Improving school-performance using a sensory integration approach for a child with autism

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Improving School-Performance Using a Sensory Integration Approach

For a Child with Autism

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Note: This document describes a Capstone Dissemination project reflecting an individually planned experience conducted under faculty and site mentorship. The goal of the Capstone Experience is to provide occupational therapy doctoral students with unique experiences whereby they can demonstrate leadership and autonomous decision-making in preparation for enhanced future practice as occupational therapists. As such, the Capstone Dissemination is not formal research.
Abstract

This case study involves an intelligent 6 ½ year-old boy who was diagnosed with autism one year ago. Maxx has several ritualistic behaviors, has decreased receptive language, and no expressive communication. Maxx did not receive any services until the age of 5 years 5 months; he currently receives school-based services for occupational therapy, physical therapy, speech therapy, and is in a multi-handicapped classroom. Maxx is unique because he has severe dyspraxia that limits his fine motor abilities, play skills, and occupations of daily living. He has difficulty with transitions and often demonstrates verbal outbursts by screaming and crying.

The sensory integrative model of practice (Ayres, 1979) guided the treatment of this child by using vestibular, proprioceptive, and tactile experiences to address Maxx’s sensory based motor disorder of dyspraxia. Many studies have demonstrated the effectiveness of sensory integration therapy with children with autism directly after or in a delayed response to intervention (Case-Smith & Bryan, 1999; Linderman & Stewart, 1999; Miller, Coll, & Schoen, 2007; Roberts, King-Thomas, & Boccia, 2007; Schaaf & Nightlinger, 2007; Smith, Press, Koenig, & Kinnealey, 2005).

Using the conceptual framework of occupational therapy (Nelson and Jepson-Thomas, 2003) the occupation can be divided into many tasks. Maxx’s development structure utilized the occupational form of “writing in sand” where he developed meaning and purpose in the occupation by becoming more interested in the writing task than typically demonstrated with the use of various writing utensils. His occupational performance was more independent with a significant decrease in verbal outbursts.
**Introduction**

**Background Information**

Maxx is a 6 ½ year-old, right handed, male who was diagnosed with autism at the age of 5 years 8 months old. Maxx meets most of the criteria in The Diagnostic and Statistical Manual of Mental Disorders Fourth Addition (DSM-IV; American Psychological Association, 2000) for the diagnosis of autism. His parents noticed ritualistic behaviors (e.g., lining up items) and limited communication at the age of two. Outpatient therapy was attempted at the age of three but insurance denied reimbursement. An Individualized Education Program (IEP) was initiated in February of 2007 at the age of 5 years 5 months and included speech therapy, occupational therapy, and physical therapy.

Maxx lives in Norwalk, Ohio with his parents and one older sister. His parents transport him to and from a public school where he attends a Multi-Handicapped (MH) classroom. Maxx’s parents are very supportive of their son and follow through with recommendations from therapists appropriately (e.g., purchasing a therapy ball and performing the Wilbarger’s Sensory Defensiveness Protocol).

A previous occupational therapy (OT) outpatient evaluation performed in March of 2007, and school based assessment performed in February of 2007, identified atypical sensory processing, severe dyspraxia, behavioral outbursts, and limited language as barriers to Maxx’s ability to function at an age appropriate level.

At the time of the school-based evaluation Maxx exhibited a strong over-reaction to nail clipping, did not eat a wide variety of food, had tactile hyper-responsiveness, and
when excited ran back and forth. The Sensory Profile (Dunn, 1999) was completed in January of 2007 by his mother and identified several factors of atypical sensory processing. A definite difference was noted in fine motor perceptual, modulation of sensory input affecting emotional responses, and behavioral outcomes of sensory processing. Probable differences were noted in sensory seeking, registration, vestibular processing, touch processing, and modulation of visual input affecting emotional responses and activity level. The school-based occupational therapist has educated the family on Wilbarger's Sensory Defensiveness Protocol (i.e. Brushing Protocol) to utilize at home to reduce atypical sensory processing.

Maxx typically enjoys messy-play after an initial introduction, plays ritualistically by lining up items, does not seek out typical motor activities, and has decreased initiation with motor tasks. Verbal behavioral outbursts occur when requests are made not of his choice or if there is a transition different from his regular routine.

OT school-based treatment has focused on following routines and transitions without disruption, participating in sensory diet activities with strong proprioception and vestibular experiences, attending to visual strategies, printing his first name, playing alongside a peer with age appropriate toys, and managing clothing and fasteners. Maxx has made significant gains from February of 2007 in OT such as following a visual schedule for sequences of tasks, taking his shoes and coat off and attempting to put them back on, taking turns, and using some basic sign language.

The special education teacher, occupational therapist, and speech therapist are using a team approach to obtain a Vanguard communication device to enable the child to
communicate more effectively and decrease the frequency of behavioral outbursts. He has been quick to learn how to use another child’s device and has demonstrated increased interest in the device. Insurance has denied reimbursement for the device so the Lions club and Eagles club are being pursued for sponsorship.

**Model of Practice**

A. Jean Ayres created the sensory integration model of practice in the late 1960s and early 1970s to address sensory concerns. Ayres was an occupational therapist and educational psychologist invested in understanding developmental learning and emotional problems that arise during childhood (Parham & Mailloux, 2005).

Ayres developed the concept of sensory integrative dysfunction which helps identify children with sensory concerns. Ayres believes that the first 7 years of life are a period of rapid development in sensory integration. Senses may include the five known senses: auditory, visual, olfactory, gustatory, and tactile, as well as two less emphasized senses: the vestibular and proprioceptive senses. Sensory integrative dysfunction can include problems with one or more senses.

Several other individuals have expanded on Ayers’ sensory integrative model of practice over time (e.g., Wilbarger, Dunn, Miller, etc). The diagnostic name of sensory integration dysfunction has evolved into sensory processing disorder. Although sensory processing disorder is not recognized in the DSM-IV, studies are being conducted to support the diagnosis through EEG (Davies & Gavin, 2007) and standardized assessments (Tomchek & Dunn, 2007; Watling, Deitz, & White, 2001). It is anticipated that the diagnosis will be included into the DSM in 2012.
There are three different categories that encompass the developmental structure of a child with sensory processing disorder: sensory discrimination disorder, sensory modulation disorder, and sensory-based motor disorder. There are many recent books published to discuss the sensory processing disorders as well as recommended treatment strategies (Kranowitz, 2004; Kranowitz, 2003; Kranowitz, 2005; Miller, 2006; & Yack, Aquilla & Sutton, 2006).

The following examples portray sensory processing disorders in the auditory realm. Sensory discrimination disorder is the difficulty distinguishing one sensation from another (e.g., difficulty differentiating between sounds, especially consonants and ends of words). Sensory modulation disorder can occur if a child is over-responsive (e.g., covers ears to close out sounds or voices), under-responsive (e.g., ignores ordinary sounds and voices, but may become aware to exaggerated musical beats or sudden sounds) or sensory seeking (e.g., welcomes loud noises and TV volume; may speak in a loud voice). Sensory-based motor disorder can present as dyspraxia (e.g., difficulty conceiving, sequencing, and carrying out new motor tasks) or as a postural disorder (e.g., losing balance easily when walking or changing positions).

Sensory integration relates to occupational therapy because a child who has a sensory processing disorder is limited in the ability to successfully complete occupations of daily living compared to their typical developing peers. The sensory integration model of practice addresses all of the sensory systems in treatment but focuses primarily on the vestibular, tactile, and proprioceptive systems (Yack, Aquilla, & Sutton, 2006).
Scientific Evidence for Model of Practice (MOP)

There is recent research published supporting and rejecting the effectiveness of sensory integration MOP in the field of occupational therapy. The discrepancy may occur due to the increased variances in each subject with sensory processing disorders.

Parham, Cohn, Spitzer, Koomer, Miller, Burke, et al (2007) established that validity in sensory integrative studies is threatened by weak fidelity. Many studies have demonstrated the effectiveness of sensory integration therapy with children with autism directly after or in a delayed response (Case-Smith & Bryan, 1999; Linderman & Stewart, 1999; Miller, Coll, & Schoen, 2007; Roberts, King-Thomas, & Boccia, 2007; Schaaf & Nightlinger, 2007; Smith, Press, Koenig, & Kinnealey, 2005). Other studies have established that sensory integration does not necessarily affect a child’s function in comparison with other teaching strategies (Bundy, Shia, Qi, & Miller, 2007; Watling Dietz, and White, 2001).

Rationale for this MOP with this case

Children with autism show many of the symptoms of poor sensory processing which hinders the development of praxis (motor planning). They have a great deal of trouble with praxis and they lack desire to do new or different things; this problem creates difficulty in the child showing meaning and purpose in doing constructive occupations (Ayres, 1979). This case study subject demonstrated extreme dyspraxia affecting his communication through sign, motor planning, fine and gross motor skills, and daily living skills.
In the sensory integrative model of practice, dyspraxia is considered the most encompassing of all the problem areas (Kimball, 1999). Dyspraxia is a term used to characterize the inability to conceptualize, plan, and execute a non-habitual motor act. A child with autism has increased limitation in transferring a skill to a new similar situation, than a typical child (Kimball, 1999). Praxis requires the vestibular and proprioceptive systems to work together to complete a task. “Proprioception updates our body percept so that the brain can plan the next movement correctly, and then contract the right muscles at the right time” (Ayres, 1979). The vestibular system is important for “navigation” of the movements. Ayres (1979) stated:

The objective of therapy for the autistic child is to improve the sensory processing so that more sensations will be more effectively “registered” and modulated, and to encourage the child to form simple adaptive responses as a means of helping him to learn to organize his behavior.

**Frame of Reference**

Using the conceptual framework of occupational therapy (Nelson & Jepson-Thomas, 2003) as the frame of reference, the sensory integrated occupation can be fractioned into separate categories and examined to see how the occupational performance is being affected. Appropriate terminology of the occupation: occupational form, developmental structure, meaning, purpose, and occupational performance are identified in the treatment intervention section.
Evaluation

Due to Maxx’s behavioral outbursts with items not of choice, severe dyspraxia, and decreased responsiveness to verbal instructions, administration of standardized assessments to address fine motor skills was inappropriate (Case-Smith & Bryan, 1999). Information on this child was gained through clinical observations and administration of the Sensory Processing Measure (completed by his main teacher and his mother).

The Sensory Processing Measure (SPM) is a standardized assessment of sensory processing issues, praxis, and social participation in elementary school-aged children (5-12 years-old). The SPM is intended to be interpreted by an occupational therapist with post professional training in sensory integration. There are several different forms created to address a variety of daily circumstances of school-aged children. There is a Home form (Parham & Eckler, 2007; 75 items) to be completed by a guardian, a Main Classroom form (Kuhaneck, Henry, & Glennon, 2007; 62 items) to be completed by the teacher, and six different School Environment forms are to be completed by the most appropriate person for the different settings (i.e. art, music, physical education, recess, cafeteria, and school bus) with 10-15 items on each. One or all of the different assessments may be completed based on the child’s behavior.

The main purpose of SPM is to assess sensory systems and vulnerabilities in multiple contexts. Sensory systems (i.e. visual, auditory, tactile, proprioceptive, and vestibular as well as integrative functions such as praxis and social participation) are assessed. Vulnerabilities of sensory integration are assessed to address under and over-responsiveness, sensory-seeking behavior, and perceptual problems. The availability to
perform the assessment across multiple environments allows the evaluator to compare
and contrast the child’s functioning in different environments.

There are eight norm-referenced standard scores from the Home and Main
Classroom forms: social participation (SOC), vision (VIS), hearing (HEA), touch (TOU),
body awareness (BOD), balance and motion (BAL), planning and ideas (PLA), and total
sensory systems (TOT). Proprioception is addressed in BOD, vestibular in BAL, and
praxis in PLA.

The assessment procedure includes explaining the reason the assessment is being
conducted. The parent and teacher must complete the questionnaire and return it for
scoring. It is important to make sure that all questions are completed by the parent prior
to scoring. Answers are recorded as never, occasionally, frequently or always with
numerical representations of 1-4. If need be, it is possible to interview the respondent by
reading the exact questions as they are written.

The Home form (see Appendix A), completed by Maxx’s mother, showed definite
dysfunction in balance and motion indicating a deficit in the vestibular sensory system,
creating multiple difficulties with movement and balance, as well as postural control.
Some problems were identified with social participation, vision, hearing, touch, planning
and ideas. Typical performance was stated in body awareness. Questions with always
responses include: enjoys watching objects spin or move more than most kids his age,
becomes distressed by having his or her fingernails or toenails cut, jumps a lot, chews on
toys, clothes, or other objects more than other children, does not seem to get dizzy when
others usually do, spins and whirls his body more than other children, seems afraid of riding in elevators or on escalators, and fails to complete tasks with multiple steps.

The Main Classroom form (see Appendix B), completed by Maxx’s main teacher, showed definite dysfunction in planning and ideas indicating a deficit in praxis creating a problem integrating multiple sensory systems, particularly tactile perception and proprioception. Some problems with social participation, vision, hearing, touch, body awareness, and total score. Typical range was noted for balance and motion. Questions with always responses include: does not notice strong or unusual odors, fidgets when seated at desk or table, demonstrates limited imagination and creativity in play and free time, and plays repetitively during free time and does not expand or alter activity when given opportunity.

Clinical observations lead to different impressions compared to standardized assessment scores on the socialization section and the planning and ideas section. Individuals with autism spectrum disorders are expected to show elevated scores on these sections. It is suspected that it was difficult for the two correspondents to compare information about the subject to a typical child due to the parents having a child who is more than 5 years older than Maxx and the special education teacher not having any typical children in her classroom. Maxx is only capable of performing 12 American signs, has no verbal communication, and has decreased receptive communication leading to the conclusion that socialization is significantly impaired. Maxx demonstrates a definite dysfunction (e.g., unable to write letters of name independently) in planning and ideas compared to typical children.
Clinical observation during an occupational therapy session concluded that this child presents with a variety of abnormal behaviors. He consistently pulls on his diaper for no apparent reason. He presses his fist to his chin or licks his upper lip in novel situations. Maxx can be very resistant to challenging tasks (e.g., don/doff shirt) by screaming and crying; he stops the behavior immediately after the task is completed. No physical outburst were reported or observed.

Clinical observation within the multi-handicapped classroom and speech therapy session led to the conclusion that Maxx is intelligent regardless of his limitations in expressive and receptive communication. The child completed multiple tasks with minimal formal teaching. He was able to complete patterns, sort the alphabet accordingly, identify objects in a book that were verbally asked, and identify appropriate colors. Some prompting was required to initiate and continue with tasks. He had decreased accuracy in tracing his name. When completed with morning school routines he enjoys running in the classroom or playing the same computer game daily. No interaction with peers was observed except when prompted by the teacher. He uses a Go Talk communication device to ask to go to the restroom or for help. He was compliant during the daily routine but somewhat aggravated with new situations with minimal behavioral outbursts. The teacher and occupational therapist agreed that his behavior has improved throughout the school year.

Maxx was observed in a swim lesson for a more conclusive understanding of his dyspraxia. The swim instructor had to support his body in the water for all occupations. Maxx was able to kick his legs when prompted verbally and move his arms with a visual
demonstration but was unable to coordinate the movements together demonstrating dyspraxia. Maxx did not want to place his face in the water, possibly due to his tactile sensory system disorder.

**Innovativeness**

Maxx is a very unique child with autism. He is intelligent but has severe difficulty with communication. He has severe dyspraxia that limits his ability to sign and occupations of daily living.

**Goal Setting**

Main concerns from clinical observation and the Sensory Processing Measure include balance and motion (vestibular), planning and ideas (praxis) fine and gross motor skills, and following adult provided directions. The goals reflect occupations of daily living necessary to function within a classroom setting.

*Long term goals (LTG)*

**LTG1. Student will independently write his name on the line with 75% legibility, 2 out of 3 times, within 12 months.**

This goal was created due to the decreased accuracy noted during his tracing of his name in the classroom and the role with being a student. He has decreased meaning and purpose in using writing utensils. It is important to complete this occupation to identify his schoolwork, sign checks in the future, participate in age appropriate tasks (e.g., coloring), and to increase his overall independence with other fine motor occupations.
LTG2. Student will follow school routines and transitions with a visual schedule with no behavioral outbursts, 90% of the time, within 12 months.

Following the daily routine in the classroom can be somewhat challenging to Maxx. He has verbal outbursts with task not of choice. Following adult-directed routines will help him follow employer’s direction as an adult.

*Short term goals (STG)*

**STG1. Student will cut a line with minimal assistance, 3 out of 4 times, within 3 weeks**

Due to the dyspraxia and decreased fine motor tolerance and coordination, it is appropriate to practice school-age skills to increase Maxx’s independence. Maxx has had little exposure to scissors at this point.

**STG2. Student will trace his first name with 75% accuracy, 3 out of 4 times, within 3 weeks**

Tracing his name is a challenge at this point; he has decreased accuracy tracing the lines and making diagonals which are vital to writing his name. As a student, he is expected to learn how to write his name and perform other fine motor tasks. Using different occupational forms with different tactile experiences, the child may find an increased meaning in purpose with the fine motor task experience and have an increase in occupational performance.

**STG3. Student will don/doff shirt independently, 3 out of 4 times, within 3 weeks**
Maxx demonstrates moderate frustration, through screaming and crying, with donning and doffing his shirt. The main problem occurs at the elbows and requires minimal assistance to complete donning and doffing.

**STG4. Student will follow a picture schedule in therapy with minimal complaint,**

**75% of the time, within 3 weeks**

Maxx is able to follow a visual schedule with Boardmaker (Mayer Johnson) pictures with minimal assistance and with moderate complaint about tasks not of his choice. Continuously using the schedule will allow the student to understand the sequence of events and decrease behaviors using the if-then sequence (Cahill, 2006) alternating the sequence from occupations he enjoys and performing undesirable occupations. Alternating routines and sequences will assist with transitions.

**Intervention**

There were several days missed in therapy due to cancellation of school for weather related purposes and absenteeism due to complications after a dental appointment. Maxx participated in individual, school-based occupational therapy two times per week for 20 to 30 minutes. One pull-out session occurred during the school day in a room with minimal auditory distractions (occupational form); the other weekly treatment session was conducted at an outpatient occupational therapy facility (occupational form) for 30 minutes to increased sensory integrative opportunities (e.g., vestibular and proprioceptive).

Individual therapy is the most effective way to initially help a child improve capabilities when sensory integrative problems are interfering with the child’s
occupations at home, in play, at school or in the community (Parham & Mailloux, 2005). Although the model of practice recommends that the therapist alter tasks chosen by the child to address desired goals, a high degree of direction often is needed when working with children with autism, whose inner drive (purpose) is limited (Parham & Mailloux, 2005). All interventions in the occupational therapy setting were premeditated and followed a Boardmaker (Mayer Johnson, 2008) visual schedule. Cahill (2006) stated that “visual supports help to increase the functional independence of children with autism spectrum disorders in daily occupations” by offering a way to communicate visually rather than verbally for children who have trouble with expressive and/or receptive communication.

Typical occupational forms at the school included a table, chair, pencil, marker, fine motor toys (e.g., strawberry tweezers), therapy ball, medium sized ball, and Vanguard communication device. Occupational performances consisted of bouncing on a large ball vigorously to increase vestibular input and arousal (meaning); writing his name with a wide range of occupational forms for fine motor skills; and different fine motor occupations (e.g., picking up pom poms with strawberry tweezers) to address the child’s severe dyspraxia.

Typical occupational forms at the outpatient facility included blue mast covering the floor, a large slide, bean bags, ball pit, Cloud 9, fine motor activities, tactile experiences (e.g., shaving cream, sand, etc.), toys (e.g., train set), net swing, and trapeze. Occupational performances consisted of motor sequences (obstacle courses), swinging, doing fine motor occupations, and playing in different textures.
Maxx had a difficult time creating and meaning and purpose initially with the change in occupational form of having a student guide his treatment. He had more verbal outbursts (occupational performance) as a result of the new occupational form but eventually was able to adapt his development structure to form meaning and purpose.

**Therapeutic Occupation to STG2 and STG4**

This particular session consisted of multiple occupational performances: swinging from a trapeze into a ball pit, donning/doffing a long-sleeve t-shirt, writing with index finger in sand, retrieving items using upper extremities prone in a net swing, and completing a four step motor-sequences (obstacle).

“Writing in sand”

Previous treatment sessions included hand over hand writing experiences using traditional writing utensils. Maxx demonstrated negative meaning and purpose with the occupations; he would have verbal outbursts (occupational performance) during the writing occupation. The impact of this occupational performance of writing with a writing utensil was to create a more meaningful and purposeful occupational form such as shaving cream, sand, moon sand, etc.

Maxx encountered the occupational form of “writing in sand” by following the visual schedule sequence in the outpatient therapy room. The occupational therapy student demonstrated using her right index finger to draw in the sand on the cookie sheet and provided verbal encouragement for the student to try it.
Maxx’s developmental structure includes being intelligent with interpreting a visual schedule and demonstration of task, having dyspraxia, decreased fine/gross motor coordination, and strong interest in messy play.

Maxx was able to create meaning in the occupational form of sand by letting the sand fall out of his hand. Being able to interpret what the sand is and follow demonstration. He enjoyed the sand as inferred by him laughing and smiling.

The tactile experience of the sand provided purpose in the different occupational form of writing versus writing with a pencil. He had intrinsic motivation by wanting to engage in the sand as he was quick to touch the sand and did not want to stop when asked.

Maxx had several occupational performances as a result of the above circumstances. After demonstration, he let the sand run through his fingers, ran his index finger through the sand, and then made an “M” using his index finger. Maxx smiled and laughed during the occupation. Due to the child’s interest in this occupation it is expected that he will progress in his writing skills.

**Outcomes**

As time progressed, Maxx’s developmental structure was adapted in interpreting the change in occupational form (new therapist) and he developed meaning and purpose with the therapists instructions (occupational form) and was able to carry out multiple occupations (occupational performance).

**STG1.** Student will cut a line with minimal assistance, 3 out of 4 times, within 3 weeks
Unfortunately due to the decreased number of treatment sessions, cutting were only able to be addressed one time requiring maximum assistance to hold the paper with his left hand and maximal assistance to operate scissors with the right hand.

**STG2. Student will trace his first name with 75% accuracy, 3 out of 4 times, within 3 weeks**

Student tolerated fine motor tasks when different tactile experiences (e.g., shaving cream, sand, and moon sand) versus pencil/markers. Moderate assistance required for tracing name with 75% accuracy. Maxx was able to write M independently in sand after demonstration.

**STG3. Student will don/doff shirt independently, 3 out of 4 times, within 3 weeks**

Student progressed from minimal assistance with doffing and donning shirt to very minimal assistance to doff shirt at his elbow and setup to don. Student decreased verbal outbursts from moderate to minimal. The visual schedule (occupational form) was rearranged so that he did not perform the task the first time he arrived at the facility but rather after he did something more meaningful and purposeful e.g., the trapeze.

**STG4. Student will follow a picture schedule in therapy with minimal complaint, 75% of the time, within 3 weeks**

Student was able to decrease frustration and verbal outbursts with visual schedule during these two weeks. He had decreased outbursts with writing tasks from moderate verbal outburst to minimal due to the change in his developmental structure by using coping skills.
**LTG1 and LTG2:** Due to the Maxx’s severe dyspraxia, it would be necessary to increase the duration of the long term goals to allow more time to perform graded occupations to reach the level desired. Long term goals will be continued in occupational therapy.

Although the child appears to have made minimal gains in these therapy sessions, he has made significant progress overall in occupational therapy in the past year. He is able to handle transitions and requests from adults with decreased verbal outbursts. He is able to spoon feed and drink from a cup without a lid. He has also learned to don/doff shoes and pants requiring at most very minimal assistance. He is able to tolerate more sensations (e.g., swinging on the swing for vestibular input, multiple tactile experiences [shaving cream]), and has increased motor planning skills in the therapy setting.
References


## Appendix A

### Sensory Integration 25

#### Home Form

**Profile Sheet**

L. Diane Parrish, Ph.D., OTRL, FAOTA, and Cheryl Esler, M.A., OTRL

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#### Data from this form completes: 3/19/08

*Reason for assessment: Case Study*

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#### DIF Calculation

- **Home Form TOT T-score:** 23
- **Main Classroom Form TOT T-score:** 19

**Environmental Difference (TMT)**: +4

**DIF Interpretation**

- **DIF < 15:** DEFINITE difference: More problems in Home than in Main Classroom
- **DIF > 15:** PROBABLY difference: More problems in Home than in Main Classroom
- **0 < DIF < 15:** NO difference in amount of problems between Main Classroom and Home
- **DIF > 15:** DEFINITE difference: More problems in Main Classroom than in Home

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