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Evaluation of inexperienced pre-school teachers' implementation of a 16-week perceptual-motor development programme in a low-resourced South African community

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Abstract

Previous research has reported higher percentages of at-risk development among children growing up in low-resourced communities, especially in perceptual-motor abilities. Such deficits can seriously hamper the acquisition of early literacy and numeracy necessary for formal school entry, while compromising the health and well-being of pre-schoolers due to physical inactivity. This study investigated whether pre-school teachers from a low resourced community, with no experience in conducting perceptual motor development programmes, can successfully implement a tailor-made intervention after a training workshop. By understanding the limitations that teachers have to design and deliver perceptual-motor programmes to pre-school children, possible solutions can be found to overcome the barriers and to maximise the perceptual-motor development of such children. Teachers presented a tailor-made perceptual-motor programme to 3- to 5-year-old pre-schoolers (n=44) after receiving a two-day training. The participants were, divided into an intervention group (n=31) that participated in the programme once a week for 16 weeks, and compared during a pre-, post- and retention test with a control group (n=21), using the Movement Assessment Battery for Children-2 (MABC-2). Monthly on-site monitoring visits, as well as a focus group reflection after completing the programme, were used to identify problems that the teachers experienced during programme delivery. Data were analysed using thematic analysis and ANOVA (analysis of variance). Limited intervention effects were found. Although teacher buy-in was reported, many challenges were experienced, mainly due to the teachers' low knowledge of the subject matter. Frequent and ongoing hands-on support by means of remedial support is essential, while also focusing on establishing key behaviours of effective programme delivery during training.

Keywords: Fundamental motor skills, perceptual-motor development, pre-school children, intervention, teachers.

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Introduction

The Global Action Plan on Physical Activity 2018-2030 (WHO, 2018) has four key objectives to improve physically active behaviour which include the creation of active societies, environments, people and systems. Twenty policy actions are recommended to accomplish these objectives needed to address multiple cultural, environmental and individual determinants of inactivity. Nested in this vision are the challenges for improvement of physical activity among children when growing up in poorly resourced communities, as such children are reported to be more likely to be disadvantaged in terms of their long-term health, social and economic well-being (Barnett, Stodden, Cohen, *et al.*, 2016). Action steps needed to improve development in children associated with physical activity include a diverse movement foundation. This would nurture successful participation and encourage sustained physical activity across the lifespan, as strong evidence exists that supports a positive association between fundamental motor skills (FMS) and physical activity (Holfelder & Schott, 2016; Lubans, Morgan, Cliff, *et al*., 2010).

Low socio-economic status (SES) is associated with at-risk development, where children who grow up in such adverse environments are reported as not reaching their developmental potential (Walker, Wachs, Meeks Gardner *et al.*, 2007). Transition from pre-school to more formal schooling can be quite challenging and stressful for such children (McClelland & Cameron, 2019). There are also strong indications that children who fail in primary education, begin schooling with disadvantages (Sherry & Draper, 2013). Poor school readiness plays a significant role especially in those without the skills needed to effectively navigate school settings and learning environments (McClelland & Cameron, 2019; Rimm-Kaufmann & Cox, 2000; Sherry & Draper, 2013).

Perceptual-motor readiness is considered to be a key component of school readiness that underlie the development of early numeracy and literacy (MacDonald, Milne, Orr *et al.*, 2018). Various studies in this regard report deficits among children with disadvantaged backgrounds (Pienaar, Barhorst & Twisk, 2013; Sherry & Draper, 2013). Consequently, well-developed FMS and perceptual-motor skills (PMS) contribute significantly to children's overall development and the transition from informal to formal learning environments (Sherry & Draper, 2013). These skills are also found to be of considerable importance in obtaining academic literacy during school entry (Gabbard, 2018; Cameron, Cottone, Murrah *et al.*, 2016; Sherry & Draper, 2013).

The low prevalence of movement competence reported amongst children from areas of high deprivation, thus necessitates that such children be prioritised for opportunities to engage in meaningful physical education experiences that foster movement competence and physical activity participation (Rudd, O'Callaghan & Williams, 2019). In the WHO's (2018) Global Action Plan on Physical Activity,

the objective to create active people for a healthier world includes action plans that can provide activity programmes across multiple settings and the enhancement of physical education and school-based programmes.

FMS are described as movement patterns or a set of skills performed by different parts of the body (Barnett *et al*., 2016; Pienaar, *et al.*, 2013), that if mastered, will give children the best possible chance to successfully and persistently participate in physical activity. Children need instruction and opportunities to improve these skills (Barnett *et al*., 2016), of which the window of opportunity for optimal development is considered to be between two and seven years of age (Gabbard, 2018).

Well-developed FMS are not only foundational for further, more complex movement development and physical activity (Kerkez & Robinson, 2013; Livonen & Saakslahti, 2013; Logan, Robinson, Wilson *et al.*, 2011), but are also associated with academic success (Cadoret, Bigras, Duval, *et al.*, 2018; MacDonald *et al*., 2018). PMS refers to the integration of sensory input (visual, auditory and kinaesthetic) with gross or fine motor responses (Cadoret *et al*., 2018).

PMS can be subdivided for descriptive purposes into perceptual- and motor skills (Pienaar *et al.*, 2013), with perception being the ability of the brain to make contact with the outside world through various senses (sight, hearing, touch, smell) while motor skills refer to skills that are inextricably linked to perceptual development (MacDonald *et al.,* 2018). The development of FMS and PMS during the pre-school years is considered to be imperative as the improvement of these skills contributes to children's general, current but also continued, overall development including their scholastic readiness (Donald, Lazarus & Lolwana, 2012; Goodway & Branta, 2003).

FMS and PMS are influenced by several factors that, amongst others, include the environment in which children grow up, lack of teacher training and the value placed on gross motor development as opposed to formal learning activities (Burnett, 2018; Loubser, Pienaar, Klopper *et al.*, 2014; NDBE, 2011; Sherry & Draper, 2013). In this regard, South Africa, a low to middle income developing country, faces early childhood education challenges including too few schools, few qualified teachers, also with regard to Physical Education, large numbers of children who do not have access to schooling, and few opportunities for children to attend a formal Grade R class (readiness year before formal schooling) (Burnett, 2018; Sherry & Draper, 2013; UNESCO, 2019).

Eighty-four percent (84%) of young children from birth to four years have no access to formal school or day-care in South Africa and are primarily dependent on caregivers, such as mothers/guardians for stimulation and development (Erasmus, Janse van Rensburg, Pienaar *et al.,* 2011; Stats SA, 2007; UNICEF,

2007). Statistics, however, improved in older age groups in recent years, where 92% of children (2 million) in the preschool age group (5–6-year-olds) are reported to have attended some kind of educational institution in 2017. Most of these children were in grade R or grade 1 which is almost double the 2002 data, where 1.1 million in the same age group were reported to be attending an educational institution. Levels of attendance among Coloured children, however, remain below the national average, at 83% (Stats SA, 2018).

The development of children who grow up in low socio-economic conditions is often in the hands of teachers with only basic or no formal teacher training (UNESCO, 2019). This implies that such children do not receive adequate school-based opportunities and stimulation that are directed at later learning (Stats SA, 2007). However, an encouraging link is established between gross motor skill interventions delivered at pre-school level and catching up in areas of cognition, visual perception and fine motor development (Sherry & Draper 2013; UNESCO, 2019). Therefore, such interventions might make a significant difference in low-resourced communities where early literacy and numeracy deficits are rampant, and interventions of this nature would be most beneficial to children.

Early identification of children with developmental difficulties is also important for school readiness, as intervention would then be most effective. A particular need is the development of quality curricula and interventions targeting specific areas of development including motor, cognitive and emotional skills that are important along with supervision, support, monitoring and resources to implement the requirement (Sherry & Draper, 2013). Therefore, solutions should be sought to support children in low socio-economic areas in developing their FMS and PMS (Erasmus, Janse van Rensburg, Pienaar *et al.,* 2015; Pienaar, 2009). One way of assisting children in this regard is through additional training of teachers to conduct age appropriate developmental programmes. The use of tailor-made programmes (that is designed for a specific purpose) presents a window of opportunity to address this shortcoming.

Intervention is described as educational and social measures aimed at alleviating problems that children may experience. This refers to programmes that are specifically designed for individual or group needs with the aim of improving or changing the individual or group's current state of development (Venter, Pienaar & Coetzee, 2015). Several intervention programmes that addressed aspects of FMS and PMS of children have been carried out worldwide to determine their feasibility (Altunsöz & Goodway, 2015; Goodway & Branta, 2003; Kirk & Rhodes, 2011; Logan *et al*., 2011; Valentini & Rudisill, 2004). Previous studies have shown that FMS and PMS can be improved by offering intervention programmes, although the success of such programmes depends on the type of programme, the training background of the teachers and the involvement of the researcher in the programme (Kirk & Rhodes, 2011; UNESCO 2019).

A concern raised by Draper, Tomaz, Stone *et al.* (2017) regarding replicating such programmes is the level of training required for the intervention to be effective. However, few presvious studies, if any, have been carried out focusing on empowering teachers with the necessary knowledge and experience to accept responsibility for directly implementing FMS and PMS programmes in schools. Moreover, none of the previous studies reviewed have investigated the possibility of using a customised perceptual-motor development programme based on the needs of pre-school children to improve their perceptual-motor development. Therefore, this study examined the feasibility of training inexperienced teachers to present a tailor-made perceptual-motor movement development programme developed for 3- to 5-year-old children successfully in a low resourced community in South Africa.

Methodology

Study participants and setting

This study forms part of a broader community project for the Faculty of Health Sciences at the North-West University (NWU), Pochefstroom titled, "*Well-being Innovation platform-* (WIN) - *Sustainable livelihoods, health and well-being in rural communities in South Africa (SA) – a trans-disciplinary multi-level approach*". This community project is located in the Vaalharts region in the Northern Cape Province of South Africa. The pre-primary school where the study was conducted is located within this low resourced community on the outskirts of Jan Kempdorp and falls under the jurisdiction of the Department of Social Development of the Northen Cape, South Africa.

All the children aged 3 years and older in the school were invited to participate in the study. Parental consent was obtained for 51 children who were divided at baseline into an intervention (boys: n=17; girls: n=13) and a control (boys: n=13; girls: n=8) group. The intervention group included 13 three-year-olds (8 boys, 5 girls), 12 four-year-olds (6 boys, 6 girls) and 5 five-year-olds (3 boys, 2 girls), while the control group included 10 three-year-olds (7 boys, 3 girls), 7 four-year-olds (4 boys, 3 girls) and 4 five-year olds (2 boys, 2 girls).

The final group tested during the follow-up assessment included 44 participants, which represents an attrition of 7 children (13.7%) from the baseline measurements(pre-test) due to various reasons, including parents of children moving out of town and children moving between schools. Three teachers at the school were identified by the principal and trained in a 2-day workshop to implement the intervention programme. Table 1 describes the teachers' training background and years of experience.

Table 1: Pre-school teachers' training background and years of experience in intervention school.

Teachers	Teacher training experience	Work experience
Teacher l	ECD – "Early Childhood Development", Level 6 (Training for teachers from pre-school to Grade R, offered by various institutions located in SA); Attendance certificate of MMaD- ("Movement Makes a Difference") workshop; No tertiary training.	8 years
Teacher 2	Trained by the principal (internal training); Attendance certificate of MMaD- ("Movement Makes a Difference") workshop; No formal training.	3 years
Teacher 3	Trained by the principal (internal training); Attendance certificate of MMaD- ("Movement Makes a Difference") workshop; No formal training.	1 year

Research design

This study used a mixed methods research design that included quantitative analysis and qualitative observations. The experimental research design consisted of a two-group (an intervention and a control group), pre-test, post-test and retest design to evaluate the teachers' implementation of the 16-week perceptual-motor programme in the intervention group.

Qualitative observation was also applied that was not intended for the formal application of specific qualitative research methodology, but rather as a supportive tool that allows the researcher to identify and comprehend problem areas that could clarify the quantitative research findings. These observations were focussed on the challenges that the teachers experienced during the programme delivery and were documented once a month at site visits of the programme delivery and during a focus group discussion after the intervention was completed, wherein the teachers had to reflect on their experiences in programme delivery.

These mixed methods approaches were used to complement the research design by providing a richer understanding of the results, which would otherwise not have been achieved if the techniques were applied in isolation. The flow diagram presented in Figure 1 illustrates specific details of the research design.

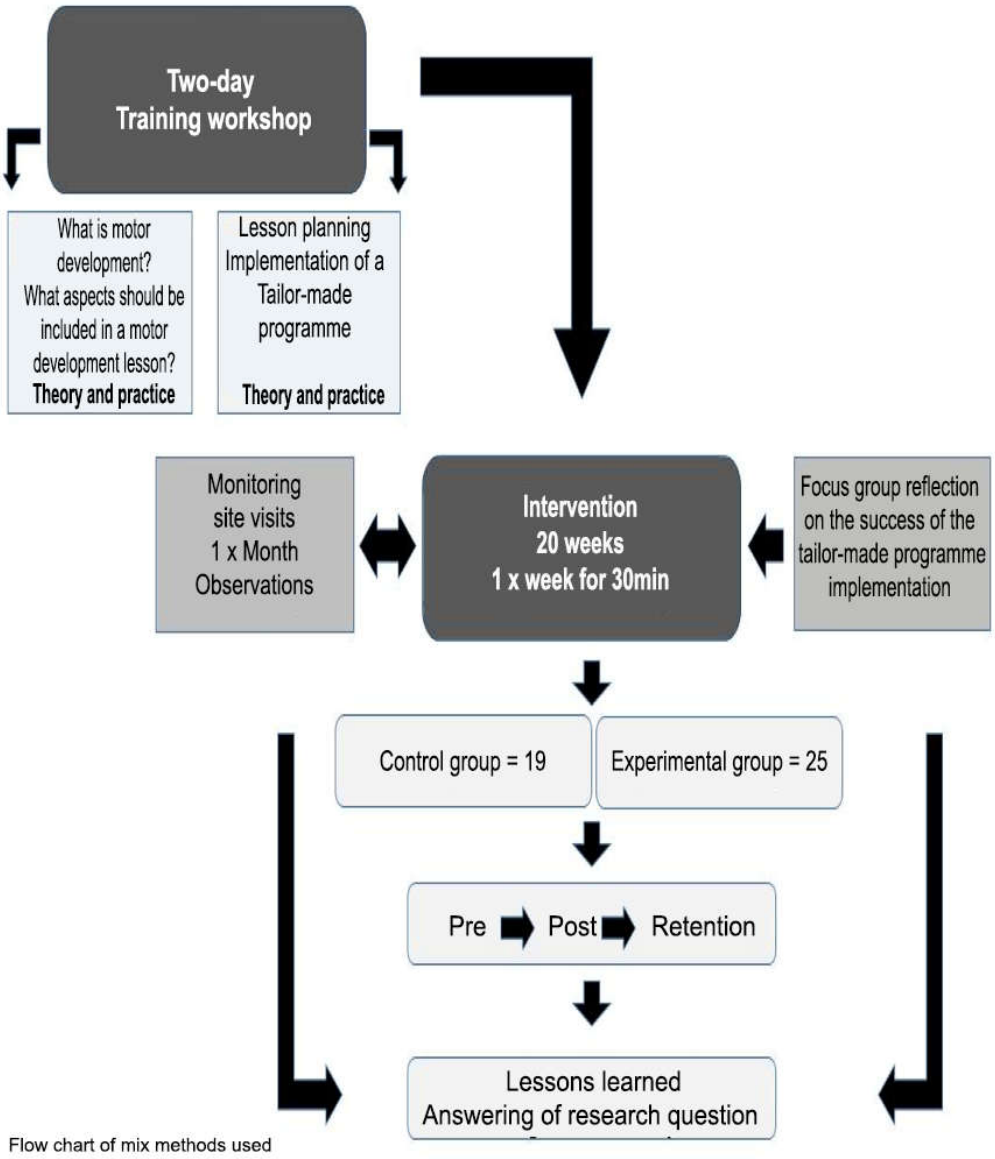


Figure 1: Flow chart of the mixed methods research design applied

Ethical considerations

The WIN project received ethical clearance (NWU-00040-13-A1) from the *Health Research Ethics Committee* (*HREC)* of the NWU, South Africa. Ethical permission was also obtained from the Department of Social Development (Northern Cape, South Africa), the principal of the school where the study was conducted, and the parents or caregivers of the pre-school children.

Instrumentation: Movement Assessment Battery for Children-2 (MABC-2)

The MABC-2 is a standardised measuring instrument designed to assess children's motor coordination and to identify those between the ages of 3.0 to 16.11 years

with motor coordination problems. The MABC-2 comprises three age bands, namely Age Band 1 (3-6 years), Age Band 2 (7-10 years) and Age Band 3 (11-16 years), of which only Age Band 1 was used in this study (Henderson, Sugden & Barnett, 2007). The assessment contains three subsections, namely aiming and catching, manual dexterity and balance skills, which have been described in detail by Henderson *et al*. (2007). The MABC-2 total score and percentile ranking were used in the analyses. The test protocol reflects good reliability for the sub-items separately (r=0.73-0.84) and for the total test score (r=0.80) (Henderson *et al*., 2007).

Training workshop and intervention

The principal was approached to do a needs analysis for movement programmes at the school. Discussions were held to determine if movement programmes were conducted at the school and what the teachers' abilities were in this regard (Table 1. Once a need was established and limitations identified, a training workshop was compiled (Movement Makes a Difference) and provided to the teachers by senior researchers in Kinderkinetics within the School of Human Movement Science at the NWU. This workshop included two days of training which focused on key behaviours that are needed to teach tailor-made movement programmes. The theoretical and practical training sessions provided the teachers with a scientific background of fundamental motor and perceptual-motor skills, as well as pedagogical aspects needed to develop these skills during lesson plan implementation.

The teachers were provided with tailor-made age-appropriate perceptual-motor movement development lesson plans, based on the outlay and ingredients of scientifically proven movement development lessons (Pienaar, Van Rensburg & Smit, 2011). A series of 30-minute lessons included fundamental motor skills (locomotor, object control, fine motor and balancing skills) and perceptual aspects (spatial orientation, body awareness, rhythm and timing). These lessons had an age appropriate developmental focus but were also compiled to address the shortcomings identified during the pre-test measurements.

A "Gross motor PLAY KIT" set, with all the necessary equipment to teach the lessons, were provided. These included round hoops of three different widths (4 each), square hoops (4), blocks (6), various sticks and fitting equipment to build specific structures when using the blocks, hoops and sticks, three by one-metre balance beams, twelve cones, ten balls, thirty bean bags and five hand and foot prints. Various obstacle courses of different heights were built by using this equipment. The tailor-made lessons were offered once a week to the intervention group by the teachers for a period of four months (16 weeks). The researcher made monthly on-site visits during the programme delivery to discuss and document the teachers' challenges during the intervention and proffer solutions for the challenges identified.

Qualitative observation

During the 16-week programme, the programme delivery was monitored by means of monthly site visits to identify problem areas and to provide ongoing guidance to the teachers. During these monitoring visits, qualitative observations were recorded by the researchers regarding the teachers' abilities, strengths and weaknesses. At the end of the programme delivery, a focus group discussion was also conducted with the teachers where they reflected on their experiences. Open-ended questions were asked about the easy and difficult aspects of the programme delivery and what further assistance the teachers required if requested to continue teaching the children.

Notes were made during the meeting, while the discussions were also audio recorded and transcribed at a later stage. The qualitative observations were used to provide support or supplemental explanations for the strengths and weaknesses of the programme. It should be noted that the qualitative observations were used as supportive methods to elucidate problem areas in the quantitative technique used for data collection. Specifically, qualitative observation was used to glean pertinent information on the success and potential gaps in the programme implemented.

Data analysis

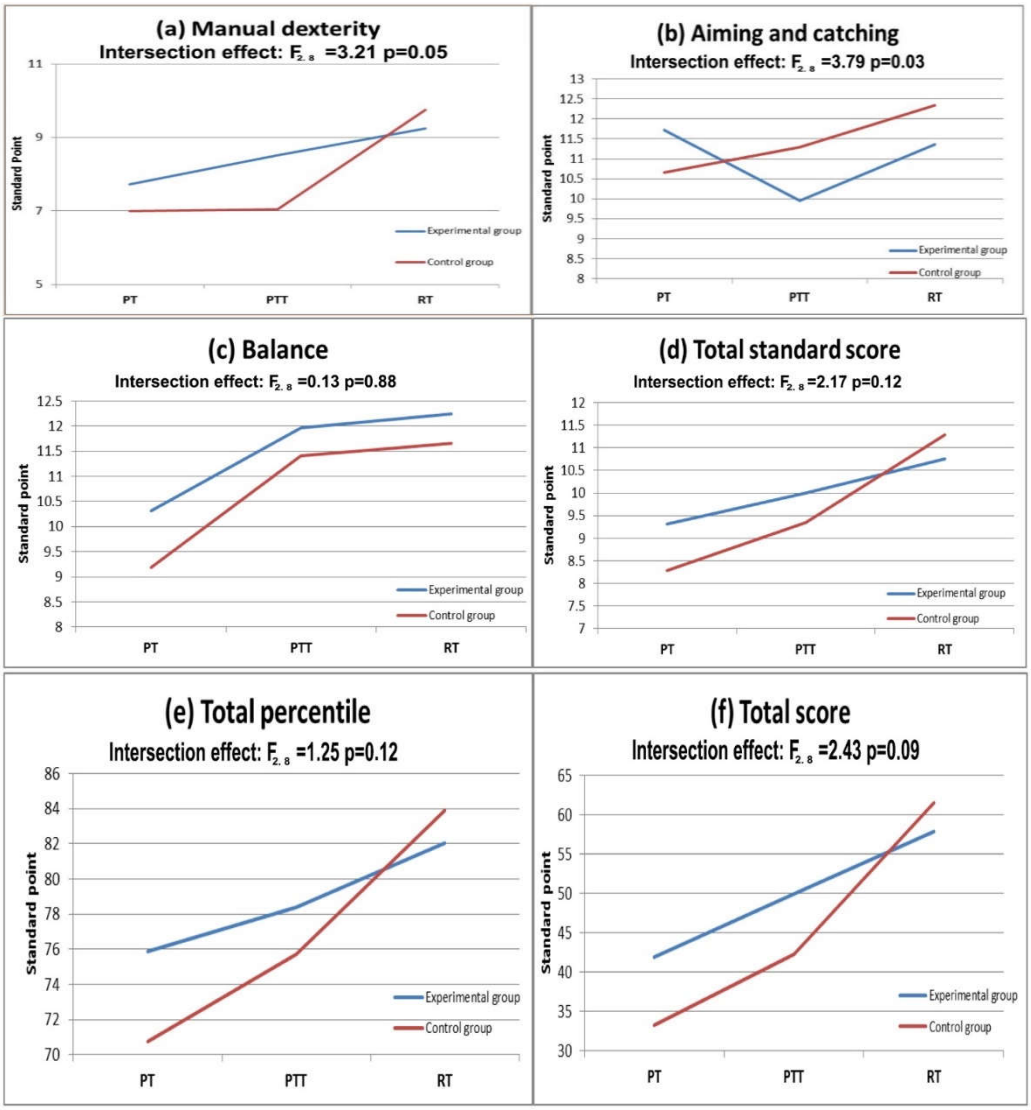
STATISTICA for Windows (StatSoft 2016) was used to analyse the data. The data were first analysed descriptively, using means (M) and standard deviations (SD). Second, analysis of variance (ANOVA) with repeated measures and a Bonferroni post-hoc test were used to compare the results of the pre-test, post-test and retention-test over time. Statistical significance was set at $p<0.05$. Practical significance of differences was also analysed using effect sizes with $0.2<d<0.05$ as small-, $0.5<d<0.08$ as medium- and $d>0.8$ as large practically significant effects (Cohen, 1988).

Results

Table 1 provides a summary of the training background and years of experience of the pre-school teachers who presented the tailor-made perceptual-motor programme. Teacher 1 was the principal and only supervised the programme presented, but was not formally involved in teaching the programme. The teachers who delivered the programme, only had 1-3 years of teaching experience although they had no formal training experience in pre-school education. All three teachers, however, did attend the two-day training workshop before the start of the programme, which prepared them theoretically and practically to deliver the FMS and PMS tailor-made programme.

Movement intervention

The results obtained in the intervention (n=25) and control groups (n=19) during the pre-test, post-test and retention test in the subcomponents and the total score of the MABC-2 are shown in Table 2 and Figures 2a-f, while effect sizes of changes between testing opportunities are reported in Tables 3 and 4.



Figures 2a-f: Changes in MABC-2 results over time within the intervention and control groups.

Only small practical significant differences were found between the groups during the baseline measurements with the intervention group showing higher mean scores in all three subcomponents. Over time, both groups obtained higher, improved mean scores, although not statistically significant in all the subcomponents, the test total and the percentile score. Significant interaction effects were also observed between the groups (Figures 2a-f) in manual dexterity

Table 2: Means, standard deviations and significance of differences over time in MABC-2 scores for-intervention and control groups.

Variables	**Intervention group** (N=25)					**Control group** (N=19)				
	Pre	**Post**	**Retention**			**Pre**	**Post**	**Retention**		
	M±SD	M±SD	M±SD	MSE	*P*	M±SD	M±SD	M±SD	MSE	*p*
Manual dexterity	7.72±0.57	8.52±0.50	9.25±0.48	13.92	0.41	7.00±0.69	7.05±0.59	9.76±0.60	3.04	0.05
Aiming and catching	11.72±0.55	9.96±0.56	11.36±0.45	11.85	0.55	10.65±0.67	11.29±0.68	12.34±0.55	4.36	0.03*
Balance	10.32±0.68	11.96±0.66	12.24±0.65	15.49	0.29	9.18±0.82	11.41±0.81	11.65±0.79	8.80	0.88
Total Standard Score	9.32±0.53	10.00±0.49	10.76±0.49	12.81	0.56	8.29±0.64	9.35±0.59	11.29±0.60	3.08	0.12
Total score	75.86±2.36	78.40±2.14	82.04±1.94	245.50	0.49	70.76±2.87	75.71±2.60	83.88±2.35	51.70	0.09
Percentile rank	41.92±5.35	49.96±5.24	57.84±5.21	1403.20	0.54	33.29±6.50	42.24±6.35	61.47±6.31	338.10	0.25

M=Mean SD=Standard deviation MSE=Mean square error $p<0.05$*=Statistical significance

Table 3: Effect size differences in MABC-2 subcomponents within and between intervention and control groups.

Group	**Test**	**Manual Dexterity**			**Aiming and Catching**			**Balance**		
		Over time		Between IG & CG	Over time		Between IG & CG	Over time		Between IG & CG
IG		PreT with	PostT with	0.25*	PreT with	PostT with	0.39*	PreT with	PostT with	0.34*
	PostT	0.28*		0.60**	0.64**		0.48*	0.49*		0.17
	RetT	0.55**	0.31*	0.20*	0.13	0.50**	0.38*	0.57**	0.08	0.18
CG	PostT	0.02			0.23*			0.66**		
	RetT	0.97***	1.11**		0.58**	0.34*		0.73**	0.07	

Test=Testing opportunity, IG= Intervention group, CG=Control group, PreT=Pre-test, PostT=Post-test, RetT=Retention test, d=0.20 small practical significance, although not considered to be important d=0.5* medium effect, d=0.80** large effect (Cohen, 1988)

($F_{2, 80}$=3.21; p=0.05) (Figure 2a) and aiming and catching ($F_{2, 80}$=3.79; p=0.03) (Figure 2b), which also showed improvements in the control group without intervention. Change over time was not statistical significant regarding manual dexterity (Table 2), aiming and catching and balancing skills (p<0.05), but showed practical significant changes (Tables 3 and 4) from the baseline to retention measurements that ranged between medium (d>0.5) and large (d>0.8) effect sizes in both groups (except for in aiming and catching skills in the intervention group).

Table 4: Effect size differences in total scores, test total and percentiles within and between groups.

Group	Test	Total Standard Score			Test Total			Percentile Rank		
		Over time		Between IG & CG	Over time		Between IG & CG	Over time		Between IG & CG
IG		Pre- with	Post- with	0.39*	Pre-with	Post-with	0.02	Pre-with	Post-with	0.32*
	PostT	0.26*		0.27*	0.01		0.01	0.30*		0.29*
	RetT	0.55**	0.31*	0.22*	0.02	0.01	0.00	0.59**	0.30*	0.14
CG	PostT	0.40*			0.02			0.33*		
	RetT	1.14***	0.80***		0.04	0.03		1.05***	0.73**	

Test=Testing opportunity, IG=Intervention group, CG=Control group, d=0.20 small practical, significance, although not considered to be important d=0.5* medium effect, d=0.80** large effect (Cohen, 1988)

No practically significant medium or large between-group differences were, however, evident during the retesting. The control group had better improvements than the intervention group over time in aiming and catching during the post-test (p<0.03; Tables 2 and 3, Figure 2a-c) while also showing better retention testing results; as they outperformed the intervention group in manual dexterity (p=0.05) and aiming and catching (p=0.03) with the intervention group only performing non-significantly better in balance skills (p=0.29). The control group showed higher mean total standard scores (+0.53), higher total scores (+1.84) and a higher percentile rank (+3.63%) during the retention test, although these differences between the groups were also of no practical significance during the retest.

Qualitative observation

Monitoring the programme delivery by the teachers during site visits and post-intervention group reflections made it possible to identify certain problem areas in the programme delivery. These included: (1) identification of feelings of information overload; (2) complex lesson plans – especially too many components to address in a lesson; (3) too few follow-up support visits; and (4) pedagogical problems, both on organisational and implementation levels. These problem areas were also linked to one another.

The teachers indicated that although the information they had received during the two-day training workshop was relevant and important, they were unable to retain and subsequently apply all the information in teaching the lessons. Although they were supplied with a tailor-made lesson plan to follow, each lesson (based on scientifically proven Kinderkinetics movement development programmes) included seven components and was considered too multifaceted to apply. This resulted in them being unable to remember what was important, what should be focused on and how the lessons should have been presented during the intervention period when the researchers were not present. They took time to grasp everything that needed to be in place in order to present a lesson which, in turn, resulted in too much time spent to prepare (unpacking apparatus in the correct way and in different stations) and to teach the lessons. In this regard, it took them more than double the time in the beginning to present the tailor-made lessons.

The teachers also indicated that the two-day training did not prepare them adequately to present the lessons immediately without assistance. They indicated that they relied to a great extent on the researchers' feedback during programme delivery and that one monthly site support visit was insufficient, especially during the first few weeks of the intervention. This influenced the last problem-area that was identified, namely pedagogy shortcomings, which ranged between inadequate organisational and pedagogical background skills to teach the skills properly. In this regard, the teachers experienced a number of challenges when organising large groups of children into smaller, more manageable groups during lesson-time. These included long lesson-periods and waiting times that were not conducive for the children's engagement with the content of the lesson. A positive aspect that was noted over the entire duration of programme delivery was that the teachers stayed positive and motivated to present the lessons.

Discussion

The purpose of this study was to evaluate inexperienced teachers' ability to present a tailor-made perceptual-motor development programme for three- to five-year-old children in a low resourced community. Our findings were based on testing of the outcome of the programme designed for the pre-school children, qualitative observations on monitoring the presentation of the programme by means of site visits and teachers' reflections regarding their experience in delivering the programme after being trained. The basic constructs of fidelity of interventions were used as a guideline to assess the results. These included usability, or the extent to which the teacher can be trained to use and implement the programme and is willing to use it; feasibility, the extent to which the programme can be used, taking into consideration limited space and equipment, and fidelity of implementation, which refers to adherence to implementation quality or whether the programme was delivered as intended. The results indicated significant challenges to implement the tailor-made programme in its current form especially

with regard to usability and implementation.

The feasibility of the programme was considered acceptable. The limited intervention effects found in the intervention group indicated that it was difficult for the teachers to implement the programme as intended in its current form. Two problem areas emerged from the observations during programme implementation, which were also confirmed by the teachers in the feedback sessions. These can be broadly categorised as information overload and pedagogical limitations to implement the movement programme in its current form.

Regarding the usability, the teachers were well motivated and took ownership of the programme. However, they indicated that they experienced information overload, which negatively affected their ability to implement the programme effectively. This limitation is considered to be manageable. It requires identifying of only the core aspects of programme delivery (delineating very specific skills and knowledge that the teachers need to be able to implement during programme delivery) and assessing their abilities to present the programme effectively in advance. These aspects could also be introduced and assessed over a longer workshop period and during practical sessions before commencing the actual programme delivery.

A second problem area that was identified was knowledge gap in the pedagogy of instruction that influenced the quality delivery of the programme, which can subsequently impede the objectives of programme delivery. To be able to present a movement lesson successfully, a presenter should have requisite background knowledge and skills. This includes understanding the choice of programme content, designing the lesson plan and composition of a lesson and understanding the motor development of children (Pienaar *et al.*, 2009). Some researchers (Loubser *et al.,* 2016; Pienaar *et al.,* 2009) have reported that the development of children between the ages of three and six years in South Africa from low socio-economic environments usually reflects at-risk developmental profiles, due to growing up in adverse environments that is often not conducive to optimal development. The situation is exacerbated by the fact that they are often taught by unqualified teachers, who have either little or no knowledge of the FMS and PMS development or the importance thereof.

During post-intervention discussions the teachers indicated that the outlay and content of the lesson were challenging to them, as they found it difficult to remember all the activities that needed to be taught as part of the lesson plan, and to apply all the information provided appropriately during the first day of training. They also lacked organisational skills and the knowledge to apply basic motor learning principles optimally during the teaching of motor skills. This includes correct demonstrations of the skills, breakdown of skills into parts according to their level of difficulty, feedback and repetition of an activity, which are all motor

learning principles that can contribute to success in the presentation of movement lessons. These are a few examples of skills which the inexperienced teachers inadequately learned during the training workshop.

In this regard, the teachers reported that some children had difficulty performing certain activities, such as gliding or jumping through a set of hopschotch hoops, while others found the same activities too easy due to more advanced motor development. However, they struggled to break down or to adapt the activities to accommodate differential developmental levels. Several researchers have found that the success of a FMS and PMS programmes is partly attributed to knowledge and experience in the specific field (Altunsöz & Goodway, 2015; Draper, Achmat, Forbes *et al.,* 2012; Logan *et al.*, 2011; Pienaar *et al.*, 2011; Robinson & Goodway, 2009). More frequent monitoring of programme delivery during its early phases can also help to identify knowledge gaps and other pedagogical problems which could be addressed promptly.

After completion of the movement programme, certain improvements were also found in the control group. This results could be explained based on two reasons. Firstly, the improvement observed could be attributed to natural motor development as a result of increasing maturity levels, which typically changes considerably within a short period of time at such a young age (Pieaar *et al.,* 2013; Robinson *et al.,* 2009). Altunsöz and Goodway (2015) are in agreement and indicate that children's motor skills improved over time despite their developmental status at the start of the study. Secondly, the control group's improvement may also have been attributed to contamination during the intervention as both groups were selected from the same school. It is plausible that participants from the control group might have been exposed to the content of the programme through child-driven learning (Kirk & Rhodes, 2011). The children that were part of the intervention group, could have practised or shown their peers the activities that they had learned during the lessons, which could have compromised the fidelity of implementation. Kirk and Rhodes (2011) explain that child-driven learning activities taught by children to one another, could be more effective than when programmes are offered by teachers or adults.

Manual dexterity skills also improved significantly in the control group compared to the intervention group, although only a small percentage of the tailor-made programme was comprised of such skills/activities as it mainly focused on gross motor and perceptual aspects. Consequently, there is a possibility that the teachers could have adapted their classroom content to practise activities related to fine motor skills during class work, as their colleagues from the specific school acted as interpreters during the pre- and follow up testing after programme implementation. Therefore, they could have been influenced to practise similar skills during lessons where participants in the control group were part of the class.

This study had various limitations that need to be acknowledged. Firstly, the degree to which teachers implemented the programme as intended by the programme developers was not assessed formally through scientific methods. However, through the mixed methods approach and procedures used, most of the fidelity aspects could be observed and evaluated informally. All participants were recruited from one school, which contributed to the fidelity of programme implementation. The intervention programme was also offered once a week over a period of four months, with the researchers visiting the school once a month for motinotring and evaluation purposes. Regular site visits and feedback to teachers would have yielded more profound findings.

Conclusions and recommendations

We can conclude that customised motor development programmes are not a simple solution to address a complex problem, as there are many background knowledge gaps to take into consideration regarding teachers with no training background such as subject matter knowledge and basic organisational skills needed to successfully present movement programmes. We believe that while the teachers were trainable to deliver the PMS programmes as intended, they experienced barriers in mastering and applying the methods appropriately. However, the challenges can be easily addressed if guidelines for improvement can be applied in future studies.

The content of the pre-training teachers' workshop need to be carefully reconsidered and delineated, as the level and amount of the knowledge that were offered and the skills that had to be mastered during one workshop contributed to an overload of information. Only key behaviours should be identified, trained and assessed in this regard. Modifications are also recommended in the guidance process during ongoing support-visits in order to improve this support mechanism during programme delivery. More frequent and ongoing monitoring visits are recommended to timeously intervene, especially during the first part of the intervention, while also focussing on establishing key behaviours of programme delivery during the lesson. A higher frequency of lessons per week are also recommended to allow more time for the programme to effectively take effect.

The lessons learned by the researchers are considered to be the most valuable contribution of this exploratory study, as it can be used in refining similar methods to improve the usability and feasibility of future studies. The present study also addressed some challenges highlighted in the national report on the state and status of physical education in South African public schools, such as a lack of trained and knowledgeable educators with good didactical skills and the lack of basic physical resources in lower quintile schools (Burnett, 2018). The objectives of this study are also well aligned with the plans for action as set out in this report, such as utilising educator-coaches to contribute to the meaningful role that movement

can play in schools which will prepare learners for a healthy, happy and fulfilling future.

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