

# DEVELOPMENT OF GROSS MOTOR SKILLS SCREENING TOOL FOR INCLUSIVE EDUCATION

*Assoc. Prof. Donald S. Lipardo (dslipardo@mnl.ust.edu.ph; dslipardo@yahoo.com)*  
*University of Santo Tomas-College of Rehabilitation Sciences*

*Assist. Prof. Maripia Rabacal*  
*University of Santo Tomas-College of Education*

*Mr. Hubert Ramos*  
*University of Santo Tomas-Faculty of Medicine and Surgery*

*Assist. Prof. Ma. Georgina Mojica*  
*University of Santo Tomas-College of Rehabilitation Sciences*

*Assist. Prof. Karen S. Ongtangco*  
*University of Santo Tomas-College of Rehabilitation Sciences*

*Assoc. Prof. Marie Ann Vargas*  
*University of Santo Tomas-College of Science*

*Ms. Marichou Beltran*  
*University of Santo Tomas-College of Education*

*Mr. Bernard Saldivar*  
*University of Santo Tomas-College of Education*

*Ms. Eleanor Bahrami Hessari*  
*University of Santo Tomas-College of Education*

## **Abstract**

Inclusive education is a strategy to increase the rate of participation of school-aged children with special needs. To ensure their active integration, an assessment of their strengths and weaknesses must be established, particularly in their gross motor skills (GMS). The purpose of this study is to develop a GMS screening tool that would help teachers in special education classes to identify the needs of children with disabilities. This study is part of a bigger qualitative descriptive psychometric study on developing a tool to measure and evaluate functional skills of children aged 4 to 6 years. The tool was drafted based on developmental milestones of typically developing children. It was subjected to face, content, and context validation by a panel of experts composed of physical therapists who had at least 2 years experience in handling pediatric patients. It was revised according to the recommendations of the expert panel and was resend for the second time to them for final approval. The tool was preliminarily introduced and utilized by elementary teachers in one urban elementary school and in one rural

elementary school. It was conducted with consent among regular and special education students. Based on the pilot testing, the tool needs to be revised through construct validation in order for it to be sensitive in showing the difference in the scores of typically developing children compared to the scores of children with special needs; further training of the teacher assessors must be done to improve inter-tester and intra-tester reliability.

**Keywords:** inclusive education, gross motor skills, screening tool

### **Introduction**

Inclusive education is a key strategy in the achievement of Education For All (EFA). As a basic human right, education must be provided to the poor, to the excluded, to the indigenous people, to the marginalized, and to those with special needs (UNESCO, 2009a; Forlin, 2013). Furthermore, inclusive education must not be viewed simply as making schools available to those who are already able to access them, but more so as a whole-school initiative in determining and addressing possible hindrances that might prevent learners to access good education (UNESCO, 2009b). It is a paradigm that hopefully increases the rate of participation in the learning process of diverse school-aged children with special needs.

And critical to the successful implementation of inclusive education is the understanding and appreciation of the characteristics of the learners. To ensure the active integration of children with disabilities into the learning environment, an assessment of their strengths and weaknesses, particularly in their gross motor skills (GMS), must first be established. This is the forte of physical therapists.

Physical therapists are allied health professionals who provide services that are geared towards the development, maintenance, and restoration of maximum movement and functional ability among patients/clients, individually or collectively as a group (WCPT, 2013). Often, they are seen working in hospitals, clinics, and rehabilitation centers. But they can actually help people at any stage of life, from infancy to old age, for as long as movement and function are threatened by ageing, injury, diseases, disorders, conditions or environmental factors (WCPT, 2013). That is why in other countries, physical therapists are also employed in educational institutions to provide services for children with physical disabilities and delayed motor developmental that might hinder them to learn and have an education.

The primary role of school-based physical therapists is to promote the participation of the learners in daily routines and educational program activities. This includes removing any physical and contextual barriers to the acquisition of appropriate knowledge and skills, and developing the needed functional abilities that will enable them to be more independent and confident in exploring the school environment. Physical therapists conduct thorough assessment of the students' functional motor abilities and the learning environment, and then perform specific therapeutic interventions based on the needs of the students. The interventions, which could be in the form of compensation, remediation and/or prevention strategies, are designed to achieve safe and efficient functional mobility of children with disabilities so that they can access and participate in activities and routines in natural learning environments (APTA; Bialy et al., 1999).

A number of assessment tools used by physical therapists to evaluate the functional abilities of school-aged children are available, such as Gross Motor Function Classification System-Expanded and Revised (GMFCS-E&R), Peabody Developmental Motor Scales Second Edition (PDMS-2), and Pediatric Evaluation of Disability Inventory (PEDI). The original GMFCS was developed to assess the functional abilities and limitations of children with cerebral palsy (CP) aged 12 years or younger. It includes five levels and four age bands. The GMFCS-E&R contains an additional 12- to 18-year age band, and a revised 6- to 12-year age band, which was also edited in concurrence with the International Classification of Functioning, Disability and Health (ICFDH). The GMFCS-E&R showed evidence of content validity and reliability in numerous studies (APTA Section on Pediatrics, 2004; Palisano et al., 2008; Silva et al., 2013; Shi et al., 2014).

The PDMS-2 is a comprehensive assessment and training/remediation tool for children with disabilities and/or developmental delays from one month to eighty-three months of age. It is considered a valid and reliable tool on the examination of gross and fine motor skills (APTA Section on Pediatrics, 2004; Hsiang-Hui et al., 2006).

The PEDI is used to determine functional capabilities and performance, monitor progress in functional skill performance, and evaluate therapeutic or rehabilitation program outcome in chronically ill children with disabilities from six months through seven years of age (APTA Section on Pediatrics, 2004). The construct and concurrent validity of this tool was established empirically (Feldman et al., 1990).

The presence of multitude of assessment tools for the functional abilities and skills of children with special needs clearly denotes the importance of preliminary screening prior to educational placement. Through preliminary assessment, assigned teachers are able to design learning opportunities well in order to optimize the participation of children with disabilities in all learning activities. This is also to avoid over- or under-estimation of the capabilities of our learners with different needs, and induce positive impact on the delivery and practice of special education (Nelson et al., 1991). This is the ideal scenario when a school has indeed a physical therapist conducting the assessment. This is, however, not the situation in many public and private schools in the Philippines. Currently, the task of assessing the learners' GMS and functional abilities is placed on the hands of the special education (SPED) teachers, who may not have the appropriate training to do so. Another concern is that the assessment tools may be too clinical and disease/condition-specific that they may not be suitable in school settings where a variety of learners with divergent maladies are enlisted. In addition, the expense and cultural adaptability of the assessment tools may be paramount concerns for the acceptance and sustained use of the tools among SPED teachers, especially in public schools where budget is quite limited. These concerns are the main reasons for the conduct of this research undertaking.

The purpose of this study is to develop a valid simple easy-to-use GMS screening tool that would help teachers in SPED classes to objectively identify the physical needs of children with disabilities.

### **Methodology**

This study is part of a bigger study entitled "*Ugnayan, Sanayan at Tulayan: Inclusive Education Resource Program for Children with Disability.*" The general objective, of

which, is to enhance the efficiency and quality of public inclusive education program through strategic partnership with the Department of Education for delivery of relevant education and services among children with disability in the Philippines. The first phase of this comprehensive study is the “Situational Analysis: Inventory of Functional Skills of Children with Disability.” The specific objectives at this phase are (1) to develop an activity-based screening that will determine the functional skills of children with disability, aged 4 to 6 years, in 6 domains namely: gross motor, fine motor, self-help, speech and communication, behavior and cognition, and (2) to provide an inventory of functional skills of the children based on the developed tool.

The gross motor domain is the focus of the current study. The other domains are concurrently studied in separate interrelated researches. To develop the screening tool, a qualitative descriptive psychometric research design was employed in the current study.

#### *Stage 1: Tool Development*

The tool was first drafted based on published developmental milestones on GMS of typically developing children (Molnar and Alexander, 1999; Martin and Kessler, 2007). This was then converged with the analysis of the tasks and physical requirements needed for a student to successfully participate in the learning process. School activities that were examined include (1) doing desk work in sitting, (2) doing board work in standing, (3) playing with classmates, (4) moving from one place to another, and (5) participating in educational activities which involves singing, dancing and others.

#### *Stage 2: Tool Validation*

The drafted GMS screening tool was subjected to face, content and contextual validation by a panel of experts composed of 3 licensed physical therapists with at least 2 years of experience in handling pediatric patients. Face validation involves superficially assessing the tool whether it looks valid to measure GMS of the targeted students. Content validity, on the other hand, looks into the extent the tool can actually measure all the facets of GMS that must be evaluated. Context validity refers to the appropriateness of the items based on the age, culture, geography and societal factors of the participants (Saks and Allsop, 2013).

The experts were given analysis sheets to look into (1) the general instructions, format, and lay-out of the tool for face validation, (2) the items in the tool whether to accept, revise or reject for content validation, and (3) the activities incorporated in the tool for the context validation. Comments and suggestions of the experts were obtained and taken into consideration. The tool was then revised accordingly, and was resend for the second time to the panel of experts for final approval before initial implementation.

#### *Stage 3: Tool Implementation*

The items in the GMS screening tool were then combined with the items of the other functional skills or domains (fine motor, self-help, speech-language, socio-emotional and cognitive functions), in one integrated tool called “Tool for Measuring Acquired Skills (ToMAS).” The ToMAS is composed of two parts. The first part is the Child Intake Form, which is about the student’s basic information supplied by the parent or guardian. The second part is a checklist of skills grouped together in 9 tasks. Each task is comprised of activities covering two or more domains (except for the last task or Task 9, which contains socio-emotional skills only) that the student has to perform, The teacher/assessor is asked to tick the “yes” box if the student was able to complete or

accomplish the given task, and the “no” box, if otherwise. A space for remarks was provided for the assessor to give additional descriptive comments about the performance of the student, as needed. It was emphasized to the teacher that since this is just a screening tool, and that further evaluation may be necessary, particularly for expected tasks to be performed by the student based on his age. It was also explained that results of the screening tool might be valuable to the teacher because ToMAS may provide information for the teacher to develop appropriate instructive program for inclusive education.

The consolidated tool was preliminarily introduced and utilized by elementary teachers in one urban elementary school and in one rural elementary school. Adequate training as to the use of the materials and conduct of ToMAS was provided to the teachers prior to implementation. A random sample of students with special needs and age-matched students from regular school were recruited. Consent from parents of the students was obtained prior to their participation.

#### *Data Analysis*

Responses supplied by the experts in the analysis sheets were collated and synthesized qualitatively, noting for similar themes and differing opinions. Data obtained from participants during the initial implementation of ToMAS were encoded in MS Excel and descriptive statistics, including mean, standard deviation (SD), percentage and frequency, was used to summarize the findings of this study. The index of discrimination and t-test were used to determine whether ToMAS could differentiate the SPED from the regular students.

### **Results and Discussion**

#### *Identified Gross Motor Skills*

Based on published developmental milestones on GMS of typically developing children and on task analysis of school activities, thirty items were identified and included in the drafted GMS screening tool. These items were then organized into four categories such as (1) sitting balance, (2) standing balance, (3) sit-to-stand, and (4) movement. Words that the SPED teachers can understand were used instead of technical physical therapy terms, for example “sitting balance” was used to replace “sitting postural control.” Figure 1 shows the content of the screening tool with the items organized into their respective categories.

GROSS MOTOR SKILLS SCREENING TOOL			
SITTING BALANCE	PRESENT	ABSENT	REMARKS
1. Sits without support (how long: _____)	<input type="checkbox"/>	<input type="checkbox"/>	
2. Sits with proper head, trunk and feet alignment	<input type="checkbox"/>	<input type="checkbox"/>	
3. Reaches objects on desk	<input type="checkbox"/>	<input type="checkbox"/>	
4. Reaches overhead	<input type="checkbox"/>	<input type="checkbox"/>	
5. Reaches objects on the floor	<input type="checkbox"/>	<input type="checkbox"/>	
6. Transfers objects	<input type="checkbox"/>	<input type="checkbox"/>	
STANDING BALANCE			
1. Stands without support (how long: _____)	<input type="checkbox"/>	<input type="checkbox"/>	
2. Stands with head, trunk and feet alignment	<input type="checkbox"/>	<input type="checkbox"/>	
3. Reaches objects on desk	<input type="checkbox"/>	<input type="checkbox"/>	
4. Reaches overhead	<input type="checkbox"/>	<input type="checkbox"/>	
5. Reaches objects on the floor	<input type="checkbox"/>	<input type="checkbox"/>	
6. Catches ball	<input type="checkbox"/>	<input type="checkbox"/>	
7. Throws ball	<input type="checkbox"/>	<input type="checkbox"/>	
8. Kicks a ball	<input type="checkbox"/>	<input type="checkbox"/>	
9. Steps in all direction	<input type="checkbox"/>	<input type="checkbox"/>	
10. Jumps in place	<input type="checkbox"/>	<input type="checkbox"/>	
11. Jumps forward	<input type="checkbox"/>	<input type="checkbox"/>	
12. Jumps to the side	<input type="checkbox"/>	<input type="checkbox"/>	
13. Jumps backward	<input type="checkbox"/>	<input type="checkbox"/>	
14. Stands on one foot	<input type="checkbox"/>	<input type="checkbox"/>	
15. Hops	<input type="checkbox"/>	<input type="checkbox"/>	
16. Skips	<input type="checkbox"/>	<input type="checkbox"/>	
SIT-TO-STAND			
1. Stands from chair alone without use of hands	<input type="checkbox"/>	<input type="checkbox"/>	
2. Sits on chair without use of hands	<input type="checkbox"/>	<input type="checkbox"/>	
MOVEMENT			
1. Walks forward	<input type="checkbox"/>	<input type="checkbox"/>	
2. Walks sideways	<input type="checkbox"/>	<input type="checkbox"/>	
3. Walks backward	<input type="checkbox"/>	<input type="checkbox"/>	
4. Runs alone	<input type="checkbox"/>	<input type="checkbox"/>	
5. Ascends stairs alone alternating feet	<input type="checkbox"/>	<input type="checkbox"/>	
6. Descend stairs alone alternating feet	<input type="checkbox"/>	<input type="checkbox"/>	

Recommendations:  
 Further evaluation by PT  
 Regular school placement  
 Inclusion to SpEd program

Figure 1. Gross Motor Skills (GMS) Screening Tool

The six items under sitting balance are important in order to measure how long a child can stay in the sitting position for short or long tabletop activities, and also to determine the need for straps or chair modifications to keep the child in the sitting position. The strength of trunk and arm muscles are also assessed in the items provided as well as the eye-hand coordination of the child in sitting. Overall, the general aim of assessing the presence or absence of the skills in sitting balance is to determine any problems that might hinder the child's participation in desk work/activities in school.

There are 16 items under the category standing balance. It is imperative that we know if the student can maintain the standing position long and stable enough to perform activities in standing like writing on the board, doing action songs, participating in play activities, or whether assistive devices and braces are needed to help the child keep or assume the standing position. The items under this set will also assess the strength of the arms, trunk and leg muscles. Ultimately, we want to identify any problems that might hinder the child from playing and moving around, and to know whether or not the student can be engaged in more active and challenging physical activities.

Although there are only two items listed under the category sit-to-stand, these two skills are of equal importance with the other gross motor skills. Aside from assessing the strength of the leg muscles, the presence or absence of these skills will inform us if the child can independently stand from sitting position, and sit from standing position without losing balance. Sit-to-stand problems might hinder the student from standing to recite to answer a teacher's question, and to transfer from his/her chair to another place/position.

The last six items in the GMS screening tool concerns the walking ability of the student. It is critical to note for any problems/deviations in ambulation like walking on toes, walking on heels, limping, uneven step, buckling of the knee, etc. In terms of class participation, these skills are vital for the student to independently walk to move from chair to blackboard, to transfer from one room to another room, or to stroll from corridor to room. Problems in mobility and walking will hinder the student in joining play activities or exploring the environment. These problems may be addressed with the use of assistive devices or braces, and provisions for environmental modifications like ramps, placement of handrails, etc.

#### *Validity of the Tool*

The GMS screening tool was found to have high face validity with 100% agreement among the three experts on the general instructions, layout and format. The experts accepted all 30 items listed in the GMS screening tool. This is based on the premise that an item is accepted only if at least two among the three experts agree that the item is important. Comments to revise and make clear some items include changing “Head, trunk and feet alignment” to “Sits with proper head, trunk and feet alignment” to associate the item to a given posture or activity performed by the student. They suggested that a manual of procedures must be made available to guide the teachers to consistently measure GMS. This is to supplement the training that is given to them prior to the use of ToMAS. It was also suggested that a set of criteria must be provided so that the teachers can make the appropriate recommendation, whether (1) to refer the child for further evaluation by a physical therapist, (2) to include the student in regular school placement, or (3) to enroll the child in special education program.

The items and activities on gross motor function in the integrated tool ToMAS were generally considered to be contextually valid. However, some parts of the tool and incorporated materials and activities need to be modified, like the sample pictures of fruits, vegetables and animals in the activity mat that were used while the child is walking in various directions, were not clear and distinguishable according to the experts. The recommendation was to use actual photos of the items instead of colored illustrations. Some activities such as hopping and skipping must be clearly defined and differentiated for consistency in assessment; and ascending and descending stairs may not be readily assessed since most of the classes for younger students and learners with special needs are held only in the first floor rooms of school buildings. These two items, therefore, were not included anymore in the integrated tool, ToMAS, for initial implementation. Aside from these two, the skill “runs alone” was deleted because of the limited space in the classroom for this skill to be observed, and also to ensure that only safe procedures will be included to avoid any injury or harm to the students. These considerations lead to the reduction of GMS items from 30 to 27.

#### *Preliminary Tool Implementation*

Table 1 shows the characteristics of students who participated in our study. Seventy five (75) students with mean age of  $7.43 \pm 1.73$  participated in the study. Thirty three (33) or 44% came from regular classes while 42 or 56% came from SPED classes. There are more male (73.33%) than female (26.67%) participants. It can be observed that the mean ages for both SPED and regular students were higher than the intended age group for the use of ToMAS, which is ideally 4-6 years old only. When this study was implemented, SPED and regular classes in the schools have already begun so the idea of using the tool as a screening assessment prior to enrollment was affected. The authors

decided to proceed with the implementation in spite of this predicament, as this is the actual situation in the schools where the study was implemented.

*Table 1 - Demographics of the Student Participants.*

	Age	Gender		Total
	Mean (SD)	Male	Female	
Regular Students	8.03 ( $\pm 2.07$ )	22	11	33
SPED Students	7 ( $\pm 1.3$ )	33	9	42
Total	7.43 ( $\pm 1.73$ )	55	20	75

The GMS items under the categories sitting balance and sit-to-stand were incorporated in Task 5 of ToMAS. The first 8 items under standing balance were included in Task 2 while the last 8 items were placed in Task 4. Movement items were put in Task 3.

Table 2 shows the indices of discrimination for GMS items in ToMAS. An index score of  $\geq 0.40$  is considered very good. Items with index scores in the range of 0.30-0.39 are classified as good. Items with index scores from 0.20 to 0.29 are fair, and those with  $\leq 0.19$  index scores are considered poor. A great majority of the items (85.19%) show very good index of item discrimination. These items were able to clearly measure and discriminate the GMS of students with special needs compared to age-matched students from regular class. Three items (11.11%) show good index score, and only one (3.7%) item is considered poor. This item with poor index (stands on one foot) may be due to the high level of difficulty of the activity for both SPED and regular students.

*Table 2 - Index of Item Discrimination of GMS Items.*

Gross Motor Skills Items		Index of Item Discrimination	Remarks
<b>Sitting Balance</b>	1. Sits without support (how long: _____)	0.46	Very Good
	2. Sits with proper head, trunk and feet alignment	0.54	Very Good
	3. Reaches objects on desk	0.46	Very Good
	4. Reaches overhead	0.46	Very Good
	5. Reaches objects on the floor	0.54	Very Good
	6. Transfers objects	0.54	Very Good
<b>Standing Balance</b>	1. Stands without support (how long: _____)	0.46	Very Good
	2. Stands with head, trunk and feet alignment	0.38	Good
	3. Reaches objects on desk	0.38	Good
	4. Reaches overhead	0.38	Good
	5. Reaches objects on the floor	0.54	Very Good
	6. Catches ball	0.61	Very Good
	7. Throws ball	0.54	Very Good
	8. Kicks a ball	0.54	Very Good
	9. Steps in all direction	0.77	Very Good
	10. Jumps in place	0.77	Very Good
	11. Jumps forward	0.77	Very Good
	12. Jumps to the side	0.77	Very Good
	13. Jumps backward	0.77	Very Good
	14. Stands on one foot	0	Poor
	15. Hops	0.92	Very Good



	16. Skips	0.85	Very Good
<b>Sit-to-stand</b>	1. Stands from chair alone without use of hands	0.54	Very Good
	2. Sits on chair without use of hands	0.54	Very Good
<b>Movement</b>	1. Walks forward	0.61	Very Good
	2. Walks sideways	0.61	Very Good
	3. Walks backward	0.69	Very Good

Comparing now the mean scores of the participants in the different tasks of ToMAS, as presented in Table 3, only Tasks 1, 2, 4 and 5 show significant differences, with p-values < 0.05, between those enrolled in SPED compared to those in regular schools. The GMS items are found in Tasks 2, 3, 4 and 5. This means majority of the GMS items were included in tasks, which significantly differentiates the two groups of students. But since ToMAS is to be taken as a whole, measures to revise and/or delete some items may need to be carried out in order to be a more sensitive and specific screening tool.

*Table 3 - ToMAS Mean Scores and Standard Deviation of Participants Per Task*

Tasks	Regular Students Mean (SD)	SPED Students Mean (SD)	t-test
1	8.22 ±3.28	3.83 ±3.08	0.00*
2	8.27 ±4.76	4.98 ±4.31	0.00*
3	6.85 ±4.02	5.19 ±3.64	0.07
4	6.45 ±3.80	4.62 ±3.70	0.04*
5	11.55 ±6.64	7.21 ±5.58	0.00*
6	9.09 ±5.44	7.26 ±5.82	0.17
7	13.36 ±7.23	9.95 ±7.44	0.05
8	10.82 ±6.02	9.83 ±6.27	0.49
9	10.18 ±10.27	12.45 ±9.98	0.34

\* *Significantly different*

## Conclusion

A validated gross motor skills screening tool was developed for SPED teachers to help them determine the weaknesses and strengths of students with physical disabilities in terms of their gross motor function. It was integrated in a comprehensive screening tool called Tool for Measuring Acquired Skills (ToMAS). Based on the pilot testing, the Some tasks and items do not show significant difference between SPED students and regular students. These parts may need to be revised in order for entire tool to be more sensitive and specific in showing the difference in the scores of typically developing children compared to the scores of children with special needs. More psychometric studies focusing on construct validity and inter-tester and intra-tester reliability of the teacher-assessors must be done in future endeavours. A more organized training of the teacher-assessors, coupled with printed manual of instructions must be conducted to ensure consistent and

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