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Implementing a Classroom-based ABA Model in a Maintained Special Education School in Wales

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ABSTRACT

There is little guidance for teachers about how best to teach young children in SEN schools in Wales. Recent research has shown that teaching based on Applied Behaviour Analysis (ABA) is an effective model for Foundation Phase and Key Stage 1 in maintained special needs schools (Foran et al., 2015; Pitts, Gent and Hoerger, 2019). The current study replicated the model and included curriculum measures (P Scales) typically used by educators and the validated, normed-assessments (MSEL and VABSII) commonly used by researchers. Following the classroom-based ABA model implementation, participants made significant gains on curriculum measures and normed-assessments. The data from all assessments showed statistically significant gains with medium to large effect sizes. This study demonstrates how teachers can utilise behaviour analytic strategies to prepare students with readiness for learning skills essential for accessing the curriculum. This study outlines how techniques based on the principles of ABA can complement educational provision in maintained SEN schools in Wales.

Key words: applied behaviour analysis, maintained special education, classroom intervention, P Scales, autism.

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Introduction

Students with SEN show positive outcomes when they are taught a curriculum that uses the principles of Applied Behaviour Analysis (ABA). In ABA programmes, behaviour analysts conduct a detailed assessment of skills, break learning targets down into small units and reinforce successive approximations of a behaviour. Programmes often teach a curriculum of developmental skills such as imitation, receptive and expressive language, and play behaviours. Children need to acquire these pivotal skills in order to learn from the natural environment. Research has shown that when behaviour analysts collaborate with teachers to develop classroom-based ABA models, students make significant gains in academic, communication, social and play domains (Peters-Scheffer et al., 2013; Grindle et al., 2012; Foran et al., 2015; Pitts, Gent and Hoerger, 2019).

In Wales, it is considered good practice to use ABA techniques in the classroom. The Social Care Institute for Excellence (SCIE) (2019) recommended that interventions based on the principles of ABA, such as discrete trial teaching, direct instruction and pivotal response training are used to teach children with Autistic Spectrum Disorder (ASD).

Foran et al. (2015) described how teachers could incorporate ABA in a maintained SEN school in Wales. In their research, behaviour analysts collaborated with teachers and school leaders to design a classroom model for children in the Foundation Phase and Key Stage 1. The model included five key features: 1) a behaviour analyst supported teachers in the classroom for one hour a week per student; 2) each student had an individual learning plan (ILP) based on skills assessments, and this curriculum included language, social and play skills, and early academic knowledge; 3) classroom staff delivered 1:1 teaching to the student for 5–7 hours a week; 4) every student had a function-based behaviour plan, and 5) time in school was structured so that students had meaningful activities to engage in throughout the day. The students who participated in the model made significant gains on standardised measures of IQ, adaptive behaviour, and in academic, communication, social and play skills.

The evidence for including ABA in the classroom is promising, but more needs to be done to translate research findings to practice. Evidence-based interventions developed by researchers are not always adopted in SEN classrooms (Malouf and Schiller, 1995). Researchers often use measures that are not relevant to teachers and school leaders, and should consider reporting findings in a way that is meaningful to the target

audience, in order to increase the dissemination of evidence-based practices (Rogers, 2003).

In SEN schools, educators use curriculum measures such as P Scales to monitor and report student achievement. The current study aimed to replicate the classroom-based ABA model in a maintained SEN school in Wales, and to consider student outcome using both the curriculum measures typically used by educators and validated assessments used by researchers to evaluate gains made by participants. We hypothesised that participants would make significant gains on curriculum measures and normed-assessments following classroom-based ABA model implementation.

Method

Participants

The study was conducted in a Key Stage 1 classroom in a maintained SEN school. Thirteen students (two females, eleven males) participated in the study. The mean age of participants was 62 months (range 52–75 months). All students had an intellectual disability and a range of additional diagnoses, including ASD, Global Developmental Delay (GDD), Down Syndrome and Spina Bifida with Hydrocephalus.

Measures

Performance scales (P Scales)

The school used P Scales as their standard curriculum measure, and B-Squared (B-Squared, 2015) to track the progress of students on P Scales. P Scales were designed to assess and describe the performance of students aged five to sixteen who achieve below the standards of the national curriculum (Department for Education, 2017). The classroom teachers completed the P Scales assessment for each participant before the intervention (pre-test) and ten months later (post-test). B-Squared data were collected on the following subject areas: reading, writing, receptive and expressive communication, number, measurement, geometry, science, art design, citizenship, computing, music, PE, PSHE and self-help. The scores from reading, writing, receptive and expressive communication were averaged to form the meta-domain of 'English/Welsh'. Number,

measurement and geometry were averaged to form the meta-domain of 'mathematics'. The Welsh Department for Education and Skills announced plans to replace level testing but had not done so at the time of this research.

Mullen Scales of Early Learning (MSEL)

The MSEL (Mullen, 1995) is a manualised, standard measure used to assess ability in areas of receptive communication, expressive communication, visual reception and fine motor skills in children from birth to 68 months. The MSEL provides a standard t-score, which is often not suitable for children with intellectual disability, who sometimes score below the floor of 20. Therefore, Developmental Quotient (DQ) scores are commonly used in research to assess and evaluate the progress of students with intellectual disability (Dawson et al., 2010, 2012). We calculated the DQ by dividing a student's Age Equivalent score by their chronological age and multiplying by 100. A student who is on a stable developmental trajectory will not show changes in DQ scores over time, because their age equivalent score will change in proportion to their chronological age. Students who gain skills faster than expected will display an increase in DQ scores. Trained researchers administered the MSEL according to standard procedures in a small room adjoining the classroom.

Vinelands Adaptive Behaviour Scales – Second Edition (VABSII)

The VABSII was used to assess adaptive behaviour (Sparrow, Cicchetti and Balla, 2005). The VABSII is conducted as a semi-structured interview; the primary researcher administered the VABSII in face-to-face meetings with classroom teachers. The VABSII is a standardised and norm-referenced assessment that produces overall adaptive behaviour composite scores, standard scores and age equivalents for communication, daily living skills, socialisation and motor skills.

Procedure

Classroom-based ABA model

The procedure for implementing the classroom-based ABA model was a replication of the procedure detailed by Foran et al. (2015).

1. A behaviour analyst collaborated with classroom staff to design and implement an ABA curriculum

A Board Certified Behaviour Analyst (BCBA) collaborated with a multi-disciplinary team to conduct assessments and design individualised learning and behaviour plans for participants. The BCBA delivered theory-based training on behaviour analytic interventions that included topics such as how to build rapport with students, conduct preference and reinforcer assessments and how to implement behavioural teaching strategies across the day. The BCBA spent thirteen hours per week across two classrooms, which was an average of one hour per pupil per week. During this time, she modelled ABA teaching techniques and provided feedback and ongoing supervision to the teaching team. She updated the behaviour and teaching plans and analysed data to measure the ongoing effectiveness of the intervention. Teachers organised materials and managed the implementation of programmes in the classroom. The behaviour analyst in this study had been working in the field of ABA and education for over three years but had no previous experience of working with early learners in maintained SEN settings. Behaviour analysts qualify by completing a taught MSc course, 2,000 hours of supervised practical experience and passing a qualifying exam. A Board Certified Behaviour Analyst – Doctorate (BCBA-D) supervised the behaviour analyst responsible for implementing the classroom-based model in this study. The Behaviour Analyst Certification Board (BACB) is a non-profit organisation which sets the professional standards behaviour analysts must meet to be accredited as Board Certified Behaviour Analysts (BACB, 2018). A BCBA-D is a BCBA who has additional training in behaviour analysis to a doctoral level. The first teacher in this study had more than five years' experience working with students in SEN settings. The second teacher was newly qualified and participated in this study during their induction year.

2. Each student had an ILP based on a developmental curriculum

The Assessment of Basic Language and Learning Skills-Revised (ABLLS-R) (Partington, 2006) was used as a curriculum alongside the P Scales. The ABLLS-R is a developmental curriculum that includes 544 skills from twenty-five areas such as language, social interaction, academic, self-help and motor skills. The items assessed within each domain are organised from simple to more complex skills. The behaviour analyst

assessed each child using the ABLLS-R at the start of the study, and the assessments informed the weekly targets. The behaviour analyst reviewed participant progress weekly and incorporated new targets into ILPs when current targets were mastered. For example, initially, an ILP target might be to 'Follow instructions to go to a person'. Students had an average of about thirty targets each week.

3. Each child received 5–7 hours a week of 1:1 teaching

Staff used direct instruction strategies to teach the individual learning targets. Teachers and classroom assistants worked 1:1 with each child for an average of one hour per day, using techniques such as discrete trial (DTT) and Natural Environment Teaching (NET). In DTT, the teacher provides clear and specific instructions and distractions are minimised. At the beginning of teaching a new skill, teachers provided reinforcement after each correct response and then fade reinforcement, so the behaviour becomes reinforced by the natural environment. The teaching team used error correction and prompts to facilitate learning (Kodak and Grow, 2011). The teaching team taught each skill until the student met a pre-specified mastery criteria (80 per cent correct across three days, with at least two different teachers).

4. Each student had a function-based behaviour plan.

The BCBA conducted functional assessments to better understand why students engaged in behaviours that challenged. The most common functional assessments were direct observations of the antecedents and consequences of the behaviour, and interviews with key stakeholders including teachers and parents. The most frequent causes of challenging behaviour were escape, attention and because the child lacked the communication skills to request what they wanted. Functional assessments informed the behaviour plans. In a typical behaviour support plan, the teachers encouraged a replacement behaviour that served the same function as the inappropriate behaviour. For example, when assessment identified that a student engaged in challenging behaviour to access a preferred item, the teaching team used prompts and reinforcement to teach the student to request the item appropriately. Self-stimulatory behaviours were not targeted as behaviours to decrease, and the behaviour analyst never recommended punishment or extinction procedures. The behaviour

analyst provided ongoing training and support for all of the staff to ensure fidelity and consistency of behaviour plans.

5. Time in school was structured so that each student had meaningful activities to engage in throughout the day

Teachers scheduled 1:1 and group activities continuously throughout the day. Teaching activities included compulsory curricular activities such as Welsh language, literacy and numeracy. During 1:1 and group lessons, teachers targeted behaviours such as on-task engagement, independent requests for help to complete tasks, the appropriate use of activity materials and being able to tolerate waiting, for example, turn-taking/waiting for their turn to participate in a group activity. Targets from ILPs were incorporated into activities across the day and taught via NET to promote generalisation. NET emphasises child-directed interaction, and generalisation of skills from 1:1 or group teaching sessions to the natural environment (LeBlanc, et al., 2006). For example, if a student had a target of increasing their use of pronouns, during a painting activity the teacher presented options of utensils (e.g. paint brushes) and asked: 'Which one do you want?' The student was taught to respond 'this brush'.

Reliability and validity

Inter Observer Agreement (IOA) is a procedure for enhancing the reliability of data that involves comparing independent observations from two or more people of the same events. Exact agreement IOA was computed by calculating the percentage of items in an assessment in which independent observers agreed exactly on scored responses. Exact agreement for the MSEL was collected by trained assistant behaviour analysts on 25 per cent of assessments across pre- and post-tests and produced 100 per cent agreement. Exact agreement was collected across 30 per cent of pre- and post-tests for the VABSII and produced 100 per cent agreement. Exact agreement was collected for 30 per cent of pre- and post-tests for the P Scales and yielded 98 per cent agreement.

Results

Researchers analysed the P Scale, MSEL and VABSII data to measure the gains the students made following the classroom-based ABA model. A Wilcoxon Signed Rank Test was used to analyse changes from pre-test to post-test. The Wilcoxon Signed Rank Test is designed for analysis of repeated measures. It is the non-parametric equivalent to the paired samples t-test and was used because the current data did not meet the assumption of normality criteria to run a t-test. The output of the Wilcoxon generates a Z value and associated significance levels. If the significance level (the p-value) is equal to or less than .05, researchers may conclude the difference between pre-test and post-test was unlikely to be caused by chance. Effect sizes were calculated following procedures outlined by Pallant (2007). Effect size criteria were applied using Cohen's (1988) criteria of .1 = small effect, .5 = medium effect and .8 = large effect.

P Scales

Wilcoxon Signed Ranks Tests revealed statistically significant increases for all subjects assessed by the P Scales at post-test. There were increases in the median scores (*M*d) from pre-test to post-test across all subjects, and Cohen's criteria indicated medium to large effect sizes for all subjects (Table 1).

MSEL

The mean gain in age-equivalent months on the MSEL was 22.33 for visual reception, 12.49 for fine motor, 15.58 for receptive language and 11.02 for expressive language. Statistically significant gains were observed for the Developmental Quotients (DQ) across all four scales of the MSEL. Medium to large effect sizes were found for all scales when applying Cohen's criteria (Table 2).

VABSII

Statistically significant increases in the means were detected for the VABSII subscales of Communication (Z = -2.76, p<.01), Daily Living Skills (Z = -2.90, p<.01), Socialisation (Z = -2.74, p<.01), Motor Skills (Z = -2.34,

Table 1. Wilcoxon Signed Ranks Test results for median P-Scale scores after ten months' intervention

Measure	N	Pre-test *Md*	Post-test *Md*	Z	P	Effect size
English/Welsh	13	113	177	-2.34	.019	$r = .65$
Mathematics	13	53	111	-3.20	.001	$r = .88$
Science	13	53	111	-2.22	.026	$r = .61$
Art design	13	22	44	-2.55	.011	$r = .70$
Citizenship	13	119	179	-2.00	.045	$r = .55$
Computing	13	24	62	-2.28	.022	$r = .63$
Music	13	32	61	-2.53	.011	$r = .70$
PE	13	29	68	-2.58	.010	$r = .71$
PSHE	13	120	180	-2.28	.023	$r = .63$
Self help	13	137	163	-2.02	.043	$r = .56$

Table 2. Wilcoxon Signed Ranks Test results for median MSEL scores after ten months' intervention

Measure	N	Pre-test *Md*	Post-test *Md*	Z	P	Effect size
MSEL visual reception DQ	13	18.00	43.47	-3.18	.001	$r = .88$
MSEL fine motor DQ	13	34.32	40.00	-2.69	.007	$r = .74$
MSEL receptive lang. DQ	13	3.92	23.33	-3.11	.002	$r = .86$
MSEL expressive lang. DQ	13	22.95	36.50	-2.48	.013	$r = .68$

$p<.05$) and Adaptive Behaviour Composite ($Z = -3.06$, $p<.01$). Medium to large effect sizes for all scales when applying Cohen's criteria were also indicated (Table 3).

Table 3. Wilcoxon Signed Ranks Test results for median VABSII scores after ten months' intervention

Measure	N	Pre-test *Md*	Post-test *Md*	Z	P	Effect size
VABS comm.	13	42.00	57.00	-2.76	.006	$r = .76$
VABS daily living	13	53.00	62.00	-2.90	.004	$r = .80$
VABS socialisation	13	53.00	63.00	-2.74	.006	$r = .75$
VABS motor skills	13	56.00	61.00	-2.34	.019	$r = .64$
VABS adaptive behaviour	13	49.00	58.00	-3.06	.002	$r = .84$

Discussion

The results of this study confirmed the hypothesis that students will make significant gains on curriculum measures (P Scales) and normed-assessments (MSEL and VABSII) after one school year participating in the classroom-based ABA model. Significant gains were detected in the teachers' assessments as well as these standardised and norm-referenced assessments, which indicate meaningful improvements across a range of developmental domains.

P Scales were designed to be summative assessments. However, the continuous focus on levels throughout the academic year might lead educators to focus on tracking and teaching students to progress through levels, which may influence teachers to focus on the linear progress of all students, rather than their development of individual strengths and weaknesses. Educators are encouraged to incorporate a range of measures to better assess for meaningful gains in students, for example, benchmarking with standardised tests (Donaldson, 2015). As previously discussed, the MSEL and VABSII assessments are used and identified as appropriate for testing early learners within intellectual disability. The MSEL and VABSII come with instructions and clear marking criteria: all participants are tested on the same items, in the same way, and scoring is done in a standard and consistent manner. In addition, reliability and validity checks for conducting assessments in this study were performed which enhanced the reliability of results. The results of these standardised assessments may offer important benchmarking information for educators of this population, as recommended by Donaldson (2015).

The MSEL and VABSII are normed assessments that are used to determine the gains in participants relative to others in the population. While we would expect some gains as a result of maturation, it is worth noting that a student who was on a stable developmental trajectory would not show changes in MSEL DQ or VABSII scores over ten months. Students who gain skills faster than expected will display an increase in standardised scores, and students who learn at a slower rate than typical will show a decrease in DQ scores. The participants in this study demonstrated statistically significant increases in standardised scores, which indicates that they gained skills faster than expected. The students' rate of learning increased, which can positively impact their ability to participate independently in their education and enhance everyday functioning. Student performance on educational and norm-referenced assessments indicates that they can transfer and generalise skills, knowledge and strategies taught during the intervention to new and unfamiliar testing situations.

The classroom-based ABA model is a collaboration between behaviour analysts, teachers and professionals such as speech and language therapists to develop curriculum for children in SEN schools. It has been demonstrated as a sustainable model in Wales (Foran et al., 2015) and England (Pitts, Gent and Hoerger, 2019). It has been acknowledged for its beneficial outcomes for recipients by the Inspectorate for Education and Training in Wales (Estyn, 2017). The teaching strategies in this study coincide with recommendations by ASD info. Wales (2015) and the SCIE (2019). The methods and results have been communicated using measures and terminology familiar and meaningful to the target audience (Malouf and Schiller, 1995; Rogers, 2003).

This study does have some limitations: the sample size is small, and it does not include a control group. The inclusion of a control group would increase the reliability and validity of results, as it would have demonstrated whether control group participants scores increased over ten months with traditional teaching approaches. However, teaching strategies within this model, which are based on the principles of ABA, have been found to produce greater gains than traditional teaching approaches (Eldevik et al., 2006; Grindle et al., 2012; Peters-Scheffer et al., 2010, 2013).

Future research should include larger sample sizes and a control group design with random assignment if possible. Future research should investigate the effect of implementation fidelity and how components of the model impact student outcomes. The results of this study are in line with the outcomes of previous studies that have demonstrated that

classroom-based ABA model results in significant gains for students (Foran et al., 2015; Pitts, Gent and Hoerger, 2019). The current research has shown how strategies based on the principles of ABA can complement educational provision in maintained SEN schools in Wales.

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