BRIEF REPORT: AN EVALUATION OF AN AUSTRALIAN AUTISM-SPECIFIC, EARLY INTERVENTION PROGRAMME

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There is a relative paucity of evidence examining the effectiveness of early intervention for young children with Autism Spectrum Disorder, in particular those delivered through educationally-based programmes. This study aimed to evaluate the real world effectiveness of a community-based autism-specific early learning and intervention programme in Australia. Children enrolled between February 2010 and May 2013 who had a diagnosis of an Autism Spectrum Disorder was eligible to participate in the study. Fifty-nine children with a mean age of 3.98 years participated. Cognitive ability, language, autistic symptoms, and motor skills were assessed at baseline and follow up (12 months or at programme exit) using standardised measures. Pre- and post-measures were compared using paired sample t-tests. Significant improvements were found in receptive and expressive language, autism symptoms, and overall adaptive behaviour. No significant change was found in motor skills. Children with Autism Spectrum Disorder attending the community-based programme had significant gains particularly in domains of cognition and language. Study limitations are discussed.

Brief Report: An Evaluation of an Australian Autism-Specific, Early Intervention Programme

Early intervention for children with Autism Spectrum Disorder (ASD) has been recognised as a health and educational priority (Charman & Howlin, 2003; Lord et al., 2005). There has been considerable research into Early Intensive Behavioural Interventions mainly in university trials (see review by Magiati, Tay, & Howlin, 2012). However, research has paid little attention to other models of intervention for young children with ASD, particularly in community settings (Benvenuto, Battan, Benassi, Gialloreti, & Curatolo, In Press). Such research is vital, as other models of intervention, specifically educationally-based programmes, are frequently delivered in local communities (Howard, Sparkman, Cohen, Green, & Stanislaw, 2005).

The Queensland Autism-Specific Early Learning and Care Centre (ASELCC) is one of six federally government funded community-based intervention centres providing affordable specific support and early learning programmes to children with ASD (Department of Families, Housing, Community Services, and Indigenous Affairs, 2009). A non-government organisation, based in Australia, AEIOU Foundation, delivers the Queensland ASELCC early learning and care programme within an autism-specific long day-care service model. The programme (for further programme information, see Paynter & Falvey-Henderson, 2011) is consistent with the Australian Good Practice Guidelines for Early Intervention in ASD (Prior & Roberts, 2012) as described in Table 1. The programme involves 25 hours

per week of intensive programme time for children who attend full-time. Staff includes speech and occupational therapists, early childhood teachers, and childcare professionals.

Table 1. Good Practice Guidelines (Prior & Roberts, 2012) and AEIOU Programme Elements

Good Practice Guideline	*AEIOU Programme Elements*
Assessment of strengths and needs to inform programming	Completion of standardised assessments (see Methods) on intake as well as classroom observations and parent interviews.
Individualised programming based on above Review, evaluation, and adjustment of program	All children have an Individual Plan (IP) that guides programming. Children's IP is reviewed at least every six months or earlier by parent request or if goals are met. Programme is adjusted from this information.
Relevant programme content addressing autism features (e.g., communication)	AEIOU uses its own autism-specific curriculum that focuses on four key areas: social emotional; language and communication; physical; and cognitive.
Highly supportive teaching environments and generalisation strategies	Teaching environment features a range of appropriate environmental supports to facilitate learning and generalisation such as visual supports, work systems, and structured teaching.
Predictability and routine	Classrooms follow a daily schedule and children have a visual schedule where indicated by assessment of strengths and needs to make routines predictable.
Functional approach to challenging behaviour	Positive behaviour support approach.
Transition support	Families receive training on educational options throughout the year, are supported when choosing their child's next educational setting, and visits from and to schools are included.
Family involvement	Families are included as partners in goal setting, and are encouraged to share their knowledge of their children and participate in AEIOU activities, decisions, and training.
Use of visual supports	Visual supports are used throughout the environment including schedules, augmentative and alternative communication devices and supports, and work schedules.
Multidisciplinary collaborative approach	Staff include teachers, childcare professionals (Diploma in Early Childhood and/or Certificate III in Early Childhood Education), speech pathologists, and occupational therapists working together in a multidisciplinary collaborative team.
Staff with knowledge and experience of ASD	Staff receive regular training via an initial induction, weekly staff meetings, professional development activities, and an annual staff conference.
Targeting of child goals in small group context with at least two adults to six children	Learning centres are conducted in small groups that target children's goals. Ratio varies between 1:1 to 1:4 dependent on children's level of independence.
Research and evaluation of programme	Systematic assessment of children's communication, thinking and reasoning, social and adaptive functioning on intake, 12-months and exit to the programme using standardised assessments.

As part of the ASELCC initiative, ongoing data have been collected via child assessments and parent questionnaires. A pilot evaluation (N = 10) of the AEIOU[1] Programme (Paynter, Scott, Beamish, Duhig, & Heussler, 2012) showed promising results in terms of improvements in educational and cognitive skills, adaptive behaviour, and autism symptoms. Significant gains on cognitive verbal/preverbal, fine motor, visual-motor imitation, and social reciprocity were found on the Psycho-Educational Profile-3, together with gains in age-equivalent scores on the receptive language scale of the Mullen Scales of Early Learning. Gains in age-equivalent scores on some subscales of the parent-rated Vineland Adaptive Behaviour Scales, including expressive and written communication, and fine motor scales were found. A reduction in autism symptoms was indicated by parent ratings on the Social Communication Questionnaire. However, the small number of children necessitated further evaluation of a larger sample.

The present study builds on the pilot evaluation using data collected over a 3-year period. The aim of this study is to evaluate the AEIOU programme as implemented at the Queensland ASELCC through evaluating changes in children's intellectual and adaptive functioning, as well as their level of autistic symptoms. Based on previous research (Paynter et al., 2012) it was predicted that children would show improvements in these areas.

Methods

Ethics

Ethics approval was granted by Griffith University (Protocol Number EBL/88/10/HREC). Signed informed consent was obtained from parents of participating children.

Participants

This study includes children who entered the Queensland ASELCC from February 2010 and finished their placement by May 2013 with 68 of 94 eligible children's families providing consent (response rate of 76%). Eligibility for entry to the programme included a DSM-IV diagnosis (American Psychiatric Association, 2000) of ASD including Autistic Disorder, Asperger Disorder, or Pervasive Developmental Disorder – Not Otherwise Specified by a medical practitioner (paediatrician, child psychiatrist, or neurologist) not associated with this research project, combined with a chronological age at intake between 30 and 71 months. All children included in this study had a *Social Communication Questionnaire* (SCQ: Rutter, Bailey, & Lord, 2003) score greater than 11 as recommended by Lee, David, Rusyniak, Landa, and Newschaffer (2007). The initial sample included 68 children; however, three were excluded due to having an SCQ score under 11, and six were excluded because their parents did not return the SCQ at intake (pre-test). Therefore, this study included 59 children, with 83% of them being male. The mean age was approximately 4 years (*Mean age* = 3.98 years, *SD* = .81, range 2.65-6.05) and the majority (64%) had an Autistic Disorder diagnosis. The majority of children were born in Australia (86.4%) and spoke English as their primary language at home (83.1%), although a significant minority (27.1%) of families identified that they were from a culturally and linguistically diverse background. The majority of children lived with both parents (88.1%) and many parents reported a tertiary qualification (primary carer: 71.1%; secondary carer: 64.4%)

Measures and Procedure

Measures were completed at intake, and then after 12 months in the programme, or on exit, whichever came first. Child assessments were conducted predominantly by the first or second author, AEIOU staff members with experience in assessing children with ASD, who were not involved in the daily programme implementation or design of individual programmes. Although assessors were not strictly blind to intake assessments, these were not reviewed prior to Time 2 assessments, and due to the high volume of assessments conducted it was unlikely that individual child data was remembered from assessments conducted approximately 12 months earlier.

Child assessment was conducted using the *Mullen Scales of Early Learning* (MSEL: Mullen, 1995) which is a standardised assessment of early developmental skills commonly used to assess cognitive functioning in young children with ASD in previous research (Eapen, Črnčec, & Walter, 2013; Vivanti, Dissanayake, Zierhut, & Rogers, 2013). This measure includes five subscales including Gross Motor, Visual Reception, Fine Motor, Receptive Language, and Expressive Language. The Gross Motor subscale was not administered in the present study because of the low ceiling (norms up to 33 months only) of this scale. This measure yields raw scores, age equivalents and standardised T scores. However, the majority (e.g., at pre-test, Receptive Language Scale 74.6%, Expressive Language scale 71.2%) of children in the present study did not achieve sufficiently high raw scores to allow calculation of a T score with their performance at less than the 1st percentile relative to typical development. As such, developmental quotients (DQs) were calculated for each subscale by dividing children's age equivalent scores by their chronological age and multiplying by 100, as has been done in previous studies with this population (e.g., Eapen et al., 2013). In addition, an overall MSEL DQ was calculated for each child by summing the four scales and dividing this by four. DQs were subsequently used as the unit for analysis to allow comparison of changes over time controlling for age.

ASD symptoms were measured using the *SCQ*, a short 40-item questionnaire derived from the *Autism Diagnostic Interview-Revised* (Lord, Rutter, & Le Couteur, 1994). On this questionnaire, parents indicate whether a child displays characteristic autistic behaviours and a total score was used in the present study to both verify diagnosis and monitor changes in symptom level over time. This measure shows good psychometric properties (Berument, Rutter, Lord, Pickles, & Bailey, 1999) and has been

commonly used as a measure of autism symptoms (e.g., Eapen et al., 2013; Paynter, Riley, Beamish, Davies, & Milford, 2013).

The *Vineland Adaptive Behaviour Scales- 2nd Edition* (VABS: Sparrow, Dominic, Cicchetti, & Balla, 2005) parent-caregiver version measured adaptive behaviour in four domains: Communication, Daily Living skills, Socialisation, and Motor Skills. Raw scores were converted into standard scores using tables in the manual. An overall Adaptive Behaviour Composite (of the four domain scores) was likewise calculated. This measure shows good psychometric properties (Sparrow et al., 2005) and has been widely used to assess changes in adaptive behaviour in other ASD early intervention studies (e.g., Eapen et al., 2013; Vivanti et al., 2013). Statistical analysis used paired sample t-tests to compare pre- and post-assessment scores on all measures.

Results

The average time between pre- and post-assessments varied between measures due to instrumentation change in the first year (MSEL), child availability for scheduling assessments, and parent return time of questionnaires. The average time between assessment completions were: SCQ, 10.39 months (*SD* = 2.10, range 4.50-12.98 months); MSEL, 9.36 months (*SD* = 1.82, range 6.21- 13.01 months); and VABS-II, 9.11 months (*SD* = 2.27, range 4.50 - 13.37 months).

Cognitive Functioning (MSEL)

Significant increases in children's overall DQ, as well as Receptive and Expressive Language DQs were found with a small effect (see Table 2). No significant changes were found in DQs on the Visual Reception or Fine Motor scales.

Autism Symptoms (SCQ)

Table 2 shows a significant decrease in mean SCQ scores from pre- to post-testing with a medium effect, indicating a reduction in ASD symptoms.

Adaptive Behaviour (VABS)

Significant increases in children's standard scores on the overall Adaptive Behaviour Composite, as well as on the Communication domain both with medium effects were found (see Table 2). No significant changes were found on the Socialisation, Daily Living Skills, or Motor Skills domains, although changes were found in the expected direction.

Discussion

We report one of the first real-world effectiveness studies of an Australian-developed educationally-based early intervention programme for young children (2½ to 6 years) with ASD. Participants in the AEIOU programme showed significant gains on a range of clinical outcomes, particularly communication scales on the MSEL, autism symptoms, and overall adaptive behaviour. Results were consistent with and stronger than, the previous pilot findings with a small sample (Paynter et al., 2012) and may be due to having sufficient power in the present study to detect small to medium effects.

Improvements in the overall adaptive behaviour score on the VABS were largely attributable to gains in the communication subscale. The finding of significant gains in standard scores on the communication measures (both VABS and MSEL) reflects the areas of focus in the AEIOU programme (Paynter & Falvey-Henderson, 2011). In addition, areas of significant gain on the MSEL scales (receptive and expressive language) also reflect areas of greatest difficulty and may thus have been areas of targeted learning in children's individual plans.

Although results are promising, the study had three key limitations. These were the lack of a control group, the programme not being fully manualised, and diagnosis not being verified beyond a brief screen with the SCQ. Lack of a control group raises the concern that significant improvements may be due to maturation or other effects. However, at least in terms of cognitive skills and adaptive behaviour, as argued also by Eapen and colleagues (2013) in their pre-post intervention study, this seems unlikely for three key reasons. First, key improvements were made in standard scores or developmental quotients standardised for age; this suggests changes are greater than what would be expected due to maturation. Second, at least in terms of cognitive skills, previous studies (see review by Begovac, Begovac, Majic, & Vidovic, 2009) have generally suggested that IQ tends to be stable over time, thus improvements are unlikely to be due to maturation. Although some studies have found improvements over time and *catch-up* in development these changes tend to be in higher functioning children and those with PDD-NOS (e.g., see review by Begovac et al., 2009). Given the majority of our children scored below the 1st percentile on the MSEL, it is unlikely that this occurred in the present study. Third, previous studies

have found among children with lower levels of functioning, regression is actually the more common course (e.g., see review by Begovac et al., 2009). However, it is acknowledged that there is some evidence that the level of ASD symptoms may remit over time (see review by Levy & Perry, 2011). Thus, it is unclear whether improvements in ASD symptoms may be attributable to participation in the AEIOU programme, maturation, a combination of both, or additional factors. Future research of community-based interventions in educational settings needs thus to incorporate appropriate control groups.

Table 2. Change in Scores from Pre- to Post-Testing in Children Attending the AEIOU Programme

	Time 1 (SD)	**Time 2 (SD)**	***t***	***df***	***p***	***Cohen's d***[a]
MSEL						
Visual Reception DQ	55.75 (20.19)	58.86 (28.91)	1.39	57	.17	.21
Fine Motor DQ	54.68 (18.05)	54.10 (21.57)	.39	57	.70	-.05
Receptive Language DQ	39.64 (22.98)	44.68 (23.91)	2.65	57	.01*	.35
Expressive Language DQ	40.12 (25.80)	44.75 (24.67)	2.04	57	.046*	.27
Overall MSEL DQ	49.28 (20.68)	52.21 (22.74)	2.17	54	.034*	.30
SCQ						
Total Score	18.61 (4.34)	15.65 (6.24)	4.58	53	< 0.001***	-.67[b]
VABS-II						
Communication Standard Score	68.33 (18.00)	75.08 (20.63)	4.19	51	< 0.001***	.59
Socialisation Standard Score	72.14 (10.67)	73.08 (14.54)	.68	49	.50	.10
Daily Living Skills Standard Score	70.14 (13.53)	72.39 (20.17)	1.22	50	.23	.19
Motor Skills Standard Score	77.02 (13.08)	78.51 (15.11)	.95	50	.35	.14
Adaptive Behaviour Composite Standard Score	69.28 (11.96)	73.38 (16.17)	3.38	49	.001**	.54

***** $p < .05$; ** $p < .01$; *** $p < .001$.

[a]Corrected for dependence between means using Morris and Deshon's (2002) equation 8.

[b]Negative effect size denotes a reduction in ASD symptoms from Time 1 to Time 2 with lower SCQ scores indicating fewer symptoms.

While the AEIOU programme is not fully manualised, it meets Australian Good Practice Guidelines (Prior & Roberts, 2012) and is documented in the organisation's current policies and procedures. A formal manual with protocols and fidelity measures is in development. Programme manualisation will operationalise core components and enable measurement of treatment fidelity, which in turn will allow comparison in controlled trials and potential independent evaluation of autism-specific intervention programmes in the future.

All children in the present study had been diagnosed by a medical professional independent of the study to meet eligibility criteria (DSM-IV) for entry to the programme as well as to access funding. In addition, they were in the clinical range on the SCQ. However, in the wake of the release of DSM-5 (American Psychiatric Association., 2013), it is becoming increasingly important to clearly specify children's diagnosis and to verify diagnosis. It is unknown if all participants would meet DSM-5 criteria or established gold-standard criteria on the Autism Diagnostic Observation Schedule (Lord, Rutter, DiLavore, & Risi, 2001). Nevertheless, the present results show real-world outcomes for the children who present to a community-based intervention centre and may have more relevance for everyday clinical practice.

In conclusion, despite the acknowledged limitations, this research provides valuable new information about the value of centre-based autism-specific intervention programmes for children with ASD that use an educational model. It suggests promising results in terms of outcomes for young children with ASD with respect to cognitive skills (particularly verbal scales), adaptive behaviour (overall and communication), and autism symptoms.

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