REFERENCES

1 Reilly M. Occupational Therapy can be one of the great ideas of the 20th century: The 1961 Eleanor Clarke Slagle Lecture. The American Journal of Occupational Therapy, 1962; 16(1): 87-105.
2 Igiuku MN. Meaning-Making through Occupational Performance: Occupational Scientists'/Therapists' Role in Guiding Society towards Meaningfulness, Purposefulness, and Happiness. Keynote address at 33rd National OTASA Congress, Durban July 2012. http://www.otasacongress.co.za/images/stories/presentations/WED/Umdoni2/09h30%20ikiugu%20plenary%20wed.pdf (8 Jul 2012)
3 Baum C. AOTA The American Occupational Therapy Inc. Mary Reilly: Remembering a True Legend. [Online].; Feb 2012. http://www.aota.org/News/AOTANews/Reilly.aspx (31 May 2012)
4 Casteleijn D. The use of core concepts and terminology in South Africa. World Federation of Occupational Therapists Bulletin. 2012; 65: 20 – 27.
5 Barry A. Learning from African communal values: The leadership challenge for Occupational Therapists in the 21st century. Plenary session at 33rd National OTASA Congress, Durban July 2012. http://www.otasacongress.co.za/images/stories/presentations/Thurs/Umdoni2/08h30%20barry%20plenary%20thurs.pdf (8 Jul 2012)
6 Du Toit V. Patient Volition and Action in Occupational Therapy. (2nd ed). Pretoria: Vona & Marie du Toit Foundation, 1980.
7 De Wit P. Creative Ability: a model for psychosocial occupational therapy. In: Crouch RB & Alers VM (Ed). Occupational Therapy in Psychiatry and Mental Health (4th Ed). London: Whurr Publishers, 2005.
8 Casteleijn JMF. Development of an outcome measure for occupational therapists in mental health care practice. University of Pretoria, South Africa. Unpublished doctoral thesis, 2010. Available from: http://upetd.up.ac.za/thesis/available/etd-02102011-143303/ (30 June 2012)
9 Andrich D. Rasch Models for Measurement. Series: Quantitative Applications in the Social Sciences. London: Sage Publications, 1988.
10 Bond TG, Fox CM. Applying the Rasch Model: Fundamental Measurement in the Human Sciences. 2nd Ed. Mahwah NJ: Lawrence Erlbaum Associates, Inc., Publishers, 2007.
11 Molineux M. Occupation in Occupational Therapy: A Labour in Vain? In M. Molinuex (Ed), Occupation for Occupational Therapists. Oxford: Blackwell Publishing Ltd., 2004.
12 Laver Fawcett A. Principles of assessment and outcome measurement for occupational therapists and physiotherapists: theory, skills and application. Hoboken, NJ: John Wiley & Sons, 2007.
13 Talbot C. Theories of Performance: Organizational and Service Improvement in the public domain. Oxford: Oxford University Press, 2010.
14 Stevens SS. On the Theory of Scales of Measurement. Science, 1946; June: 677-680.
15 Michell J. Measurement in Psychology: A critical history of a methodological concept. Cambridge: Cambridge University Press, 2004.
16 Casteleijn D, Graham M. Domains for occupational therapy outcomes in mental health practices. South African Journal of Occupational Therapy, 2012; 42: 26 – 34.
17 Smart A. A multi-dimensional model of clinical utility. International Journal for Quality in Health Care, 2006; 18 (5): 377-382. ❑

Author

Daleen Casteleijn
Daleen.casteleijn@wits.ac.za

Development of a Task-Based Bilateral Fine Motor Skill Assessment for Grade 0 Children in South Africa

Ingrid Ratcliffe BSc OT (Wits),MSc OT (Wits), PhD (Wits)
Private Practice. This study was completed as part of the PhD in the Department of Occupational therapy, School of Therapeutic Sciences, Faculty of Health Sciences, University of the Witwatersrand

Denise Franzsen BSc OT (Wits), MSc OT (Wits)
Lecturer, Department of Occupational Therapy, School of Therapeutic Sciences, Faculty of Health Sciences University of the Witwatersrand, Johannesburg

Faith Bischof BSc PT (Wits), MSc PT (Wits), PhD (Wits)
Honorary Adjunct Professor, Department of Physiotherapy, School of Therapeutic Sciences, Faculty of Health Sciences University of the Witwatersrand, Johannesburg

ABSTRACT

The need for an assessment for Grade 0 children, to establish their school readiness in the area of fine motor skills, resulted in the development of the Task Based Assessment (TBA). The aim of the assessment was to include task-based items based on every day activities required at school and for personal management. Aspects of fine motor skills in terms of efficiency, accuracy, motor skill and time were considered.

The development of the items and the psychometric testing for aspects validity and reliability are reported. Testing included the focus groups and pilot studies to field test the TBA and align the items with fine motor skills appropriate for Grade 0 children. Construct and convergent validity and test-retest reliability were found to be at acceptable levels. Field testing on 130 participants from different socioeconomic backgrounds was completed to assess the sensitivity to change over time.

Key words: Assessment; Bilateral fine motor skills; Task-based; Grade 0 children

INTRODUCTION

The National Education Department has emphasised the need for the early identification of "barriers to learning" which prevents learners from achieving success in the classroom[1]. Approximately 7.3% of learners in the Gauteng school system can be identified as having intrinsic impairments in the form of deficits in internal performance components (for example low muscle tone) or client factors and performance skills (such as in-hand manipulation) which interfere with their learning[2]. Occupational therapists are concerned with the assessment and remediation of a number of these performance skills in the pre-school years including bilateral fine motor skills or co-ordination[3]. These skills present as the ability to manipulate the various tools and materials required to perform in school-related tasks such as cutting with scissors and writing and are needed for participation in other daily activities[4].

Children show the most improvement in more complex bilateral fine-motor control in the year before entering Grade 1, at 5 to 6 years[5] but the development of bilateral fine motor skills is dependent on the child's exposure to activities and their experience[6]. In South Africa additional external barriers to learning exist as children in poorly resourced communities often have no access to adequate teaching and learning materials in their pre-school years to develop school related fine motor skills[7]. This means that the fine motor skill levels of pre-school children will vary. It is therefore important to develop assessments for the performance skills related to fine motor functioning specifically for the South African context that incorporates some activities any child may be familiar with and some learnt activities they need to achieve in order to be able to perform in Grade 1.

The purpose of the study was to develop such an assessment, based on the fine motor skills for typically developing South African children between 5 and 6 years attending Grade 0. As occupational therapy is concerned with the child's level of participation in daily activities, a bilateral fine motor skills assessment should include everyday tasks that reflect the personal management and vocational activities of these children rather than the paper based assessments found in the many standardised tests available[8,9]. The use of these everyday occupational performance activities in the assessment allows the occupational therapist to analyse the steps involved in each task and thereby to evaluate the child's ability to perform each step in either the personal management, recreational or vocational related activities chosen[10].

The inclusion of a number of activities was important as a greater variety of items in the assessment would provide for a range of skills and yield a more accurate picture of the child's development of bilateral hand function. Bilateral fine motor tasks were therefore considered in relation to the needs and skills of typical 5-6 year old South African children and those selected to be part of the test were identified as being in the repertoire of 5-6 year old children's everyday occupational performance activities in personal management and schoolwork. By this age children, according to the literature, should be completing self-care tasks such as buttoning and tying shoelaces[4]. These important tasks promote independence in dressing and allow them during a school day to take off their shoes and shirts for sport and put them on again independently.

At this age children should be doing activities in terms of schoolwork that prepare them for Grade 1, so they become school-ready. According to the literature they should be using a preferred hand for fine motor tasks and also a tripod pinch when holding a pencil. They should be able to cut on straight and curved lines and shapes, use one hand to stabilise an object and the other to perform a separate activity and manipulate small objects within the hand[11,12].

Teachers who had experience in pre-school as well as in grade classes, were consulted as to which fine motor tasks best represented these abilities and which they included in the daily routine of their classes. Activities such as shaping play dough, cutting and colouring were mentioned. They felt that the ability to trace, draw within lines and free drawing as well as threading beads, cutting and folding paper were all important skills that should be achieved before the children started Grade 1. Working with thick triangular pencils and colouring pencils, as well as felt tipped pens, was emphasised as they felt that children should move away from wax crayons at this stage, except for use in art classes.

These activities were analysed and tasks requiring different levels of difficulty in relation to bilateral hand function or co-ordination were included. Activities were considered in terms of asymmetrical bilateral tasks, where the dominant hand leads and the non-dominant hand stabilises. Further, asymmetrical differentiated bilateral tasks were considered. In these tasks the dominant hand leads and the non-dominant hand performs a different action[13].

DEVELOPMENT OF THE TASK BASED ASSESSMENT (TBA)

Identification of activity components

From the literature and the discussions with the teachers activities were identified and the expected execution of each described (*Table I*).

Each activity was broken down into motor components and both movement (mobility) and stabilisation (stability) were considered in

Table I: Description of the Activities for the Bilateral Fine Motor Skill Assessment and the criteria for each

Asymmetrical bilateral activities	
Drawing with a ruler	The item requires drawing a line to join two dots (6 cm apart) with a 30cm, transparent ruler. This item was included in the assessment, as teachers pointed out that children are expected to use a ruler once they start school in Grade 1.
Writing name	Each child is required to write their name on a thin black line of the same thickness as used in school books. The child will be shown a sample in order to provide a visual aid to confirm the task requirement. Generally in schools, children are encouraged to write their names in Grade 0 usually on blank paper and when they enter Grade 1, they are expected to write on lines.
Threading beads	Threading of beads is an activity seen in many Grade 0 classes. This was included as a task that children are exposed to and generally also have the ability to do. The assessment included threading of beads within a time limit, using the dominant hand to thread the beads. Square beads were chosen, similar to those of the Bruininsk-Oseretsky Test of Motor Proficiency14. Further, the same time limit of 15 seconds was used, in order to be able to compare results with the standardised test.
Lacing cards	This activity was included as another variation of threading beads. The child was given a plastic card in shape of a crocodile with five holes around the edge. One end of the string was already laced through a hole, in order to prevent incorrect starting positions. The task was to lace the thread through all 5 holes in consecutive order. The child was timed while doing this task.
Asymmetrical differentiated bilateral activities	
Folding paper	Folding a sheet of paper in half is a creative activity done at a Grade 0 level. Each child was given an A4 sheet paper and asked to fold the paper in half. The end-product was shown to the child, so that they understood which way to face the paper i.e. short side along the top edge.
Cutting out a square and circle	Cutting is often commented on in reports for Grade 0 children and is an activity widely used at this level. The cutting task was modified from that used in the Bruininsk-Oseretsky Test of Motor Proficiency14 and a 16 cm circle with a 0.65 mm thick bold line was to be cut out. The other six concentric circles were copied onto a transparency and placed over the circle once the child had cut out on the line to measure the accuracy of their cutting. The square used in this assessment copied the measurements of the circle i.e. same circumference (16cm) and same line thicknesses (0.65 cm)
Tearing a paper	Tearing paper along a line is used in creative activities at a Grade 0 level. For this task, the child was asked to tear along a straight pre-drawn line, using their fingers. The line was 3mm wide and 5cm long. It was situated in the middle of a paper sized 5cm x 6cm.
Tying shoelaces	Children generally learn to tie their shoelaces at a Grade 0 level. Here the child was asked to tie a knot and a bow on a flat plastic shoe, placed in front of the child on the table. 30cm laces were used, to make the tying of the bow easier.

each activity and based on the assessment of motor skills. The following 4 criteria were identified and utilised when analysing the tasks:

A = accuracy [evaluation of the end product of the task];
M = motor components [observing how the task is performed, including the positioning of the body and grasp of tools];
T = time [timing the task];
E = efficiency of movement [are components of the task performed without any difficulties and are all steps in the task included to make it efficient[10]].

The use of the criteria allowed the activities to be broken down into easily observable task components, which could be consistently scored. This makes the assessment more reliable as it does not rely as much on the experience of the therapist. After analysing and dividing the tasks into motor components, the eight bilateral tasks that had been selected were finalised as the initial test items.

A scoring system was developed for these items so that clinical observation and measurement of the outcomes could be recorded. On consultation with the statistician the scores were allocated according to the correct response, thus the higher the score, the better the performance of the child.

Observation sheets were developed for the various assessments either using a point system or yes/no answers, which enabled the researcher to work out percentage scores. An example of the components for drawing a line with a ruler is presented in *Table II*. This item is not timed but some items were and the score was noted in seconds.

Content Validity

This is the extent to which content of a scale is representative of the conceptual domain of bilateral fine motor skills; assessed through expert opinion. Twelve experienced occupational therapists who have been working in the paediatric field for at least eight years were asked to judge the test for content validity. A focus group was held and individual items on the assessment were discussed. Generally therapists felt that all items included were bilateral tasks and also relevant to grade 0 children. It was suggested, that one further item be included in the assessment, namely another personal management activity. Initially, eating with a knife and fork was suggested but this was impractical in the classroom setting, and therefore, putting on a shirt and fastening the buttons were chosen as additional items.

The same group of therapists were asked to weight the assessment items according to their importance for Grade 0 children as each item scored a different number of total points. Scoring on the TBA was weighted for the items according to their importance and then adjusted by using the ratio and logarithms. The order of importance placed cutting with scissors at the top of the list followed by tearing; tying shoelaces; folding paper; name writing; threading beads; lacing; and finally drawing with a ruler.

Construct and Convergent Validity and Test-Retest Reliability

All other validity and reliability studies required field testing of the TBA on Grade 0 children. Thus *Pilot Study 1* was completed on 10 participants conveniently selected from the four Grade 0 classes by the principal of a public primary school in Johannesburg. The parents of the participants were asked to sign informed consent and give permission for their children to participate in the testing. A parent questionnaire, relating to the children's activities in the afternoon, and the equipment available to the children at home was included with the consent form. Children gave witnessed verbal assent for participation.

The researcher administered the TBA to each of the 10 participants in a room at the school that was made available for testing. A suitable table with two chairs were used. Each assessment took approximately 15 minutes and the participants were presented with the eight original items and the new dressing item in varying order. The researcher scored each participant's performance on the scoring sheet as per the criteria that had been set, while they were completing the activities. Responses were scored in terms of the motor components used, the efficiency, as well as the time taken to complete a task. Accuracy scoring was done afterwards on the actual paper the children used for drawing with

Table II: Example of the component task of the activity drawing with a ruler and the scoring system

DRAWING WITH A RULER	
	Mark the hand that is used
Stabilising hand (Motor components)	R / L
Ruler stabilised between the two dots	3
Ruler stabilised immediately next to the dot (index within 2 cm)	2
Ruler stabilised far away from the dots	0
Ruler (Efficiency)	
Ruler does not move at all	1
Ruler moves	0
Line Drawing (Accuracy)	R / L
Child draws on the ruler for 6 cm and the two dots are joined	6
Child draws on the ruler for 5 cm and the ruler is touching one dot	5
Child draws on the ruler for 4 cm and the ruler is touching one dot	4
Child draws on the ruler for 3 cm and the ruler is touching one dot	3
Child draws on the ruler for 2 cm and the ruler is touching one dot	2
Child draws on the ruler for 1 cm and the ruler is touching one dot	1
Child draws free hand	0

The items were designed to produce an end product to guide the child as to what was required and to use simple two to eight word instructions only. These simple instructions could be translated easily if necessary. This was important for the South African context where a number of different languages are spoken and translating instructions may affect the results of an assessment.

PSYCHOMETRIC ASSESSMENTS

Validity and Reliability studies of the TBA

This section describes the validity and reliability studies done in order to determine the extent to which the TBA measured the bilateral fine motor skills of Grade 0 children. As described in the development of the test all items and scoring was designed based on motor skill theory and in consultation with Grade 0 teachers. This was further validated from the information from the parents as to what activities the children did at home.

Three types of validity were considered in the development of this assessment.

Table 111: Analysis of tasks and items which need adjustment to achieve test-retest reliability after Pilot Study 1 and 2

Changes – Pilot Study 1				Changes Pilot Study 2			
Description	**r**	**p**	**Analysis**	**Description**	**r**	**p**	**Analysis**
Cutting a square - time	0.00	1	This gave a general idea of the time but it was not realistic to add practice trials for this item.	Cutting a square - time	0.00	1	Although the scores were not significant the item was included as it gave a graded time score for children as they progressed through Grade 0.
Cutting a circle - time	0.00	1		Cutting a circle time	0.00	1	
				Drawing with a ruler stabilizing	0.00	1	This item was removed from the assessment, as the task did not seem to be sensitive to the children's skill.
Drawing with a ruler-efficiency	0.43	0.08	The child would be given three trials, to accommodate errors.	Drawing with a ruler efficiency	0.00	1	
Drawing with a ruler motor component	0.42	0.09					
				Drawing with a ruler	0.00	1	
Writing name - accuracy	0.00	1.00	The task proved too difficult, with a very thin line. Children in Grade 0 may not have written on lines and some assumed they should write above the line. A margin of error was introduced, allowing the child to write on and up to 1mm above the line.	Writing name - accuracy	0.42	0.16	The task of writing on a line was probably too difficult for Grade 0 children but it was, still included in the assessment, as this is one of the most used activities in Grade 1.
Folding paper – motor components	0.26	0.21	The activity of folding paper was not a suitable test item. It could be included as an activity in the class and the correct method taught in Grade 0. This test item was removed.				
Folding paper - efficiency	0.00	1.00					
Folding paper - accuracy	0.41	0.09					
Tearing paper – motor component	0.51	0.04*	Although the scores were statistically significant, the straight line was changed to a curved line to allow children to tear in stages, and use a more organised and consistent approach.	Tearing –motor components	0.75	0.02*	The children tended to use a more consistent approach due to the fact that the line was curved, rather than straight.
Drawing around an object - accuracy	0.16	0.30	The poor result was related to the scoring of 1 or 0 meaning an error, was immediately penalised. Scoring was adjusted.				
Buttoning a shirt - motor components	0.88	0.00*	One further motor component was observed thus the scoring was changed.				
Buttoning a shirt - time	0.13	0.34	The child will be given three trials and the best score used.				

* significance set at 0.05

a ruler, writing on the line, tearing on a line, cutting and drawing around an object.

Participants were re-assessed by the researcher four days later. As one child was absent, only 9 children were re-assessed. Exactly the same procedure was followed in the re-assessment. The researcher was blinded to the results of the first assessment during the second assessment to eliminate bias. At the end of this pilot study lacing was removed as all aspects under consideration could be scored in the other items and this item did not contribute to any new observations.

Construct Validity

Construct validity provides evidence that each scale measures a single construct and that items can be combined to form summary scores; assessed on the basis of evidence of good internal consistency and correlations between scores.

A correlation matrix for the four constructs of fine motor skills, on which items were measured, indicated high correlations except for time. The correlation ranges across items for the different constructs were as follows:

Accuracy (0.99 to 0.96); Motor control (0.99 to 0.72); Time (0.90 to -0.94); Efficiency (0.90 to 0.50). All correlations were significant at $p \leq 0.01$.

The correlation of the scores for the participants indicated that similar constructs were being measured in each item across the assessment for accuracy, motor control and efficiency, but not for the time scores. The variation in the correlations found for the time scores was accounted for by the difference in the time participants took on the separate occasions they were assessed and indicated the need for practice sessions to be added to some of the timed components.

Convergent validity

Convergent validity requires evidence that items on the assessment are correlated with other measures of bilateral fine motor skills. This validity was established by the use of two items (cutting out a circle and threading beads) on the TBA which was the same as those used in the Bruininsk-Oseretsky Test of Motor Proficiency[14]. These two items were scored in the TBA using appropriate criteria for accuracy, motor components and efficiency with the number of beads threaded in 15 seconds adding a time element to the threading item. These two items were also scored using the criteria from the Bruininsk-Oseretsky Test of Motor Proficiency[14] and these scores were correlated with those obtained on the TBA as an indication of the extent to which the items accurately estimated the children's bilateral fine motor skills against existing standardised test results.

When comparing the scores for the bead threading on the Bruininsk-Oseretsky Test of Motor Proficiency[14] and the TBA, the high correlation of 0.96 indicates that the TBA was measuring a similar fine motor construct even though it was scored in a different way. The initial poor correlation of 0.04 for the scores for cutting out the circle using the Bruininsk-Oseretsky Test of Motor Proficiency[14] criteria and the scores on the TBA was identified as being as a result of high accuracy expectations in the TBA scoring. When a greater margin of error was allowed in the scoring of the TBA, and no penalty was applied for cutting off the line, or cutting immediately next to the outline of the circle, an acceptable correlation of 0.75 was then obtained.

Test-Retest Reliability

The test-retest reliability of the TBA was established to determine the stability of the test over repeated administrations and the extent to which items in a scale measure the same construct.

Reliability testing is done to determine the degree of consistency from one test administration to the next. The test was administered and then re-administered four days later to the same participants and cluster analysis using random-effect multi-level regression determined the similarity between the two scores[15]. When establishing the validity and reliability of the TBA, items were individually evaluated to ascertain if they were sensitive enough for measuring bilateral skills in Grade 0 children. This was a process, whereby scores were changed and items adapted in order to achieve the required validity and reliability.

All the scores were captured on a grid, documenting all the items tested as well as the first and re-assessment scores for each child. The data were then analysed for test-retest reliability. A number of the task analyses of the items failed to reach the required test-retest correlation required at a significance of $p \leq 0.05$, these tasks were subsequently analysed and adjusted (*Table III*).

Adjustments were made to the scoring of the motor components for name writing and drawing around an object, since several of the children used different methods for the tasks than those described on the observation form. The differences were recorded on the individual observation sheets, revised and added onto the assessment sheets when the children were re-assessed for the second time. The items that were timed (using a stopwatch) were also moved to the end of the assessment, so participants did not rush through initial tasks where no emphasis was placed on timing.

Once the TBA had been revised to accommodate all the changes needed a further *Pilot Study 2* to establish test - retest reliability on the changed items was completed on five Grade 0 children. The remaining eight items of the test were used once paper folding had been removed. As for the initial study, permission was obtained from the children's parents and who gave verbal assent for the children to take part and to be videotaped. The revised TBA sheets were filled in while the children were undertaking the tasks. The researcher videotaped and simultaneously timed the children cutting the square and circle. All children were re-assessed three days later. The data were then analysed for test-retest reliability as above (See *Table III*).

After completion of *Pilot Study 2* for the test-retest reliability the drawing with a ruler item was removed, leaving seven items in the assessment. Timing was kept in as a construct to be measured with three trials being allowed for buttoning a shirt. It was not possible to give trials for cutting around a square and a circle as this would have made the assessment too tedious and long. The timing was retained for observation in the assessment to establish the effect of intervention and maturity over the Grade 0 year. Videotaping for the cutting task was retained as well.

Final Version of the TBA

Table IV summarises the changes made to the TBA items during validity and reliability testing and the final items included.

The final version of the TBA ultimately consisted of seven items

Table IV: Summary of Test Item Development

Initial Test Items	Focus Group	Pilot Study 1	Pilot Study 2
Drawing with a ruler	No change	3 trials	Exclude
Name writing	No change	Margin of error introduced	Scoring adjusted for pencil grip
Threading beads	No change	No change	No change
Lacing cards	Exclude	N/A	N/A
Folding paper	Change scoring	Exclude	N/A
Cutting a square and circle	No change	Use video	Cutting approach added
Tearing paper	No change	Introduced curved path	No change
Tying Shoelaces	No change	No change	No change
	Drawing around Object (Added)	Change scoring	No change
	Buttoning a shirt (Added)	Change scoring Three trials	No change

which were *name writing*; *drawing around an object*; *tearing on a line*; *threading beads*; *tying shoelaces*; *cutting around a circle and a square;* and *buttoning a shirt*. While the child was completing the various tasks, the therapist was recording the observations step-by-step, filling out the observation sheet. An example of this can be seen in *Table V*. This table reflects all changes made throughout *Pilot Study 1* and *Pilot Study 2*.

Preliminary results on the field testing of the TBA on 130 children in Grade 0 across a variety of socio-economic backgrounds in Johannesburg measured the responsiveness of the assessment to change over time in the performance of bilateral fine motor skills. Assessments were completed at the beginning of the year and three months later on the participants. It can be assumed that during that time there was some input in terms of fine motor skills in the Grade 0 classroom and this was confirmed with the test components indicating a small positive change, although marginal in this time for most items, particularly for tearing paper and tying shoelaces (*Figure 1*). This test is therefore responsive to expected small changes over time in typically developing children in Grade 0.

Table V: Final assessment scoring sheet for Name Writing

Item		**NAME WRITING**				
Stabilising Hand - efficiency			**R**	**L**	**Score**	
1	E	With the non-dominant hand			2	Efficiency
	E	For some of the time			1	
	E	Child does not hold the paper with the non-dominant hand			0	
Pencil grip –motor component			**R**	**L**		
2	M	Dynamic tripod grip			3	Motor Component 1
	M	Tripod grip with thumb on index finger, or index further front			2	
	M	Three fingers on the shaft			1	
	M	Lateral grip or other			0	
3	M	Pencil held 2 – 3 cm from the tip			1	Motor Component 2
	M	Pencil held too close or too far up the shaft			0	
4	M	Shaft resting in the web-space			1	Motor Component 3
	M	Vertical pencil shaft			0	
Writing - accuracy			**R**	**L**		
5	A	Child writes whole name on line			3	Accuracy 1
	A	2 letters are touching the line			2	
	A	1 letter is touching the line			1	
	A	No letters are on the line			0	
6	A	All letters are above the line			1	Accuracy 2
	A	Some letters extend below the line			0	

CONCLUSION

The TBA has been designed as a school readiness test to identify fine motor problems in children in Grade 0. The test consists of 7 items, covering the areas of personal management, recreation and vocation. These items form part of the day-to-day routine of children of this age. While children perform the tasks, the therapist completes the observation sheets. These contain all of the items broken down into step-by-step task components as well as approaches to the tasks. Thus all of the items were analysed for motor components, accuracy, efficiency and time taken. The test does not rely on the therapist's own observation and interpretation skills but rather being made aware of all the components to be scored. This makes the therapist's comments about the child's function in the classroom more standardised and objective. It enables the occupational therapist to identify and confirm problems in task-based bilateral fine motor skills of pre-school children.

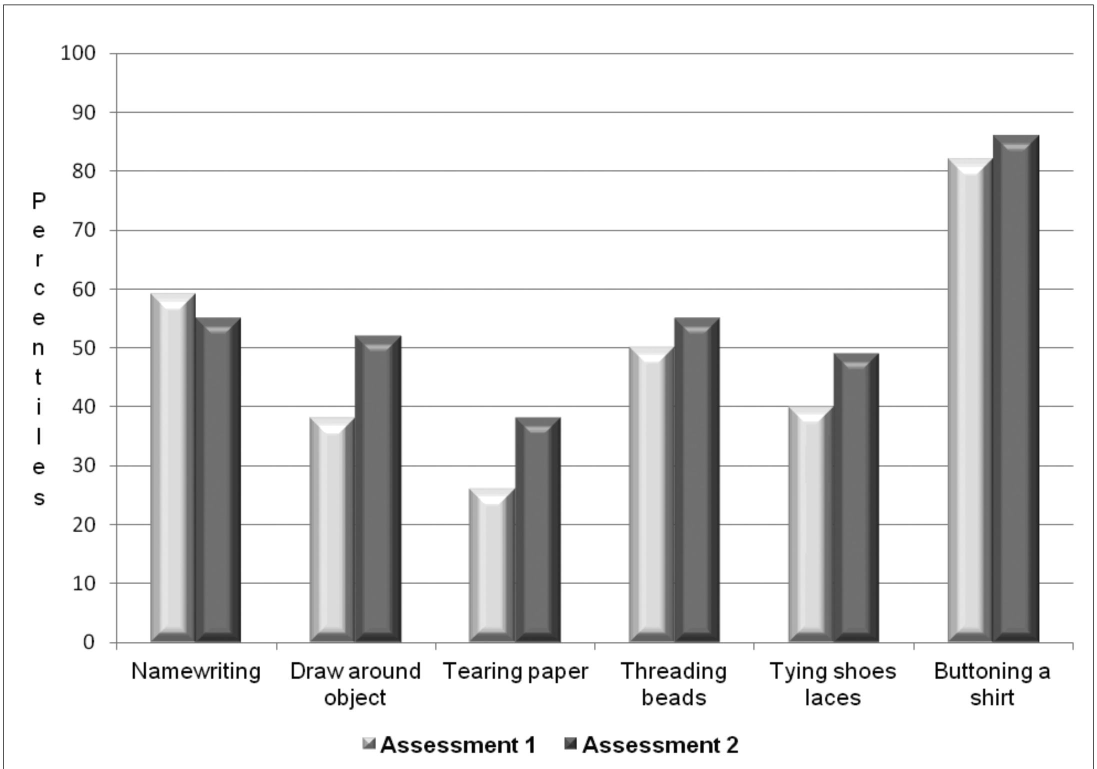

Figure 1: Change in scores over months for typically developing children in Grade 0

Acknowledgements

I would like to acknowledge the Wits O.T. Department and the statistician Dr. P. Becker for their valuable input. Final scores and percentiles as well as complete observation sheets for the TBA are available from the first author.

REFERENCES

1. Prinsloo E. Working towards inclusive education in South African classrooms. South African Journal of Education, 2001; 21(4): 344-348.
2. Nel N, Müller H, Rheeders E. Support services within inclusive education in Gauteng: The necessity and efficiency of support. Mevlana International Journal of Education (MIJE), 2011; 1(1): 38-53.
3. American Occupational Therapy Association.

Occupational Therapy Practice Framework: Domain and Process, 2nd Edition. The American Journal of Occupational Therapy, 2008; 62(6):625-642.
4. Case-Smith J, Rogers J. School-based Occupational Therapy.. In Case-Smith J. Occupational Therapy for Children. 5th ed.: Elsevier Mosby; 2005. p. p. 795-805.
5. Pearson Education Inc. Fine-Motor Skills. Pearson Education Inc; 2009 [cited 2011 March 12]. Available from: http://www.ncbtp.org/pdf_documents/para/handouts/aug_2009/05_fine_motor_skills.pdf.
6. Fingergym Fine Motor Skills. Fingergym Fine Motor Skills School readiness program. 2011 [cited 2012 May 23]. Available from: HYPERLINK "www.fingergym.info/downloads/Finemotordevpp1-4.pdf" www.fingergym.info/downloads/Finemotordevpp1-4.pdf .
7. Donald D, Lazarus S, Lolwana P. Educational psychology in social context. Cape Town: Oxford University Press; 2002.
8. Henderson S, Sudgen D, Barnett A. Movement Assessment Battery for Children-2, 2nd Edition New York: Pearson Assessment; 2007.
9. Beery K. The Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI): Administration, Scoring and Teaching Manual, 6th Edition. Parsippany NJ: Modern Curriculum Press, 2010.
10. Radomski M, Trombly C. Occupational Therapy for Physical Dysfunction: 6th edition Philadelphia: Lippincott: Williams & Wilkins, 2007.
11. Edwards S, Buckland D, McCoy-Powlen J. Developmental & Functional Hand Grasps. Thorofare: Slack Incorporated, 2002.
12. Ratcliffe I, Concha M, Franzsen D. Analysis of cutting skills in four to six year olds attending nursery schools in Johannesburg. South African Journal of Occupational Therapy, 2007; 37(1): 4-9.
13. Erhardt R. The Erhardt Hand Preference Assessment. Maplewood: Erhardt Developmental Products, 2006.
14. Bruininks R, Bruininks B. Manual for the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). San Antonio: Pearson Education, Inc, 2005.
15. McCulloch C, Neuhaus J. Prediction of random effects in linear and generalized linear models under model misspecification. Biometrics, 2011; 67(1): 270-279.

❑

Corresponding Author
Ingrid Ratcliffe
Ratcliffe@worldonline.co.za

Intra-Rater Reliability of the Posture Analysis Tool kit

Ronette Hough, B OT, M OT (UFS)
Lecturer, Department of Occupational Therapy, Faculty of Health Sciences, University of the Free State, Bloemfontein, South Africa

Riette Nel, M Med Sc (UFS)
Lecturer, Department of Biostatistics, Faculty of Health Sciences, University of the Free State, Bloemfontein, South Africa

ABSTRACT

Background: *Health care professionals mainly assess posture through qualitative observation of the relationship between a plumb line and specified anatomical landmarks. However, quantitative assessments of spinal alignment are mostly done by biophotogrammetry and are limited to laboratory environments. The Posture Analysis Toolkit (PAT), a photogrammetric measurement instrument was developed in 2009 to assess standing posture.* **Aim**: *The aim of this study was to test the intra-rater reliability of the Posture Analysis Toolkit.* **Methodology:** *A prospective, cross-sectional study design was conducted. Fourteen participants were required to do three measurements of the posture of a single subject using the PAT. Photographs of the anterior and left lateral upright standing posture were taken once, and imported three times for computerised analysis. Reliability was determined using descriptive statistics per session, confidence interval for the median difference between sessions, 95% limits of agreement and Spearman correlations.* **Results:** *In this study the intra-rater reliability of PAT between sessions was good.* **Conclusion:** *The Posture Analysis Toolkit was tested and proved to be reliable for use as an instrument for the assessment of standing postural alignment. Recommendations are suggested for the development of the PAT.*

Key words: posture assessment, biophotogrammetry, reliability, postural assessment toolkit

INTRODUCTION

Spinal posture is considered a prominent factor in the development and prevalence of low back pain[1,2,3]. Assessment and modification of postural alignment have been associated with improved clinical outcomes[4], energy efficiency and mechanical advantage during a person's participation in activity[5a]. Health care workers make use of a variety of methods to assess body alignment and postural imbalances[1,6,7]. These methods range from simple visual observation in clinical practice[8], to more complex laboratory-based motion analysis systems[9,10,11].

A number of computerised postural analysis systems has been developed that involve digitising an image of a client's upright standing posture to evaluate postural asymmetries[12,13]. Unfortunately, many of these systems are complex and time-consuming and cannot be easily used outside the laboratory setting. Furthermore, a significant limitation of these traditional laboratory-based motion analysis systems is that they cannot provide instantaneous postural feedback.

In 2008 Hermens and Vollenbroek-Hutton[14] advocated the use of portable, minimally invasive methods of analysing posture in "real world" settings to provide a quantitative measurement of posture in the workplace. Numerous devices have been developed to analyse spinal posture outside the laboratory, such as Biotoniz, ChiroVision, and Posture Pro[15], but many have proven to be too large and invasive, and lack empirical data to support their use. In 2009 the Postural Analysis Toolkit (PAT)[16,17], a novel wireless method of measuring postural alignment, was developed for use in studies to establish the Accuracy of the Plumbline Method[16], and body alignment[17]. In both these studies the PAT method demonstrated potential clinical utility, with data accessible for immediate analysis and presentation.

Whereas many laboratory-based methods of analysing posture have been shown to be both reliable and valid[18] the PAT has not been subjected to scientific validation in this regard. With increasing pressure for accountability and ethical practice in health service delivery, methods for assessment of posture are under continuous investigation to contribute to valid and reliable assessment practices.