

Analyzing the Use of Kinems Movement Based Games for Skill Development and Maintenance

Kinems Learning Games

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Executive Summary

What are the impacts of kinesthetic movement and engaging technology on student performance? Thus, the question of whether or not kinesthetic movement can increase academic skill development and generalization for students with disabilities was posed for the purpose of this research. While research involving the link between kinesthetic movements and long term memory has become developed extensively, the idea of linking kinesthetic movements to specific academic skills for students with disabilities is one that has been far less explored until now.

This research examined the use of the Kinems Learning Games, over the course of one academic year focusing on individualized interventions aligned to both academic and non-academic skills outlined in their IEPs and classroom curriculum. This allowed the instructor to create instructional programs that conform to the unique needs of each student without the heavy burden of creating multiple activities or worksheets to do so, these items often go unanalyzed as they do not offer a consistent and systematic approach to measuring skill development over time, also teacher made materials are not normed nor validated to determine how well they fit the target they are aimed to measure. Thus, a means of addressing data collection and analysis is a current dilemma for many teachers both novice and experienced. However, when data is used effectively, it can help teachers make important decisions about student's education outcomes and create meaningful change.

Thus, the purpose of this study was to determine the effect of the Kinems Learning Games on both academic and non-academic skill sets for students with disabilities by examining the influence of specific variables, which address a range of deficits in specific learners. This study identified intervention strategies created by the Kinems Learning Games used to allow students with disabilities to acquire and generalize the use of special skills sets based upon both the academic curriculum and IEP goals. The participants included five students who attended a public special education school on Staten Island, New York, devoted to working with students with severe and significant impairments. Students ranged in age from 14-21.

The findings of this study consisted of two parts, examining the individual students as well as the general themes of the group as a whole. This research found that students were able to develop and maintain both academic and non-academic skills that were addressed in the Kinems Learning Games sessions, across all students. Also the research did not find any significant loss of skill even when a particular skill was not addressed consistently after mastery, the students were able to demonstrate maintenance of skill when it was reintroduced. Thus, data captured in this analysis provides a firm backing for the success of the skills using the Kinems Learning Games for both skill development and maintenance of skill over time. At the individual level, each student was able to demonstrate an increase proficiency in at least one variable being observed (time to complete, accuracy, difficulty level), in addition, the instructor noted that once skills were mastered, she was able to use the Kinems Learning Games as an extension activity in which she could engage the students in turn taking skills.

Finally, the analysis also revealed areas of struggle and potential road blocks to learning for the students that may not have otherwise been disclosed during traditional observational. This is perhaps one of the most significant, new and unexpected findings of this research. Because the Kinems analytics captures data for multiple data points simultaneously, the instructor is easily able to see when students may be experiencing frustration, lack of focus, difficulties for OT/PT skills not otherwise captured by traditional tasks and ABA strategies.

Introduction

Understanding Kinesthetic Movement and Skill Development

Can the use of kinesthetic movement increase academic skill development and generalization for students with disabilities? The answer to this question and others like it hold the potential to change the dynamic of education for students with disabilities. The purpose of this study was to determine the impact of academic software using total body movements, on academic skill development and most importantly generalization of skills.

While research involving the link between kinesthetic movements and long term memory has become developed extensively (Lengel & Kuczala, 2012; Coppola, 2006; Armstrong, 2000), the idea of linking kinesthetic movements to specific academic skills for students with disabilities is one that has been far less explored until now.

This research examined the effects of the Kinems Learning Games on academic and non-academic skills sets for students with disabilities. The Kinems Learning Games are movement-based educational games that combine technology with kinesthetic & learning analytics. Each student's progress was monitored over the course of one academic year (September –June 2016). While the students have continued to utilize the software and its games after the intervention period, for the purpose of this research study, the academic and physical/occupational impact on skill development as well as maintenance of skills was explored for a specific period of time when the software was first introduced to the students, thus creating an authentic measurement from baseline to mastery.

The Research

The Importance of Data

As educators, our ability to impart knowledge onto our students represents a major component of what we do. We spend tireless hours developing activities and materials, identifying the objectives and creating lesson plans, yet often the use of data to drive instruction is a component absent in the classroom teacher's repertoire. Why is that? Data collection and analysis is a skill that elusive to many teachers, but it doesn't need to be, understanding the value of data analysis and subsequently making decisions for students based upon this data on a daily basis has the potential to reshape education.

Perhaps no area of education has a greater need for effective daily data analysis than special education. The push for all students to be placed into the Least Restrictive Environment (LRE) and inclusive educational settings, there has also been an increase push for the use of data to provide students with effective program options. Data provide a basis for educational decision making, however, to be effective, data must be appropriately documented, reported and analyzed. Data has a unique role in the determination of educational progress and individual programming needs in the form of the Individual Education Plan (IEP) (Bowen, 2012).

The Individuals with Disabilities in Education Act, 1975 reauthorized in 2003, (IDEA) provides guidelines for monitoring each student's academic, functional and behavior progress towards specific goals for the purpose of determining the most appropriate educational setting. The first thing to be explored is how a student's disability

affects the student's involvement and progress in the general curriculum, thus the needs and strengths of the student must also be identified and reviewed in the form of data collection and analysis. These evaluations of the student conducted for initial or continued eligibility or services are critical and are based on the data collected by each teacher during instructional time.

To understand data fully, it is important to remember what data are intended to do. Effective data; focus on the student and the student's actions within instruction. They create an accurate picture of what the student is doing, including work on specific skills and progress. Data also create a link between the instruction the student receives within the classroom and other environments by describing both the action of the teacher or others in the environment and the student's action. And perhaps most importantly, data provide a body of evidence when taken together and viewed for overall trends create a firm basis for making instructional decisions. (Bowen, year)

Understanding the importance of data however, is only the first step in providing the best outcomes for student learning, so how do we do it? A teacher's ability to demonstrate anecdotal data to evidence their student's growth shares a strong link to their retention, (Billingsly, 2004) which also holds a link to student academic success and skill development. When a teacher is confident in what they are teaching and are able to demonstrate that to stakeholders including, parents, administrators and the students themselves they are more likely to stay in the field and subsequently develop stronger more engaging activities for students.

Movement, Engagement and Skill Development

Research has come to suggest that using multiple sensory learning approaches to learning is more effective for skill development and retention than traditional visual and auditory approaches alone. The use of kinesthetic movement and strategies has become an area of increased research focus as the link between kinesthetic learning and increased engagement for students, particularly those with disabilities and non-traditional (visual and auditory) learning style preferences has become determined (Gormley, 2016; Dihoff & Klanderman, 2006). As illustrated in several research studies involving kinesthetic movement based learning strategies, there is an emotional connection between learning and engagement, thus activities that engage students will also drive learning (Sylvester, 1994).

A research study by Gormley (2016) involving engagement of students with low-incidence disabilities including autism spectrum disorder (ASD) and attention deficit hyper-activity disorder (ADHD) given a choice of a learning activity, students consistently demonstrated a preference towards kinesthetic movement based activities. The study also noted that the highest number of incidences demonstrating a target skill were in the area of kinesthetic movement when compared to the two most common forms of learning styles, (auditory and visual learning). Students successfully demonstrated target skills using kinesthetic strategies 25% - 40% more when provided a choice. These results also support the argument of Barnum, 1994 that learning cannot consist of simply stuffing minds with information, but rather providing meaningful knowledge developed by doing.

While some studies focus on engagement as a measure of effect, Jensen, 2000 explains that movement will result in increased rates of performance of skill sets due to increased heart rate and therefore the chemical reaction and release of dopamine results in happier students and higher levels of achievement. Murphy & McLaughlin (2006) found that the use of tactile and kinesthetic learning resulted in improved spelling for students with disabilities, particularly those with specific learning disabilities. The study highlighted the use of

games, puzzles, and tracing letters and words which showed an increase in spelling accuracy. Another area of accuracy for students through the use of kinesthetic learning is in the area of mathematic, studies have shown the use of kinesthetic movement to understand difficult concepts and abstract reasoning as well as better understand the application of mathematic operations and formulas for both children and adults (Flores, 2002; Willis & Johnson, 2001).

Purpose of this Research

The purpose of this study was to determine the effect kinesthetic movement has on the development of both academic and non-academic skill sets for students with disabilities. This study examined the influence of specific variables within the spectrum offered by the Kinems Learning Games, which address a range of deficits in specific learners. This study identified intervention strategies created by the Kinems Learning Games used to allow students with disabilities to acquire and generalize the use of special skills sets based upon both the academic curriculum and their unique IEP goals.

The following research questions outlined the fundamental purpose of this research: Can the use of kinesthetic movement impact the development of specific academic and non-academic skills in students with disabilities? Can the use of kinesthetic movement based activities impact the generalization and maintenance of specific skills and skill sets once they have been mastered? Can the use of anecdotal data help instructors track student progress?

Interventions that focus on teaching specific skills through the use of traditional written and behavior based methods only offer a systematic approach to meet the needs of students with disabilities; however what is lacking is a systematic analysis of this data as well as a means to track the impact of movement, and engagement, as well as non-academic skills such as PT/OT goals and other data not captured in traditional data collection methods. While currently there is a large body of research in the demonstrated use of kinesthetic movement based activities; the affect these methods have on specific outcomes has rarely been analyzed. Although the systematic and evidence based nature of these interventions offer students high levels of positive outcomes, an examination of the impact of specific students and skill sets is needed in order to yield the best outcomes and further support the use of these practices in the school setting.

Methods

This study used a single subject design to compare the effect of kinesthetic movement based activities, interventions for the purpose of helping students develop academic and non-academic skill sets based on both curriculum and IEP goals. Results for each student was analyzed prior to analyzing the data for general themes across all students. For the purpose of this analysis 5 of the students were focused on, these students were selected due to the wealth of data trails available to analyze and record effectively. These students were selected at random by the SLP who provided the interventions and the author of the research was only provided with their names prior to the analysis, after the data was analyzed the SLP disclosed that all students are diagnosed to autism spectrum disorder (ASD) and in some cases multiple disabilities.

Participants

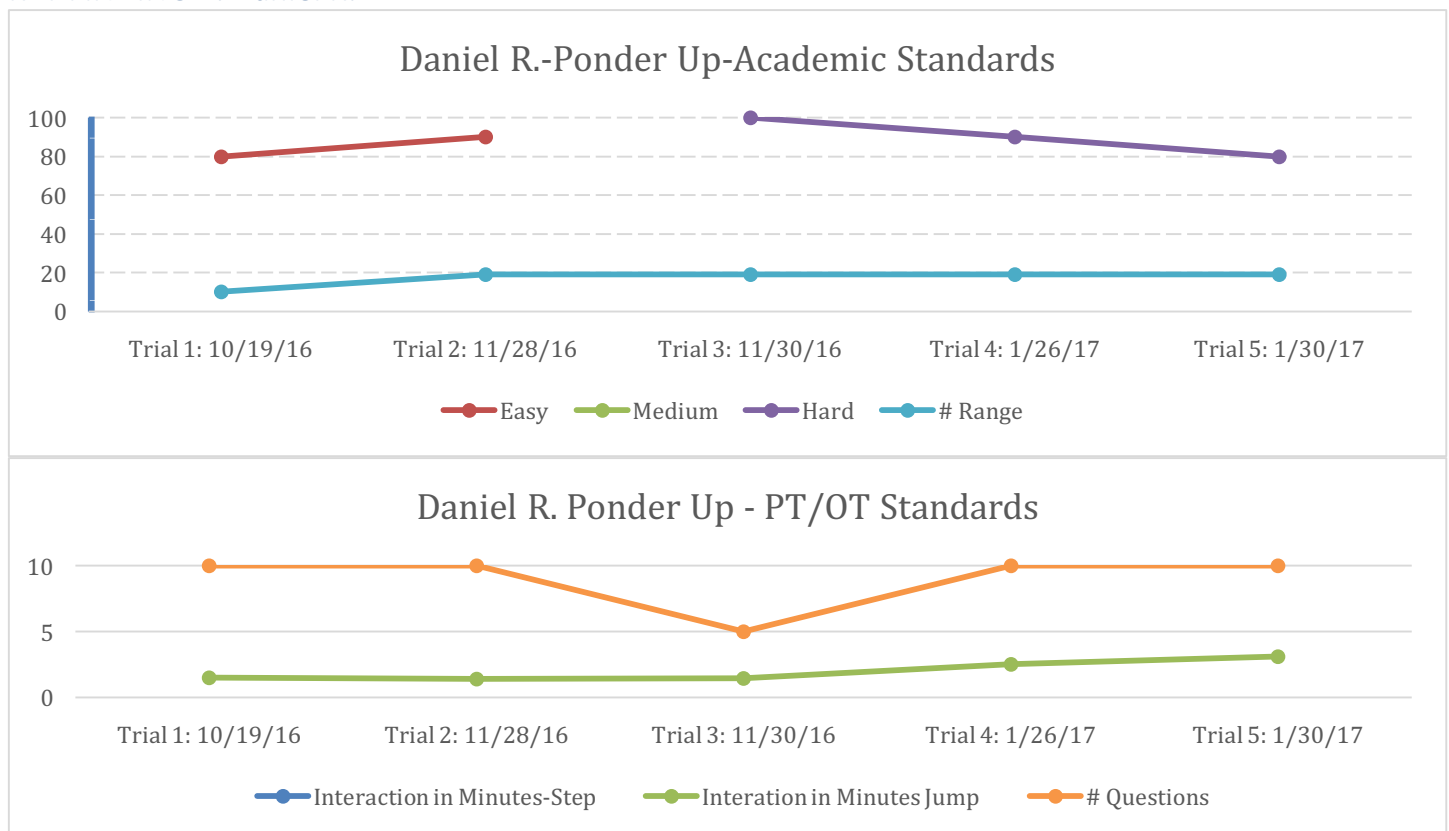
The participants were students who attended a public special education school on Staten Island, New York. Students range in age from 14-21 and attend a District 75 (Special Education District which is part of the New York City Department of Education) school which is devoted to working with students with severe and significant impairments. Developmentally the students academics ranged from ages 5-9 years old and are currently working of basic language and mathematics skills

Data Analysis

Individual Student Findings

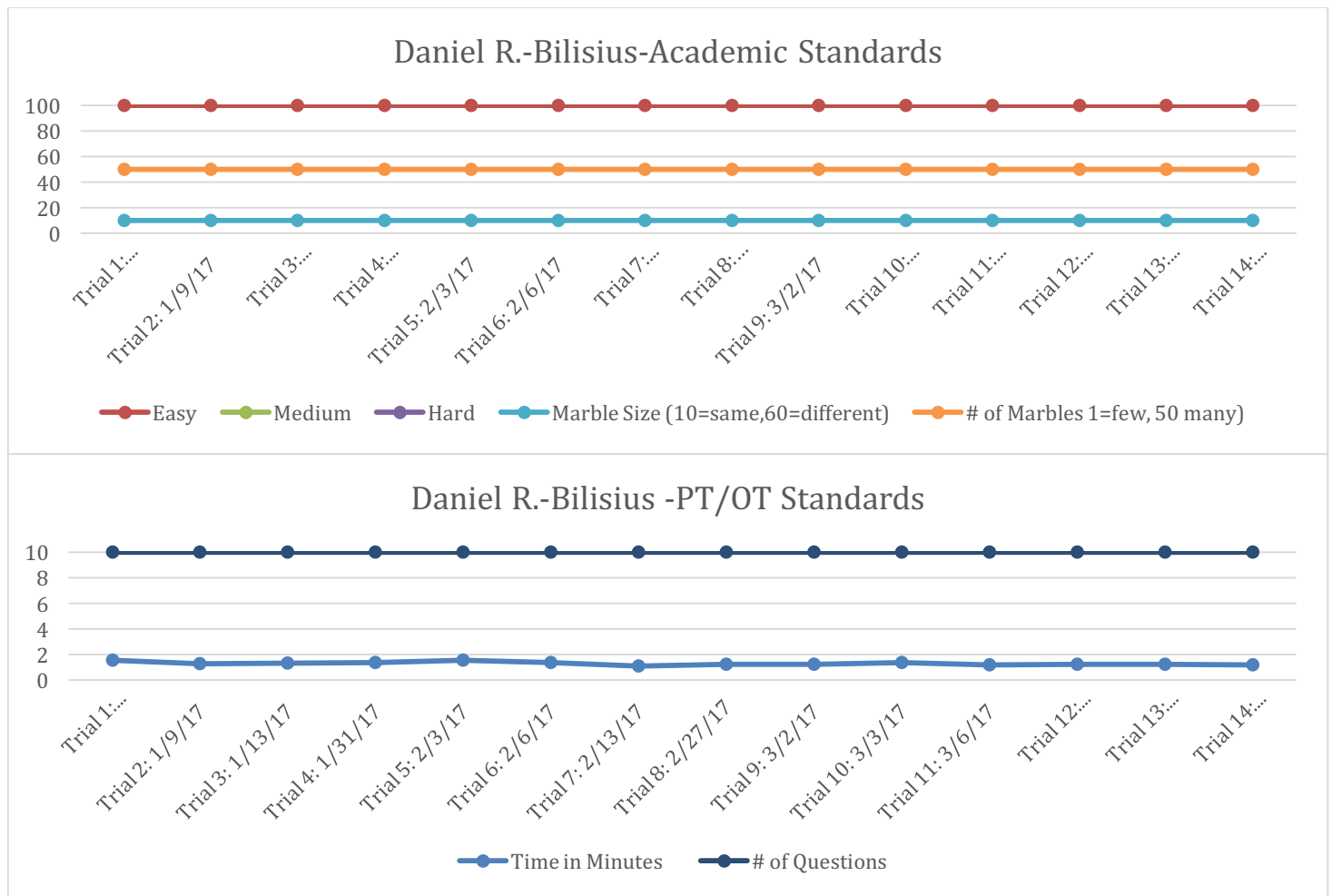
The use of a single subject module of data analysis was used for the purpose of determining individual student growth and development during the course of the intervention process.

KEY FINDING 1: Daniel R.



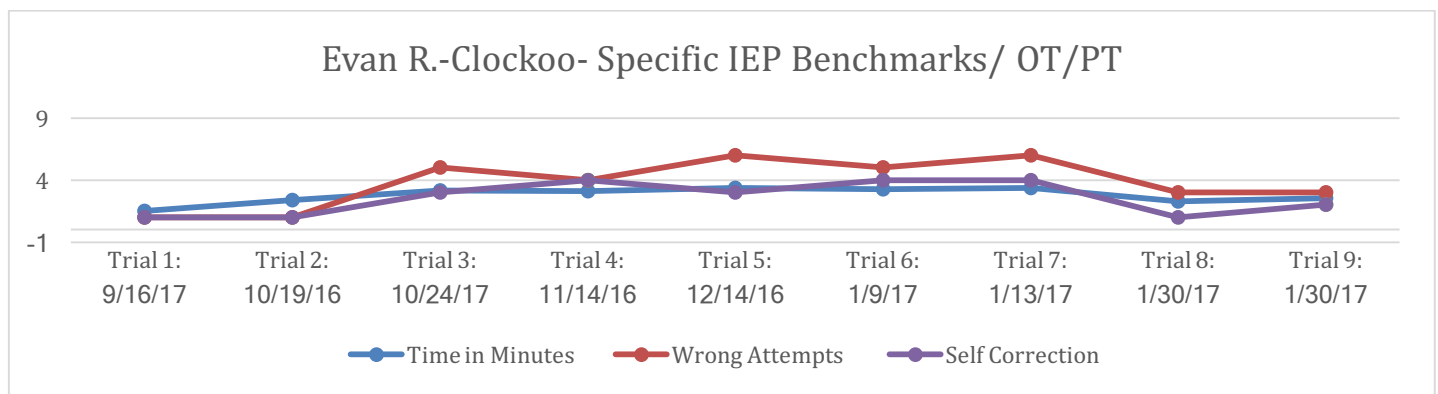
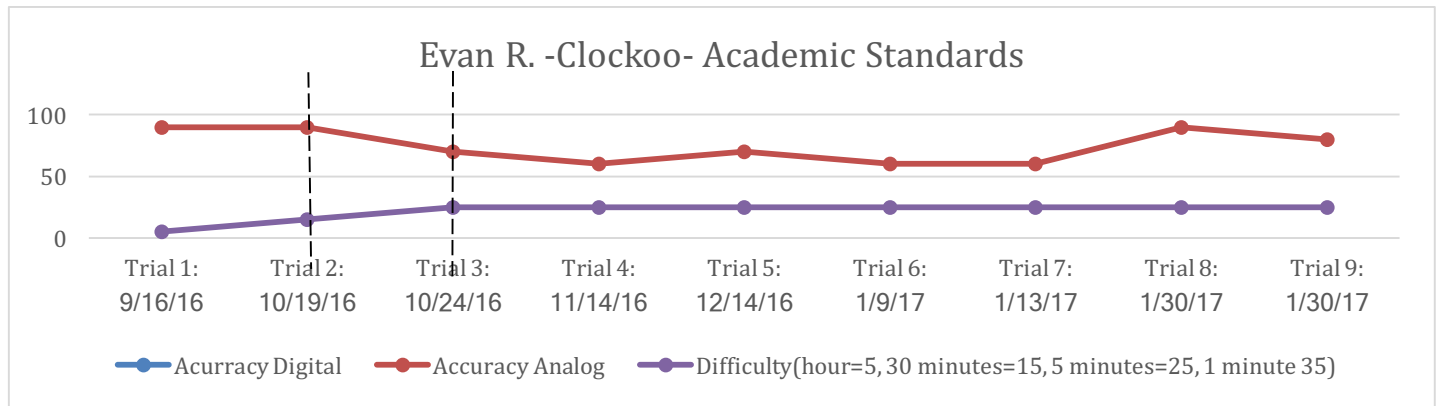
The above graphic illustrates the benefit of systematic data collection. The data show that the consistent frequency of use, the student was able to increase the difficulty level used from easy to hard over the course of 5

sessions and also demonstrate the student was able to master the skill set (and IEP goal) in a relatively short period of time, approximately three and a half months (October to January 2017). As noted in the student's difficulty rating once mastery (80%) was demonstrated at the easy level, the teacher increased the difficulty rating to hard, also the teacher reduced the total # of questions for the first trial in the new setting which demonstrates the student was given the opportunity to adjust to the increase difficulty rating prior to being exposed to the full 10 question range.



As mentioned previously, the consistency of all levels across 14 trials at various frequency intervals demonstrates that the student holds a clear mastery of this skill at this level. This graphic demonstrates the value of maintaining a skill after the skill has been mastered to ensure it can be called upon at a later date. After my conversations with the instructor, she did disclose that mastered skills are later used as reinforcement and engagement thus using this game a preferred activity. Thus, the use of the Kinems Learning Games provided the instructor with data to support both the development of the specific skills and the maintenance of such skill for the purposes of IEP documentation and planning preferred activities for the student.

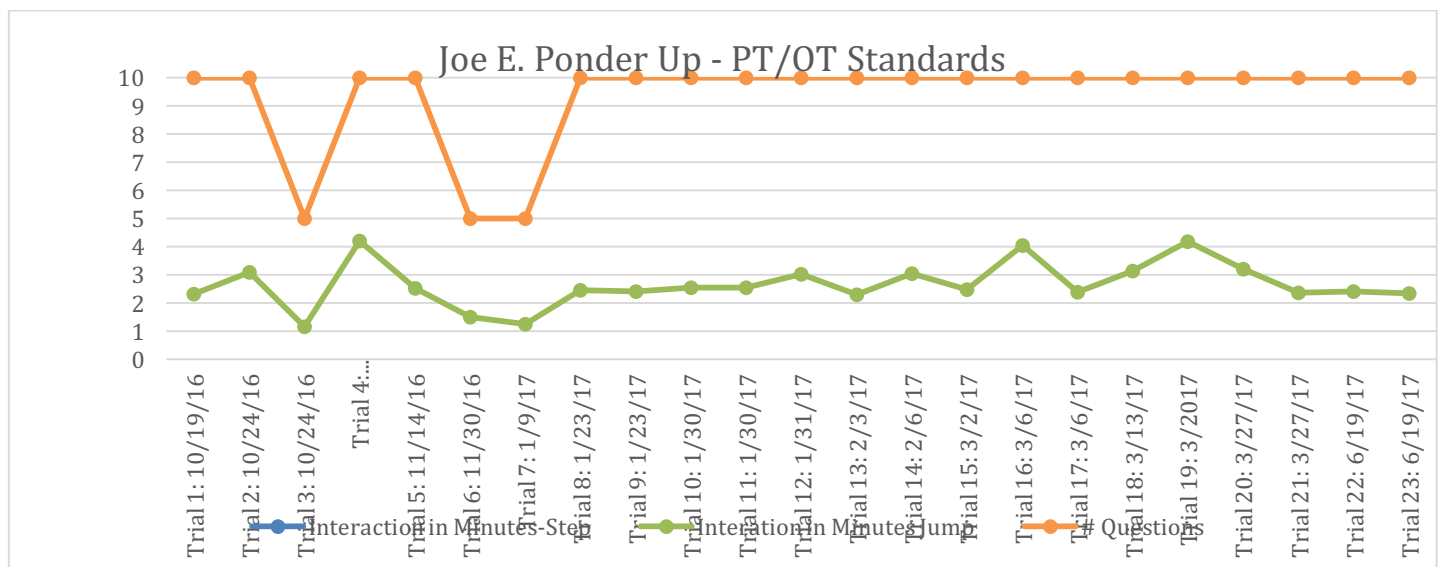
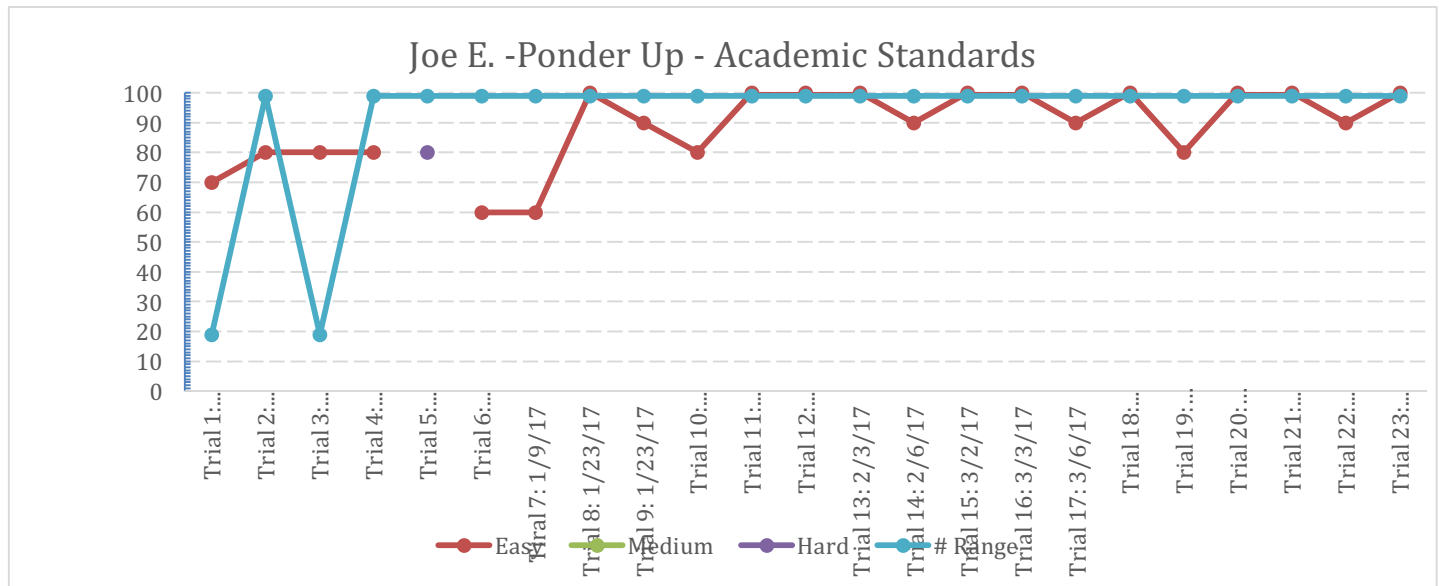
KEY FINDING 2: Evan R.



The dotted lines (in the top graphic) indicate where the teacher changed the difficulty level of the task by adding in additional hands and intervals of answers thus indicating this was an instructional level for the student. Also evidenced by the additional data in the second graphic, the student consistently used the practice of self-error-correction to come to the correct answer during the instructional period.

Although the increase in difficulty with a return to mastery within 4 trials illustrates that through continued use of the technology, the student reached mastery of 90 and 80 percent accuracy at the difficulty rating to the nearest 5 minutes, this is likely due to the continued use of the technology and continued exposure.

KEY FINDING 3: Joe E.



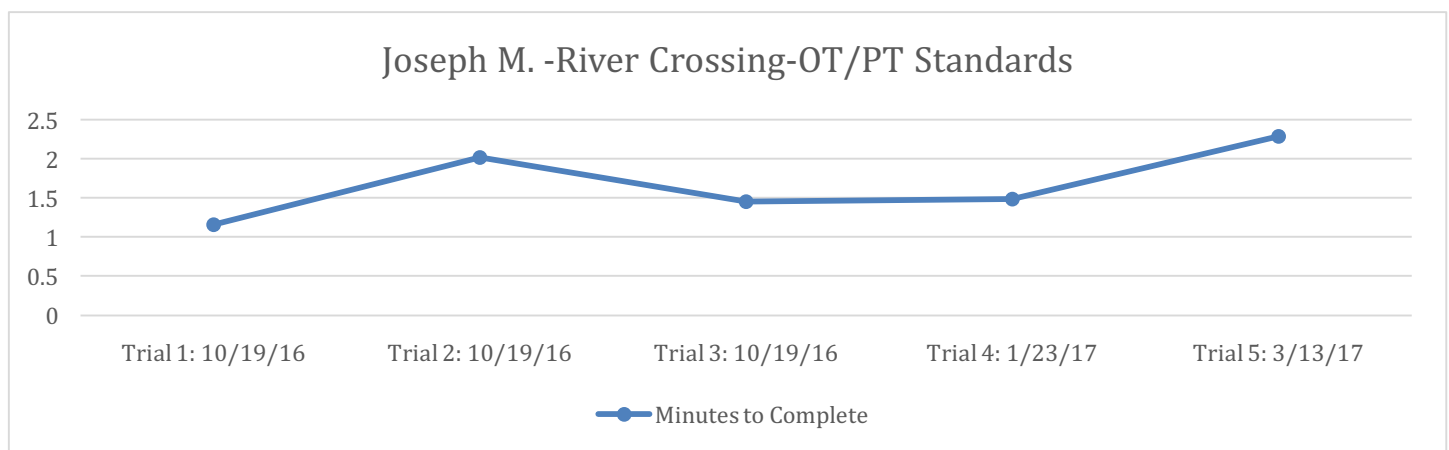
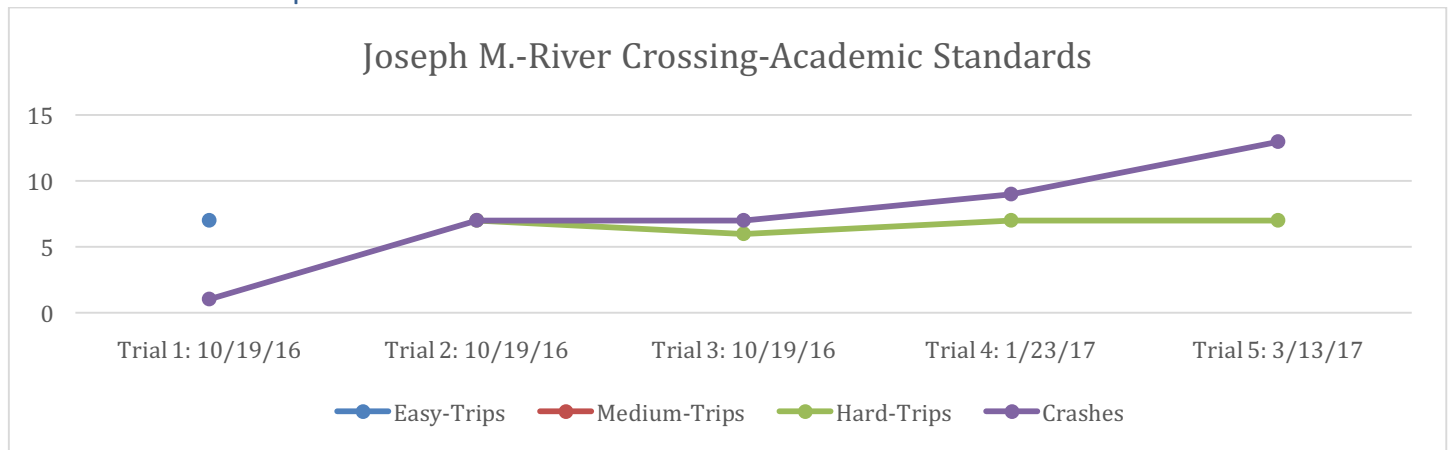
An analysis of the data illustrates the most consistent data of the skill samples, the range of numbers and the number of questions was adjusted twice, based upon my communication with the SLP, this a response to the limited time she can devote to these games prior to the preparation for the high stakes ELA and Math assessments administered in March and April thus created a limited amount of time with the student during this time because other skills needed to be addressed during the session time.

Observations of the data illustrate that in alignment with ABA strategies after 3 consecutive trials at 80 percent accuracy, trial 5 increased the difficulty rating to hard from easy. It is also noted that the time to complete ranged from 1:50 to 4:17, however note that trials 21 to 23 at the end of the intervention demonstrated the

Shortest time to completion with 10 questions and a number range to 100.

Finally, given the data of the trials with the variables of difficulty and number of questions remaining consistent over time, the student demonstrated both mastery maintenance of the skill at this level. The variance to the amount of time taken to complete the skills could be accounted for by the lap in time between trials in that the student needed to once again familiarize himself with the technology and the use of the system through coordinated body movements. Therefore advocating for the continued and consistent use of the technology to yield the most significant results, although even with variability of intervention sessions the student has noted progress and supports that skills are developed at all frequency of intervention opportunities.

KEY FINDING 4: Joseph M.



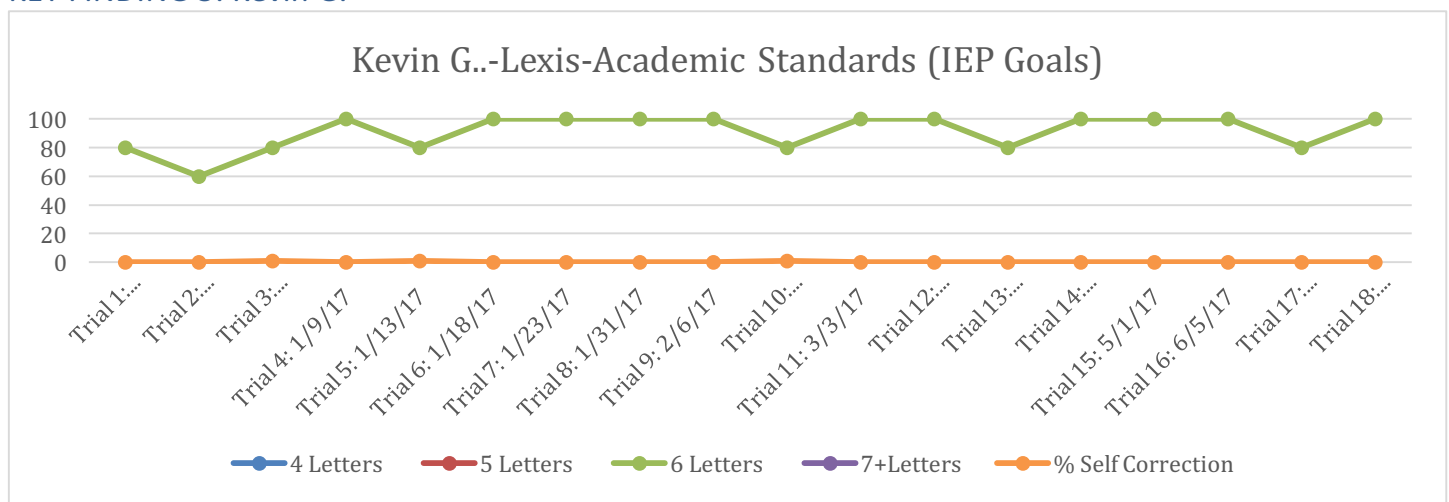
An analysis of these data illustrates an increase in both the student's minutes to complete as well as the number of crashes documented. Without a full analysis of the student's mood during the trials it is difficult to pinpoint the reasoning for this trend, however given my professional background in the nature of behavior, I can narrow this behavior to two potential functions. These data provide the instructor with a valuable tool that would not be

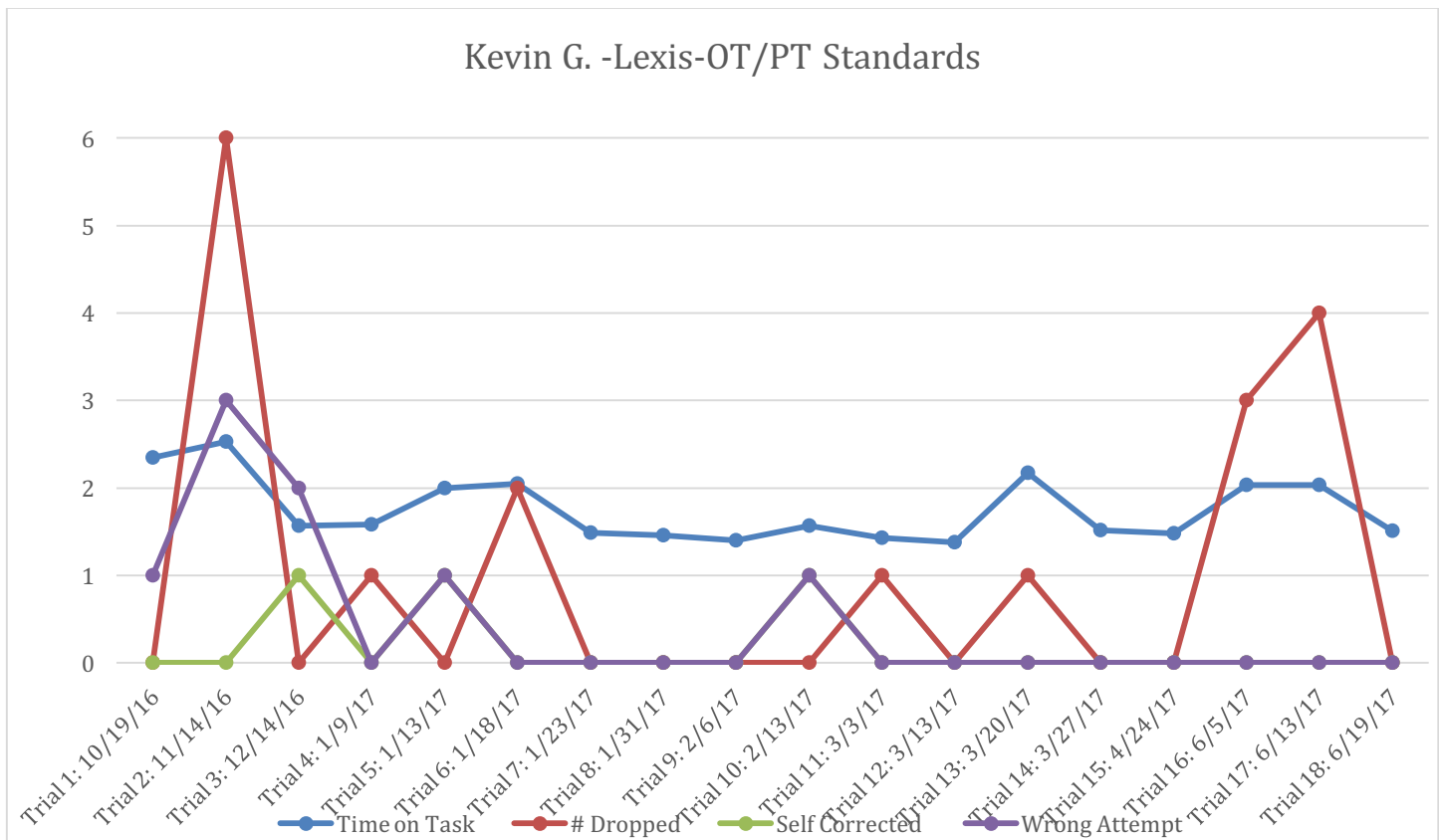
created through the use of traditional measurement strategies making it a key to potential behavior modification if needed

The student demonstrated a high level of success at the easy level in trial one (10/19/16), both in time to complete and minimal number of crashes, however it appears that the same day (10/19/16) the difficulty rating was increase to hard and the amount of time to complete as well as the number of crashes increased and this trend continued for the subsequent trails a third the same day and two more approximately 3 and 5 months later respectively. I believe perhaps the student needed 2-4 more trials at the easy level to establish familiarity with the program as well demonstrate skill and then progressively increase the difficulty over time.

A second less probably cause for the increase in time to complete and the increase number of crashes over time is that the student was receiving a positive reinforcement of these actions. The student may enjoy the increase attention received during the 1:1 time with the game and thus prolong the activity or perhaps enjoys the response of the games interaction when a crash occurs, however given the amount of time between trials 3, 4, and 5, it is unlikely that the student would develop this type of reinforced behavior in a non-intensive exposure.

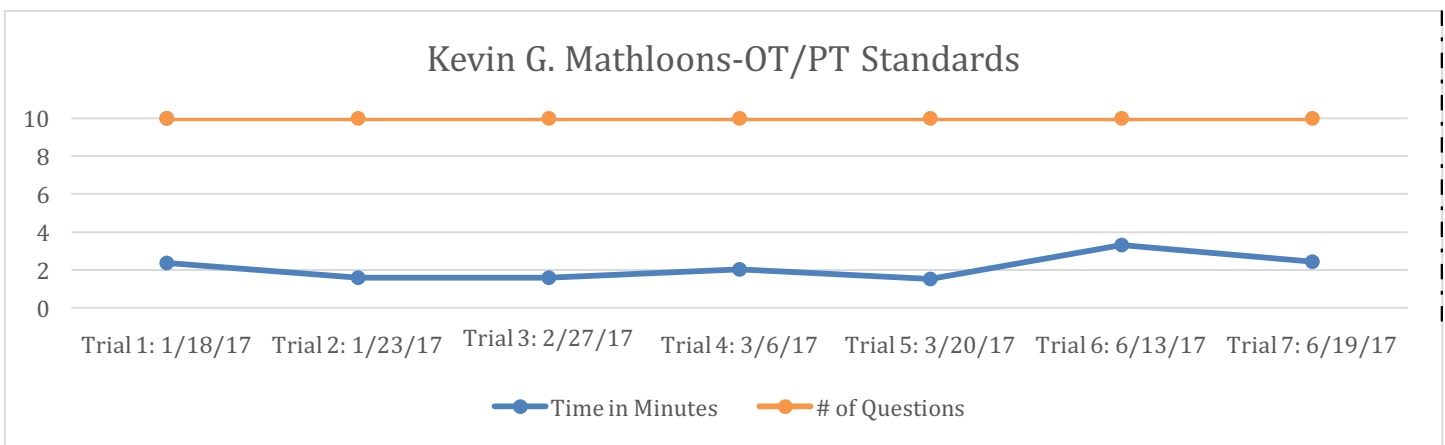
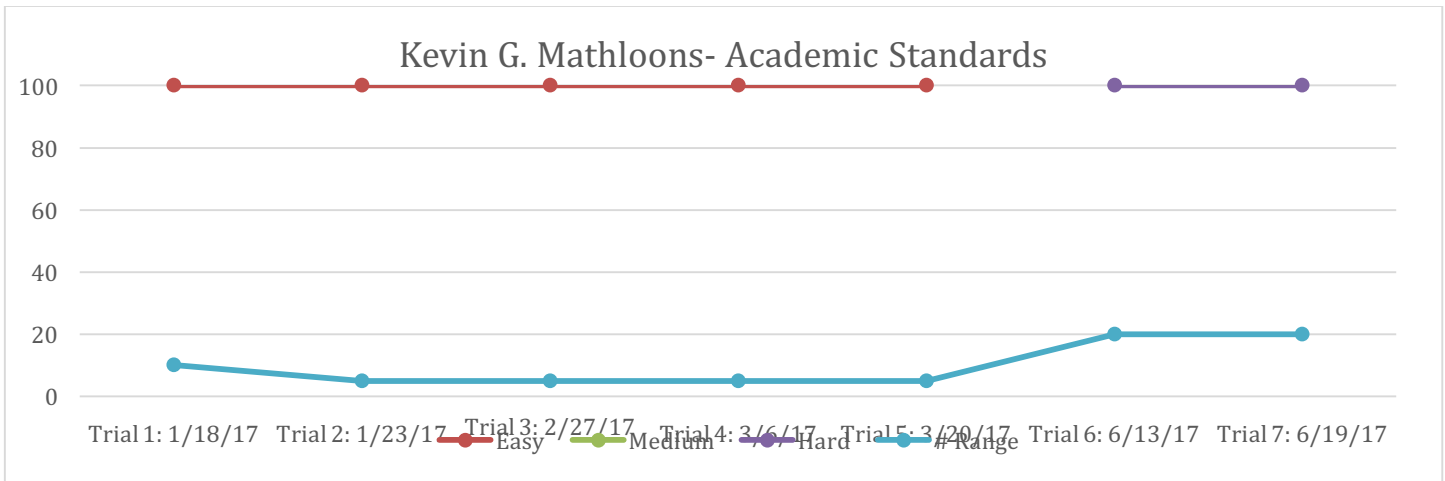
KEY FINDING 5: Kevin G.





The visual graphic above is a clear representation of the student's success and skill development over time. While I would like to see an increase in difficulty across trials, my conversations with the SLP who completed the interventions revealed that this "strong skill" was used as the focus to develop another IEP skill not noted on the graphic which was the process of turn taking and verbally expressing turn taking, thus she used a mastered skill to develop another skill. Therefore, while the data suggests that the student should increase the number of letters being presented to the student, as well as the number of hidden letters, (not shown in the chart), the additional information provides a better understanding of the student's progress using the Kinems Learning Games. The graphic does however illustrate the student's time on task has continued to decrease demonstrating the student's skill development and confidence has increased.

The graphic also provided data for an unknown OT concern with fine motor coordination and grasp, while this student does not currently receive OT services, it was noted that he does struggle with grasp and this game provides reinforced practice to further develop his fine motor coordination which would not otherwise be addressed nor data collected to determine progress.



The orange dotted line indicates that the level of difficulty was increased from easy to hard, while I am surprised by the jump from easy to hard, it is evident in the data analysis that the student held a mastery at the easy level and the increase of difficulty and number range was required, thus demonstrating that the while the usage was not frequent, it was sufficient to both develop and maintain the skill set while increasing the range and difficulty. While the time to complete the task did increase when the range and difficulty were increased, it quickly decreased again by the next trial.

Summary of Findings Across Students and Conclusions

For the purpose of this research, an analysis of 6 high school students who used the Kinems Learning Games during the 2016-2017 school year during sessions with their Speech and Language Pathologist (SLP) was examined. Approximately 150 individual data points across these students. While I multiple based line single subject design analysis was complete for each individual student. I was able to observe several common trends in the data. While the standard in the field of special education research does remain a single subject design, I felt it was important to note several common trends both between games and students.

While not all students had enough trials to completion to determine a full spectrum for analysis the following observations across data have been noted. The most frequently used games for all students included; Bilisuis, Lexis, Ponder Up, Clockroo, Mathloons, and Tika Bubble. Upon conference with the instructor, it was determined that the sessions were conducted during her time collaborating with the special education classroom teacher to provide Speech and Language (SL) services for the specific students outlined in this analysis during. Thus, with the exception of Tika Bubble which focuses on a variety of categories for the purpose of developing matching/relationship skills, and bi-linier coordination, the previous games focus of math and language skills, which are also the academic cornerstone for IEP annual goals. While the instructor was a SLP, it is not uncommon for this related service provider to work on academic goals that reinforce academic benchmarks. This was the case in this study, this allowed both the SLP and classroom special education teacher to effectively address both academic (Mathematics and English Language Arts) and Speech goals for the focus students.

A cross comparison of games and students revealed that even in instances where the difficulty and/or complexity was not systematically increased upon mastery of a given skill, (80-100% accuracy across three consecutive trials), the development of the skill both from an academic accuracy perspective as well as a time on task perspective for Occupational Therapy/Physical Therapy (OT/PT) goals noted marked improvements for all students. The data also showed that these gains were more significant when the game system was used consistently during the academic year (at least once every two weeks). Thus data captured in this analysis provides a firm backing for the success of the skills using the Kinems Learning Games for both skill development and maintenance of skill over time. In the instances where students did not used the Kinems Learning Games on a consistent and regular basis, the students were able to demonstrate retention of the previously mastered skill with accuracy percentages within 1 standard deviation (20%) of the previously achieved score.

Finally, the analysis also revealed areas of struggle and potential road blocks to learning for the students that may not have otherwise been disclosed during traditional observational. This is perhaps one of the most significant, new findings of this research. Because the Kinems analytics captures data for multiple data points simultaneously, the instructor is easily able to see when students may be experiencing frustration, lack of focus, difficulties for OT/PT skills not otherwise captured by traditional pen and paper tasks and ABA strategies via hand written data sheets that are likely being used to provide the data for IEP goals development and benchmarking. Examples of these can be found under the individual student analysis for each Kinems Learning Game.

Closing: Why Use Kinems Learning Games in the Classroom?

1. While IDEA indicates what evidence must focus on in order to make educational decisions, it does not mandate or provide the specific pieces of evidence that must be reported or the method for doing so. Therefore, the data collected to be presented to the educational team should be analytical and provide a full picture of the student. The Kinems Learning Games allows the teacher to fully engage students while ensuring this complete picture of the student learner is created, thus allowing for more quality time on task and the development of critical rapport between teachers and students, parents and administrators.
2. The outcomes of the analytics created by Kinems can be shared with parents and other stake holders on a daily basis via the use of the per session PDF feature and for the purpose of determining skill development and maintenance over time through the use of a single subject design graphic which highlights both academic goals and Physical Therapy (PT) and Occupational Therapy (OT) goals.
3. The research heavily supports the effective use of kinesthetic movement for the purpose of increasing student engagement and performance outcomes. Students who are able to reconcile difficult tasks through movement have shown an increase in success rates and maintenance of both academic and non-academic goals.