period of time and not only in the first few years of intervention.

Despite the difference in the amount of progress made, it is interesting that both participants were ultimately weaker in the areas of communication and social skills. Again, future research could determine whether this is the case with a larger group of participants. If so, then future research should also look at how these repertoires can be improved upon so that larger gains are made. Curriculum revisions could be made to allow more time to be spent on teaching these areas of the curriculum.

Future research could also look at whether the initial PIRK® assessment can be a predictor of a pupil's progress. It could be useful to review the data over ten years for other pupils in CABAS® settings.

Despite the limitations of the current study the data does demonstrate clear progress for two boys with ASD over a ten-year period.

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