THE EFFECT OF MULTIMEDIA WRITING SUPPORT SOFTWARE ON WRITTEN PRODUCTIVITY

A Project

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ABSTRACT

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The purpose of this study was to explore the effects of multimedia writing support software on the quality and quantity of writing productivity as well as writer self-perception for students who have mild to moderate developmental delays. Participants in this study included twenty-two special education students in grades kindergarten through 6th grade. Methodology included a pre- and post-test to measure student progress in the areas of quantitative developmental writing skills and qualitative writer self-perception after an intensive technology writing intervention. Three special education teachers and their support staff were trained in the use of an interactive Smart board and use of Clicker 5 multimedia writing support software to create motivating writing lessons for their classrooms to implement over an eight-week intervention period of twice per week sessions with participating students. Results showed significant growth and positive correlation in overall writing scores. Even though the students' writer self-perception did not change significantly from pre- to post-test, the teacher survey results expressed a positive change in student motivation and performance, as well as a feeling of empowerment for teachers and support staff to increase and expand their use of technology in the classroom.

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Chapter One

Introduction

Purpose of the Study

The purpose of this study is to explore the effects of multimedia writing support software on the quality and quantity of writing productivity as well as writer self-perception for students who have mild to moderate developmental delays. Participants in this study will include twenty-two special education students in grades kindergarten through sixth grade who have mild to moderate developmental delay, written language goals on their Individualized Education Plans (IEP) and ability to access the computer with a mouse and regular keyboard. Three special education teachers and their support staff will be trained in the use of an interactive SMART Board and use of Clicker 5.2 multimedia writing support software to create motivating writing lessons for their classrooms to implement over an eight-week intervention period of twice per week sessions with participating students. Teachers will also be trained in administering and scoring a pre-test and post-test to measure student progress, including the Developing Writer's Assessment (Beaver, Carter, Taps, & Williams, 2002) and an adapted version of the Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997-98). The researcher anticipates that the results of this research will show improved student navigational use of the SMART Board, computers and Clicker 5.2 software, improved quantity and quality of written production, increased motivation and more positive self-perception about writing ability. Additionally,

this researcher hopes to lay the foundation for the participating teachers and support staff to sustain use of the flexible multimedia software and interactive technology hardware tools after the completion of the research intervention period.

Assistive Technology (AT) is a specialty within occupational therapy (OT) that focuses on identifying adaptations in technology hardware and/or software to enable a client's participation in occupations. Cook & Polgar (2008) propose a conceptual model called the Human Activity Assistive Technology Model (HAAT) which describes providing AT intervention based on the interaction among the person, environment and activity. This is similar to the Occupational Therapy Practice Framework's (OTPF) description of occupational performance as balancing the interacting factors of the human, the occupation and the environment, thus illustrating a natural match between occupational therapy practice and the provision of AT services (American Occupational Therapy Association [AOTA], 2008; Letts, Rigby, & Stewart, 2003). When OT's provide AT services to students in a school setting, they are striving to facilitate full student participation in meaningful roles within relevant contexts (AOTA, 2008). One of these important roles within the classroom context, which enables students to express their knowledge, is writing. Many students with disabilities demonstrate difficulty expressing their thoughts with paper and pencil due to physical and/or cognitive reasons, and consequently underachieve in this area. However, students who use AT tools to produce written work in the classroom

often demonstrate improved writing speed, spelling accuracy, fluency and legibility in their writing product (Handley-More, Deitz, Billingsley, & Coggins, 2003; Hetzroni & Shrieber, 2004; Tam, 2005; Wanzek, Vaughn, Wexler, Swanson, Edmonds & Ae-Hwa, 2006).

"Although it makes sense that AT improves functional ability for persons with disabilities, a considerable need exists for evidence to support this notion" (Gitlow, Meserve, & Michie, 2006, p. 1). Edyburn (2006) discusses growing interest in AT outcomes and the creation of several research centers and projects across the U.S. to address this issue such as the Assistive Technology Outcomes Measurement System (ATOMS) Project and Consortium for Assistive Technology Outcome Research (CATOR). As this need for measurement of AT outcomes becomes a greater priority, school-based AT teams and OT's are seeking out effective data collection methods that can be used to inform decisions about AT use (Edyburn, 2006). In this written productivity study on measuring AT outcomes, the researcher hopes to gain databased evidence to support the use of multimedia software as an effective writing support and motivator for struggling writers. The results of this study will provide important evidence to guide the decisions of OT's, educators and parents on selecting technology options that may improve their student's writing performance in the classroom and help close the achievement gap. In an age where higher expectations and standards are being set for all students by laws such as the No Child Left Behind [NCLB] Act of 2001, OT's must be informed and utilize the

most effective and evidence-based methods. AT software and hardware is a fast changing area that needs continual research and current evidence to support its use with students.

Statement of the Problem

Students with mild to moderate disabilities are often at risk for underachieving in the area of written expression due to cognitive, physical and emotional issues. In school-based practice, occupational therapists often evaluate and work with students exhibiting these kinds of learning needs that may require a specialized teaching approach or accommodations. These students may have problems in memory, perception, conceptualization, and receptive and/or expressive language, which affect their reading and writing performance (Brown, 2001; Behrmann, 1984). Frustration with writing can lead to decreased motivation and poor writer self-perception, further impacting student effort and achievement. In Kent School District (KSD), these students are increasingly referred for occupational therapy or assistive technology evaluations because the IEP team is seeking alternate methods for their students to achieve in the area of written production. An estimated 80% of the referrals are concerning difficulties with written productivity. However, the problem is that teachers often seek help from OT and AT practitioners for individual students before utilizing existing technology resources already available in their classrooms such as an interactive SMART Board, word processing, word prediction, multimedia and visual mapping software. Many of these individual

evaluations could be eliminated if teachers were given structured classroom support by OT's and the AT team to create and implement flexible technology-based curriculum in the classroom to benefit all of their students (Center for Applied Special Technology [CAST], 2009). Additionally, the technology lessons presented must be engaging, instructionally sound and developmentally appropriate to promote student interest and acceptance. A student's attitude, values, beliefs, motivation and satisfaction all play a significant role in literacy learning (Bottomley et al, 1997-98) and can influence the effectiveness of technology writing interventions as described in this proposed study.

Another problem is that teachers often expect that struggling learners need special 1:1 services and tools different from their other students, which leaves teachers frustrated and overwhelmed due to lack of consistent routine, fragmented schedule and difficulty lesson planning for so many varying needs in the classroom. On the contrary, when students are provided flexible multi-modal technology tools to produce written work in the classroom, it is easier to adapt writing activities to different performance levels and provide alternative access methods while presenting the same content on a consistent schedule for continuity and inclusion. This technique of incorporating flexible strategies and materials into the classroom is called Universal Design for Learning (UDL) and allows curriculum to be easily adapted to meet the continuum of needs for all their learners (CAST, 2008).

To keep up with the growing numbers of special education students, a more flexible creative teaching approach based on UDL principles is needed. According to a 2005 survey, the National Center for Educational Statistics' (NCES) reports that "89% of public schools indicated they use the Internet to provide data to inform instructional planning at the school levels and 87% reported using the Internet to provide assessment results and data for teachers to use to individualized instruction" (U.S. Department of Education, 2006. p. 10). A projected 15% growth in need for special education teachers from 2006-2016 (U.S. Department of Labor, 2008), points to a need for flexible technology-based instruction as a key strategy in programming for increasing numbers of special education students, currently at 15.1% national disability prevalence (Brault, 2008). Locally, the target schools for the proposed program in KSD have 15% (KSD, 2008b) and 16.6% (KSD, 2008c) special education students. These data point to a need for teacher training on creating flexible digital curriculum and data collection systems to support increased use of flexible technology-based instruction. This written productivity study addresses teacher training on software use, creating digital curriculum and trial of assessment methods to measure student growth in writing skills.

The uniqueness of this research study is that student interventions will be implemented in the classroom with careful planning and collaboration with the teachers and support staff. Assessment tools were selected to illustrate how general education assessment tools can be adapted for use with a specialized

population. Intervention methods were chosen specifically to facilitate integration of currently available technology into daily teaching strategies to benefit all students. Given this training and AT support in the classroom, students are expected to demonstrate improved motivation to write as well as increased quantity and quality of written production. The teachers of these students will emerge from this study equipped to serve as model teachers on how to integrate AT writing support into daily classroom curriculum lessons and teaching strategies.

Research Questions

a. Does the use of multimedia writing support software (i.e. Clicker 5.2) increase the quality of written work production for students with moderate developmental delays?

b. Does the use of multimedia writing support software (i.e. Clicker 5.2) motivate/enable the learner with moderate developmental delays to produce a greater quantity of written work?

c. Does the use of multimedia writing support software (i.e. Clicker 5.2) have a positive effect on writer self-perception and satisfaction?

This author hypothesizes that an occupational therapy intervention utilizing multimedia writing support software will have a measurable positive impact on the writing performance of students with mild to moderate developmental delay in the areas of quantity and quality of writing, motivation and writer self perception.

Definitions

Multimedia. The use of different media to convey information; text together with audio, graphics and animation.

Multimodal. Having two or more modes of information exchange such as auditory, visual and kinesthetic modes.

Mild to moderate developmental delays. Students placed in "support center" classrooms serving those with mild to moderate developmental delays generally can be described as having some or all of the following:

- Intellectual functioning is usually within the moderate to mild mentally retarded range.
- Severe academic deficits in basic academic areas require more intervention than the Integrated Program setting can provide. This typically includes the use of alternative curricula and instructional methods.
- Student demonstrates an inability to work independently in the general education classroom environment.
- Students require repeated, systematic instruction with an emphasis on the generalization of skills across multiple environments.
- Significant delay in the acquisition of social and problem solving/coping skills.
- Significant difficulty in transitions and unstructured situations without adult supervision. (KSD, 2004)

Developing Writer's Assessment. An analytic writing assessment designed to help teachers develop competent writers in kindergarten through grade 6. The DWA is designed to help teachers analyze student strengths and needs so that teachers can effectively plan their instruction to scaffold their students' learning (Beaver et al, 2002).

Adapted Writer Self-Perception Scale. An adapted version of the Writer's Self-Perception Scale, a norm-referenced assessment instrument that teachers may use to assess classroom writing climates and children's perceptions of themselves as writers (Bottomley et al, 1997-98). The original 38 items were reduced in number to 18 for intermediate and 10 for primary aged students. Emoticon icons were selected to represent words in the original rating scale such as "strongly agree", "disagree", and "I don't know".

Clicker 5.2 software. Multimedia writing support software with writing support grids, word banks, pictures, talking word processor and capacity to import digital pictures and videos into customized activities (Crick software, 2009).

SMART Board (interactive whiteboard). A SMART Board "is a large, touch-controlled screen that works with a projector and a computer. The projector puts the computer's desktop image onto the interactive whiteboard, which acts as both a monitor and an input device. Users can write on the interactive whiteboard in digital ink or use a finger to control computer applications by pointing, clicking and dragging, just as with a desktop mouse. Buttons launch a popup keyboard

and a right-mouse-click menu for more input options. The interactive whiteboard is usually mounted on a wall or a floor stand and is used in face-to-face or virtual settings in education, business and government" (Wikipedia, n.d.).

Technology Integration. A department within Kent School District that is dedicated to helping students and staff become successful users of technology in their classrooms, with the mission of bringing 21st Century learning to all students by helping our teachers become comfortable with the tools technology brings to the learning environment (KSD website, 2009).

Assistive Technology: "...products, devices or equipment, whether acquired commercially, modified or customized, that are used to maintain, increase or improve the functional capabilities of individuals with disabilities..." (Cook & Polgar, 2008, p. 5)

Universal Design for Learning (UDL). UDL is a framework for designing curricula that enable all individuals to gain knowledge, skills, and enthusiasm for learning. UDL provides rich supports for learning and reduces barriers to the curriculum while maintaining high achievement standards for all (CAST, 2008).

Human Activity Assistive Technology Model. This is a proposed framework for understanding the place of AT in the lives of persons with disabilities. AT, the human and activity form a collective dynamic process that occurs within the context of physical, social, cultural, and environmental factors (Cook & Polgar, 2008).

Assistive Technology System. A system that consists of an AT device, a

human operator who has a disability, and an environment in which the functional activity is to be carried out (Cook & Polgar, 2008).

Significance of the Project

This project is significant to the field of occupational therapy because it will provide current evidence to support OT's use of AT to help students participate and achieve in their occupation of student in the natural context of their classroom (AOTA, 2008). In the design of this study, the researcher considers current trends such as UDL which calls for "frontloading" the classroom with flexible digital instructional tools and methods that are easily adapted for all students on the learning continuum (CAST, 2008). To address the need for measuring AT outcomes identified by Edyburn (2003), this study will explore and trial adapted general education assessment tools for measuring the effectiveness of AT interventions with students in special education. Finally, the planning and methodology described in this study will demonstrate the success of using a collaborative in-class service delivery model for OT in implementing AT strategies. This collaborative model reflects the current trends of moving OT service delivery away from 1:1 in the therapy room and into the classroom (Swinth, 2007).

AT integrates beautifully into occupational therapy, keeps us on the cutting edge of new technology developments and shows us how technology can benefit our clients in their pursuit of full engagement in their occupations. The inherent limitations of this intervention is that technology changes so quickly and it is

difficult for OT's and their team members to keep up with training competencies (Long, Woolverton, Perry, & Thomas, 2007). OT's should play a primary role in leading school teams to consider and evaluate the need for AT for students. With a growing number of OT's looking to AT treatment options as an alternative to handwriting, we must have more data to show that this is effective. Recent research demonstrates that OT's are looking closely at our current role in AT, trying to further define how the use of AT benefits our clients and carving a place for use of our expertise in this ever-growing and changing field (Freeman, MacKinnon, & Miller, 2004; Long et al, 2007). There is sufficient evidence to support that AT tools such as computers, word processing, and word prediction help at least some children with special needs improve their writing speed, legibility, spelling and satisfaction with writing (Antonucci, Lancioni, O'Reilly, Oliva, Singh, Sigafoos, & Bosco, 2006; Handley-More, Deitz, Billingsley, & Coggins, 2003; Hetzroni & Shrieber, 2004; Outred, 1989; Tam, 2005). More research is needed with objective measurement tools in the area of using computer word processing and various writing support software to improve written productivity (Edyburn, 2003; Tam, 2005), while maintaining subjective measurement tools to assessment student motivation and satisfaction. Future studies in use of word processing and word prediction should encourage a baseline of basic computer navigation and keyboarding skills (Gemmel, 2003). Student outcomes using AT need to be measured in terms of achievement on academic goals. As OT's, our aim is to support and create AT studies that show

improved engagement and quality of performance in the student occupations of writing, reading and literacy.

In addition to the specific benefits to students and educators, this research study will be of particular benefit to the KSD in providing evidence to support technology use. The AT Team, Special Education and Technology Integration departments are looking for specific ways to evaluate the effectiveness of current software and hardware tools that have been purchased and provided to classrooms and students throughout the district. The AT team has been working with Technology Integration and Special Education departments to write and implement Title IID Technology Grants for the past 6 years and the grant evaluation process specifically requests evidence of effectiveness. The data from this study may provide evidence that will help validate past grant and technology levy money expenditures, as well as guide the future direction of technology purchases, trainings and integration with curriculum. The No Child Left Behind Act of 2001 also requires the same research-based interventions and is further justification for studies of this kind to be conducted within KSD. In the area of student achievement, the research tools (Clicker 5.2 and the SMART Board) provide a visual, auditory, kinesthetic and hands-on learning style that is a comfortable and preferred mode for our 21st century students. This study and intervention program will provide a strong pilot study and data, which can serve as a foundation for future studies and evidence-based instruction.

Conceptual Framework

In considering the conceptual practice models related to this research study proposal, several models provide a strong theoretical rationale for using technology for improving student written productivity. The central and most thorough conceptual framework for this study is the Human Activity Assistive Technology (HAAT) Model, which serves as a guide for understanding the role of assistive technology in the lives of persons with disabilities (Cook & Polgar, 2008). HAAT model is based on four components: assistive technology, the activity, the human and the context. AT, the human and the activity form a collective dynamic process that occurs within the context of physical, social, cultural, and environmental factors (Cook & Polgar, 2008). “A match among all the model’s elements results in enabling a person to engage in meaningful functional performance” (Gitlow, Meserve, & Michie, 2006, p. 1). In this framework, we can hypothesize that the student with disabilities (human) will improve his/her ability to perform the role of writing (activity) using multimedia software (AT) in the context of the classroom with planning and support by the researcher to the teacher and support staff (context). Of course, the results of this intervention will depend on the student’s effort and behavior, the teacher’s classroom management skills, the cultural value of writing to the students (and families), the technology skills of the staff to carry out the intervention and the ability of the activity to be graded to the skill level of each individual student to allow successful participation and adequate challenge.

Several additional theories give strong support and justification for this study. The Social Cognitive Theory (Braveman & Kielhofner, 2006) applies when bearing in mind the student's cognitive ability to compose and produce meaningful and grammatically correct sentences and the social incentives to engage in writing through physical touching of the interactive SMART Board with peer turn taking. The behavioral model becomes visible during the intervention phase of the study, as the student works toward acquisition of new skills such as learning to navigate the computer and software program, learning sentence structure and increasing their production of written work (Swinth, Brodbeck, & Clark et al, 2007). The Social Model of Disability (Braveman & Kielhofner, 2006) assumes that eliminating the physical barrier of manual handwriting and replacing it with adaptable technology access to the writing process will reduce the effects of disability and increase performance outcomes. Finally, the model of human occupation (MOHO) provides a foundation for this study when examining written productivity as it related to the student's occupational role as "writer" in the educational setting (Braveman & Kielhofner, 2006; OTPF, 2008).

Assumptions

Researcher Assumptions. Most special education teachers lack the time and training to implement technology strategies for writing without significant support and training. They have excessive paperwork, meetings and lack of quality planning time to implement the most effective, current teaching trends and best practice methods.

Students in special education lack adequate opportunities to access technology compared to their general education peers due to behavior problems, wide variety of student learning needs, and higher ratio of supervision needs for assistance.

This researcher assumes that students with mild to moderate disability will respond positively to a multi-sensory technology intervention approach to meet their unique learning styles with adaptable technology features such as speech feedback, digital pictures and videos, customizable writing support grids, and an interactive touch interface with the SMART Board. Additionally, teachers of these students and their administrators will welcome specialized training, electronic curriculum resource support and modeling for how to teach with these specialized tools.

Assumptions underlying the study: The researcher assumes that all participating students can understand and give reasonably accurate responses on a picture icon-based rating scale about their writing self-perception, if this is read to them either individually or in a small group. These participants struggle with the task of writing with paper and pencil and this creates a barrier to their written productivity. Students with a wide-range of writing ability from pre-kindergarten to second grade level can all use the same first grade writing prompt, storyboard and writing paper to get a reasonable assessment result, even though the writing assessment does not correspond with their actual grade level by age. Finally, the researcher assumes that reasonable conclusions and

data analysis can be achieved by comparing a pre-test paper and pencil-writing sample using the DWA to a post-test writing sample using Clicker 5.2 writing support software and a laptop computer.

Chapter Two

Review of the Literature

History of Assistive Technology, the Law and the Role of Occupation Therapy

Assistive technology has been an important tool for occupational therapy (OT) since the origins of our profession. Therapists have used a variety of low-tech adaptive devices over the years such as reachers, pencil grips and buttonhooks to help clients gain functional independence (Swinth, 2005). However, the technological advances of the last 10-15 years have brought an even a wider range of electronic devices to help promote improved function and expanded options. Perhaps the biggest influential event on the growth of AT was the legislative passage of “The Technology Related Assistance for Individuals with Disabilities Act” (TRAIDA) which was initially passed in 1988 and amended in 1994. This was also known as the Tech Act, Public Law 100-407. This law defines an assistive technology device (ATD) as “any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improved functional capabilities that individuals with disabilities" (Cook & Polgar, 2008, p. 5). In addition to defining AT, this law also served to expand the availability of AT services and devices for all individuals, as well as assuring quality (AT Training Online Project, 2000-2005). The Assistive Technology Act of 1998 builds on the Tech Act with a purpose of increasing access to, availability of, and funding for AT through state efforts and national initiatives (Swinth, 2005). The 1980’s and 1990’s

represented an important historical foundation for AT recognition and growth with these pivotal laws and support from the federal government. The government acknowledged AT's value in increasing independence and participation in task performance for persons with disabilities, enabling them to become more productive citizens (University at Buffalo Center for Assistive Technology, 2000-2005).

To clarify the school district's role and strengthen the need for providing AT to students, the Individuals with Disabilities Act of 1990 and 1997 stated that each public agency shall ensure that assistive technology devices and/or services are made available to a child with a disability if required as part of the child's: (a) Special education; (b) Related services; or (c) Supplementary aids and services (University at Buffalo Center for Assistive Technology, 2000-2005). The challenge for school districts is in determining what AT services are "required" for the student to receive a free, appropriate public education (FAPE). Ultimately, AT needs are decided by the student's IEP team and school districts are tasked with providing training and support opportunities for their staff members to prepare them to make this decision. Often AT Teams are formed at the district level as AT experts who train and consult with IEP teams to assist in these decisions (University at Buffalo Center for Assistive Technology, 2000-2005).

Assistive Technology as a Team Process

When considering AT, a team approach is common with involvement of

multiple disciplines. AT teams in the schools may include OT's, physical therapists (PT), speech language pathologists (SLP), special education teachers, administrators, nurses and parents. OT's assess functional needs in school-related tasks, adapt and position adaptive control systems, analyze skills needed to use the technology device successfully and train students and staff in the use of equipment. SLP's assess receptive and expressive communication, PT's assess positioning, mobility and seating for optimal access and use of assistive devices and special educators consider technology adaptations as they relate to achieving academic and vocational goals. Administrators help coordinate the service and funding for the device, parents advocate for their child, follow through at home and nurses address medical needs (Struck, 1996).

This research study incorporates a team approach to AT intervention, similar to the AT team assessment process described above. In this case, the team members actively participating in the study include three special education teachers, Para educators, an SLP, OT, Certified OT Assistant (COTA), and an AT team member, as well as support from literacy coaches, information technology specialists, parents and principals. The collaborative approach brings a variety of ideas and approaches together in one cohesive program plan, using the latest technology tools and integrating the individual school's cultures and priorities.

Collaboration as an important service delivery method for OT's is further supported by Swinth & Handley-More (2008), who assert that direct services may

not always be the most effective choice for addressing a student's written language and literacy needs. Rather, therapists may have better results in facilitating achievement of students' goals using a team approach or even working at the system level. By working with the teacher, IEP team or system to implement an intervention such as the one in this research study, the OT would provide services on behalf of the child (Swinth & Handley-More, 2008). The specific strategies implemented by the OT in this case would be setting up the environment and access through a laptop cart and the SMART Board, as well as co-designing custom electronic curricula using Clicker 5.2 multimedia software and adapting to meet the individualized needs of the participants. The OT could document these strategies as an "OT intervention plan" on the IEP (AOTA, 2008).

Rationale for Kent School District's role in the research study

As the fourth largest district in the state of Washington with 40 schools serving over 26,000 students, Kent School District's (KSD) mission is to "successfully prepare all students for their future" (KSD, n.d.). With annual budget expenditures at $319 million (KSD, 2008a) and consistent passage of technology levies, KSD has prioritized purchase of the latest educational technology tools such as SMART Boards and access to Clicker 5.2 software in every classroom. KSD's vision fits in with a bigger national trend called Universal Design for Learning (UDL), which "is a framework for designing curricula that enable all individuals to gain knowledge, skills, and enthusiasm for learning. UDL

provides rich supports for learning and reduces barriers to the curriculum, while maintaining high achievement standards for all" (CAST, 2008, p. 1).

According to Pitler, Hubbell, Kuhn & Malenoski (2007), bringing technology into the classroom creates a dynamic learning environment where instruction can be differentiated to reach learners of diverse developmental levels, interests and learning styles. "Applied effectively, technology implementation not only increases student learning, understanding, and achievement but also augments motivation to learn, encourages collaborative learning, and supports the development of critical thinking and problem-solving skills" (Pitler et al, 2007, p. 3; Schacter & Fagnano, 1999). In the case of this research study, the student participants range in grade level from kindergarten to grade six and have various learning and physical disability levels that require specialized instruction. Technology would provide adaptable and multi-sensory interactive tools to allow each student to participate at his/her own unique functioning level.

Literature on Word Processing, Keyboarding and Word Prediction

To support this proposed research study, a literature review was conducted including approximately 28 studies and articles on the subject of using Assistive Technology to enhance writing, reading and spelling. Most of these studies explored keyboarding skill improvement with typing tutors, training in use of a laptop with standard word processing tools, use of visual mapping software programs (like Inspiration) to improve organization and writing, word prediction

software to improve writing, voice recognition software's effect on written productivity and technology tools to improve reading and spelling skills. There were also studies addressing the assistive technology training needs of occupational therapists and the kinds of interventions they most recommend to address written productivity needs.

The research articles by Handley-More et al (2003) and Tam (2005) were studies specifically looking at clinical trials using word prediction as a tool to improve written productivity. Handley-More et al (2003) conducted a research project within the school setting to explore the effectiveness of an occupational therapy intervention that teaches students with learning disabilities and handwriting issues to use word processing with or without word prediction. The results demonstrated that two children showed definite improvements in spelling when using word prediction and improved legibility when using either word processing and/or word prediction. Two children were able to hand-write faster than typing with a word processor, although there did not seem to be a significant difference in quantity of written output between handwriting and word processing. The researcher concluded that OT intervention using the tools of word processing and word prediction does improved legibility and spelling with some students who have writing difficulties and learning disabilities. This study provided good ideas for how to gather data on written production including using the COPM for a subjective measure and scoring legibility, spelling, total amount written and speed of written production as objective measures. Another important

conclusion was the need to give initial training on using software before the intervention period.

Tam (2005) conducted a study to evaluate one approach for measuring AT outcomes. Specific training on word prediction software called WordQ was provided to 29 children with physical and learning disabilities between 3.9 and 19 years old. The Canadian Occupational Performance Measure (COPM) was used as a pre and post-measurement tool. The results of this study showed both that WordQ software appeared to be an effective intervention tool for improving written productivity and that the COPM was an effective outcome measure that provided performance and satisfaction ratings on the technology tasks.

The next three studies focused on keyboarding and word processing as an AT tool to improve academic success. The first study by Outhred (1989) explains how a word processor affects written work production for children with learning disabilities. The study was set up with 15 children ranging in age from 8.6 to 12.0 years who had learning disabilities. Their interventions varied from 12 to 21 weeks and consisted of writing one handwritten and one word-processed story each week. Fluency and misspellings were measured for each sample. The results of this study indicate that using a word processor may benefit children who are experiencing spelling difficulties or those concerned with the mechanics of the writing task. The children in this study also demonstrated increased confidence in their writing and were much more willing to share their work with others.

The second study on word processing (Hetzroni & Shrieber, 2004) measured whether AT tools such as word processors influenced the academic outcomes of students with writing disabilities. A single-subject case study design was used with three students who were observed producing written work during regular classroom activities in a junior high school with and without a laptop PC computer with word processing. Factors considered in determining academic outcomes included the percentage of spelling errors, percentage of errors in the oral reading of final products, the total number of words in the text taken from all final classroom products and text structure and organization. The results illustrated with clear data based evidence that the students produced significantly improved written work with the laptop and word processor vs. writing with paper and pencil. With use of the computer, the students demonstrated reduced spelling and reading errors, and higher quality of organization and structure.

Turning to the topic of keyboarding instruction, Gemmell (2003) looked in depth at keyboarding instruction and its effect on improving word processing skills in 3rd grade students. Six students were trained on the typing tutor "Type to Learn" over a six-week period, spending about 45 minutes per week on the computer. The researcher used observations, questionnaires and interviews to collect data on the students' progress. An important component of the data included interviews with the students regarding how they felt about keyboarding both before and after the study. At the conclusion of 6 weeks, the students were asked to write a story using a word processor. The study results were positive in

that all the students expressed increased comfort using a word processor for typing rather than writing a story with paper and pencil. Finally, this study also concluded that 6 weeks was an adequate amount of time to teach keyboarding. This study speaks to the importance of having a training period on keyboarding and computer use prior to writing demands as well as interviewing participants about their feelings and confidence level before and after intervention.

Literature on the role of OT in Assistive Technology

In a research study by Long et al (2007), a national survey was conducted of 272 pediatric OT's who answered questions about therapist training needs in the area of AT and delivering AT services. Results of this study indicated that most pediatric OT's in this national sample reported having less than adequate preparation and low confidence level for delivering services in the area of AT and AT services. The therapist surveyed expressed a preference for hands on and group training strategies. One of the highest identified training needs was the identification of funding sources and the use of high-tech devices. Finally, the results of this survey point to a strong need for development of pre-service and in-service training in AT for OT's who work with children who have disabilities. This study supports the need for more OT research in the area of AT and follow-up training of OT's in evidence-based AT interventions.

Canadian OT's conducted a study called "Assistive technology and handwriting problems: What do occupational therapists recommend?" (Freeman et al, 2004), which explores the variety of technology recommendations given by

OT's who work with students with writing difficulties. This research attempts to gather evidence and information about the appropriate role of an OT in prescribing technology for writing, while also considering how this intervention fits into person-environment-occupation. The results of this study showed that technology tools were more frequently recommended by experienced OT's. Keyboard-based strategies were the most popular at 93% followed by dictation-based strategies 72% of the time. Likewise, dictation to a scribe was recommended 93% of the time followed by use of desktop computers at 89%. Factors that influenced the OT's technology recommendations included cost and availability of the technology, the teaching style and technology skills of the school staff, and the environment in which the child uses the technology. This excellent study gave very useful information for moving forward with developing more OT training in AT, reinforcing the commonly used technology tools by OT's, and also acknowledging the factors influencing AT decisions.

Literature on Literacy and Graphics

Additional literature review in the area of literacy and graphics unveiled several more studies that speak to issues related to the proposed study. In a study about interactive whiteboards (IWB), Martin (2007) investigated how the use of an IWB with talking books affected children's writing, how IWB affected the behaviors of children with special needs and the advantages and disadvantages of using an IWB to teach whole-class writing lessons. Since my proposed study would involve a group writing lesson of Clicker 5.2 (multimedia

writing software) on an IWB followed by student work on an individual computer with Clicker 5.2, this literature provides important information that my impact my study. The resulting evidence suggests that “while some children benefited from the approach, teaching children to write through examination of professional models of writing in whole-class lessons did not promote the most effective learning even where the text was provided in such an interactive medium” (Martin, 2007, p. 26). However, there was clearer evidence on the positive motivational effect of using interactive learning on the white board, which was consistent with the findings of Smith, Higgins, Wall & Miller (2005). Martin (2007) also expresses that speech feedback with a variety of voices and accents for the talking books on the IWB helped motivate struggling readers to engage more in the text during the group lessons. Finally, he raises two questions for further study, which are related to research: “How can interactive technology be used more effectively for teaching writing? And what writing strategies are effective in enhancing the progress of all learners” (Martin, 2007, p. 34)?

A search for evidence on the significance of spelling in the writing process lead to finding a synthesis of research studies regarding spelling outcomes for students with learning disabilities (LD) that had received spelling and reading interventions (Wanzek et al, 2006). These studies provided evidence that spelling outcomes were positively impacted by interventions such as assistive technology, repeated practice opportunities and immediate corrective feedback after a misspelling (Wanzek et al, 2006). When comparing those findings to the

features of the Clicker 5.2 software for this author's research, Clicker 5.2 provides speech feedback, word banks and activity grids that allow for repeated practice and corrective feedback for a student. In addition, Wanzek et al (2006) identified a need for further experimental design group studies particularly with younger students (grades 1-3) to explore the effectiveness of specific spelling interventions for students with LD. The Clicker 5.2 study would address this need by looking at the use of AT software to improve the writing quality (including spelling) of special education students whose developmental writing level was between Kindergarten and second grade.

An article by MacArthur (2000) reviews research on the use of computer technologies (including hypermedia and multimedia) to support writing for students with mild disability. The author discusses the more commonly studied technology such as word processing using spell checker, speech feedback, word prediction and speech recognition but referred to multimedia as having more limited research, thus demonstrating a "hole" in the knowledge-base in this area. He specifically states, "Few studies have systematically investigated the impact of hypermedia on composing by students with disabilities" (MacArthur, 2000, p. 97). "Hypermedia changes the nature of reading and writing by incorporating a variety of media and permitting nonlinear links among the elements. For students with disabilities, the capability to combine graphics, sound, and video with writing may enhance motivation, support generation of content, and compensate for limited writing ability"(MacArthur, 2000, p. 97). MacArthur

challenges researchers and educators to work together to develop instructional methods for using technology in writing, since technology alone may not produce the desired results. The implication for this research study is careful planning of the writing intervention with the teachers to make sure technology is the "tool" for accomplishing writing and not the focus.

Daiute & Morse (1994) studied the role of multimedia images and sounds in the development of literacy skills for students with different types of literacy problems. Struggling writers often have difficulty progressing in their writing skills because their teachers are centering instruction around text rather than visual and aural sources of information. These students often learn much better from lessons rich in visual and aural sources, which are relevant to their cultural, social and emotional contexts. The study concluded that some children show improved written expression when presented with varied resources, including technology tools, to research and express their ideas. Rather than being exclusive to just a few students, these technology tools were available to share with all students in an interactive and flexible classroom environment. Daiute & Morse (1994) reiterate that there has been little research that identifies the process or value of multimedia (relevant images, sounds and text) as support for literacy and assert that this model provides a way for students to incorporate their own cultures, personal interests, and other issues into a writing project. There needs to be more research "to determine whether and how children use such multimedia tools to build bridges between their lives and the world of text, which

they must inhabit to be successful at school" (Daiute & Morse 1994, p. 221). Although written 15 years ago, this study's conclusions support the value of the current multimedia software features in Clicker 5.2 software such as picture support, whole word (text) icons, and speech feedback. The implication is that use of these multimedia tools will improve written productivity with struggling writers, as hypothesized in this study.

The only other mention of pictographic or visual support writing software was using Inspiration visual mapping software in a study (Anderson-Inman, Knox-Quinn & Horne, 1996) and an article mentioning Clicker 4 and Writing with Symbols software as "specialized word processors" (Edyburn, 2003) . There appears to be few studies on use of "multimedia" writing support tools to improve writing such as Clicker 5.2, IntelliTools Classroom Suite, and Pixwriter.

Multimedia technology – why use Clicker 5.2 software?

Clicker 5.2 software was chosen for this study because of its multimedia writing support features that support both emergent and fluent readers and writers. This software uses writing grid and picture support to allow emergent readers and writers to create sentences by clicking on whole words or phrases, pictures and/or individual letters. More fluent readers and writers who have some decoding ability have the option of typing from the keyboard, using a Clicker grid, or a series of grids with customizable word banks on specific topics. Writing support can be graded from a level of supplying just key words or phrases to providing all the words, pictures and phrases needed to complete the writing

task. Clicker 5.2 reinforces punctuation by reading the sentence when a period is added to the end of a sentence. Reviewing and editing of work is encouraged by being able to have text read back at any time with speech feedback. In addition, speech feedback provides intrinsic motivation as it allows non-readers to hear and select words to create their own meaningful writing as well as access electronic books and activities (Cricksoft, 2009).

In their article titled, "Multimedia or NOT multimedia", Wissick and Gardner (2000, p. 34) write, "Instructional multimedia can help with the following instructional principles: overlearning and automaticity, mastery learning, direct instruction, cooperative learning, mnemonics and memorization skills, reading comprehension, written composition, and study skills". It seems clear that multimedia technology has great promise for assisting students of diverse backgrounds and ability levels to achieve improved reading and writing outcomes. The next challenge, then, is to identify accurate ways of measuring AT outcomes to support this hypothesis.

Literature related to Assistive Technology Evaluation and Assessment Tools

A multi-disciplinary team determines the need for AT in the schools by completing a collaborative assessment. Struck (1996) suggests that the evaluation process begins a dynamic process of evaluation, selection, and reevaluation. To guide this process, there are many assessment tools and models that can be helpful for an OT looking at AT needs. DeCoste (2005) developed the "Written Productivity Profile" which provides a four-part process for

documenting and assessing written productivity, including handwriting, keyboarding, spelling and qualitative writing traits. Struck (1996) created a question-based assessment outline that examines the four areas of student skills, curriculum, environment and the device. The SETT Framework developed by Zabala (2002) was designed specifically for use in the school setting to help school staff make good decisions about AT through collaboration and communication. SETT is a series of questions around the students, the environments, the tasks and the tools (Swinth, 2005). In the human activity assistive technology model by Cook & Polgar (2008), the assessment process is dynamic and each step is interrelated. The activity component defines the goal of the AT system and "represents the functional result of human performance" (Cook & Polgar, 2008, P. 37). Other components include human (client), context and assistive technology. Another assessment process that focuses on a problem-solving approach outlines four major areas of assessment: (a) data collections of the client's background and needs; (b) evaluation of client's abilities, including positioning; planning with the client, caregivers, and rehabilitation team members; (c) and selection of appropriate AT devices that will enhance the client's functional abilities throughout the day and in a variety of environments (Bain, 2003).

The materials and equipment needed to complete an AT evaluation and intervention range from low tech supplies such as adapted paper, pencil grips, and adapted books to higher tech equipment such as computers, educational

software, adapted keyboards and mice, switches, and/or electronic communication devices. In addition to more formal assessment tools, AT assessment also includes observation of the student interacting in his routine school activities, looking at samples of class work and interviewing teachers and staff who work with student. An AT evaluation may take forty-five minutes to one and one-half hours depending upon the student's attention and the AT software and hardware to be trialed. Interventions may include direct instruction, consultation and training for both students and staff on use of AT. AT specialists have no required specific training to practice in this area but Smith (1991) proposed several competencies and responsibilities for OT's who practice in the area of AT. These consist of becoming a technology problem-solver to promote functional independence using AT, recognizing oneself as an expert in environment and human technology, gaining a basic comfort level of skills with both high and low technology, becoming literate in topics related to technology, and understanding ethical issues that may be encountered and one's own limitations in working with technology. Most OT's pursue informal advanced training by participating in classes, workshops and conference related to their topic of interest. There are various AT certifications and advanced degree programs that OT's can pursue to add to their credentials. For example, Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) offers a national certification as an Assistive Technology Practitioner (ATP).

One aspect of AT assessment that has recently received increased attention and research is looking at measurement outcomes related to AT. Edyburn (2003, 2006) is one of the most published authors on this subject and asks, “How do we understand/recognize technology-enhanced writing? That is, given a claim that a specific AT device enhances the writing performance of a specific student with a disability, can we support that claim? Or, do the data suggest the need to make a change in the instructional/remedial process? Or, change devices? Or, continue on the path we have set” (Edyburn, 2003, p. 63)? Edyburn (2003) describes one measurement technique called “Time Series Concurrent and Differential Approach” (TSCD), which compares a series of performance measures with and without use of AT. The author also outlines a variety of other measurement options from various sources such as measuring total words, number of legible words, correctly spelled words, correct word sequences, legible word sequences, T-Units (subject-verb), and complete sentences. This article presents the case for needing more research on possible measurement tools for taking data on AT interventions and their effectiveness.

In selecting measurement tools for this research study, consideration was given to the following factors. The assessment tools needed to be easy to use, appropriate and adaptable for students with learning disabilities, address both subjective and objective data measurement, and integrate measurement concepts outlined in the literature (Edyburn, 2003) and preferably related to current assessments for writing within KSD.

The Developing Writer's Assessment (DWA) is an analytic writing assessment designed to be used annually to help teachers develop competent writers in kindergarten through sixth grade. This assessment includes a comprehensive teacher resource book, standardized prompts, student writing materials, analysis forms, scoring continuum and focus of instruction forms. The DWA helps teachers analyze student writers' strengths and needs so that teachers can effectively plan their instruction to scaffold their students' learning. The DWA is intended to assess writing that has been completed independently (Beaver et al, 2002). In KSD, the DWA is supported by the Director of Assessment as a pilot writing assessment tool at one of the two research study target schools, where it is administered twice per year at each grade level. The second target school is piloting use of the DWA at the 3rd and 4th grade levels with support from the literacy coach. The DWA measures five writing traits for emerging writers and eleven writing traits for more capable writers. A detailed scoring breakdown of skills in the emerging writer levels helps measure small gains for beginning writers, which makes this tool a good match for the participants of this study.

The Writer's Self-Perception Scale (WSPS) was developed so that teachers could assess the affective elements in children's writing for both the overall classroom climate as well as for the children's self-perception of themselves as writers (Bottomley et al, 1997-98). This scale was inspired by the well-validated Reader Self-Perception Scale (1992) and contributes to more

complete literacy evaluations. The WSPS is one of very few assessments designed to measure writer self-perceptions and in particular the WSPS is unique in its "inclusive theory of motivation" (Bottomley et al, 1997-98, p. 287). Addressing a writer's self-perception in the assessment process recognizes the social aspect of writing and the combined influence of the classroom, the home and other social contexts in which writing occurs. Experiences in all these contexts are important in contributing to children's positive writer self-image. Since the WSPS was designed for general education students in fourth through sixth grade, adaptations would be required to use this with special education populations in grades kindergarten through sixth grade, both in reducing the length and adding pictures icons to the rating scale for increased comprehension.

In conclusion, the current literature demonstrates a clear need for more research in the area of using multimedia writing support software to increase written productivity, the effectiveness of using dynamic interactive hardware access such as interactive whiteboards and laptops for instruction, and the need to identify appropriate assessment tools to measure assistive technology outcomes. In this ever-changing technological society, occupational therapists need to seek opportunities to learn and implement the latest technology equipment, software, assessment tools and interventions to enable their students to fully participate and achieve in their occupation of writing. For students to successfully use technology in their classrooms, a collaborative team approach is required using the varied expertise of teachers, OT's, PT's, SLP's and

instructional technology specialists. Technology must be integrated with researched classroom instructional techniques and be flexible to meet the individualized needs of each learner. With the emerging availability of Interactive Whiteboards (IWB) in the classroom and increasing computer access and software options, there is need to produce classroom-based data to show the effectiveness of these tools. This research study attempts to provide data on state of the art technology hardware, software and evidence-based instructional strategies that align with concepts of Universal Design for Learning (UDL) and assume that every learner can achieve in the area of literacy and written expression, given the correct tools and support.

Chapter Three

Methodology

Participants

Subjects. The participants for this study include twenty-two students with mild to moderate learning disabilities and developmental delays, aged kindergarten through sixth grade. These participants are enrolled in three self-contained special education classes at two different elementary schools within Kent School District in Kent, Washington. Two of the classrooms consist of intermediate aged students in grades four through six and one classroom consists of primary age students in kindergarten through the third grade. Diagnoses include seizure disorders, autism, attention deficit disorder, learning disabilities, genetic disorders, sensory integration dysfunction, brain injury, static encephalopathy and global developmental delay. Students come from a variety of ethnic backgrounds including Hispanic, Somali, Ukrainian, Asian, African American, Hawaiian/Pacific Islander, Kurdish and Caucasian. Please note more detailed demographic data on study participants in Table 1.

Table 1

Research Participant Data

Student #	Attendance %	Age	Sex	Disability	Grade	Reading Level	Writing Level
1	100	8	M	Autism	3rd	1.2	1
2	87	6	M	Multiple Disabilities	K1	Pre-primer	pre-K
3	75	6	M	DD - Mild MR	1st	pre-K	pre-K
4	100	7	M	Autism	1st	3.2	1
5	62	6	M	DD - Mild MR	K1	pre-K	Pre-K
6	100	7	F	DD - Mild MR	1st	K	K
11	100	10	M	Mild MR	5th	3.9	early 2nd
12	87	10	M	Moderate MR	5th	1	early 1st
14	75	9	M	Mild MR	4th	1.3	mid-1st
15	100	11	M	Autism	6th	1.5	mid-1st
16	100	9	M	HI - Fragile X Syndrome	4th	1	K
17	100	9	M	Autism	4th	2	K
19	75	8	M	moderate MR	3rd	K	Pre-K
20	87	11	M	Multiple Disabilities	6th	1.3	early 1st
22	100	9	M	moderate MR	4th	K9	Pre-K
24	93	9	M	Learning Disabled	3rd	beg 2nd	beg 2nd
25	93	10	M	Mild MR	4th	1.1	Pre-K
26	56	12	M	Autism	6th	4	2nd
27	75	13	F	Mild MR	6th	4	2nd
28	93	10	M	Mild MR	4th`	1.5-1.9	K
29	100	9	F	Mild MR	4th	1	K
30	81	12	M	HI - Seizures	6th	1.3	Pre-K
AVERAGE	88	9.14					

Note. DD = Developmental Delay; MR = Mental Retardation; HI = Health Impaired; K = Kindergarten.

Procedure for selections of subjects. Students were recruited in a nonrandomized method from three self-contained special education classrooms based on qualifying criteria of having writing goals on their Individualized Education Plan and possessing the skills to navigate a computer with a regular

mouse and keyboard. All students were required to have a functional understanding of the English language. The teachers of these potential subjects were selected based on their willingness to participate in assisting the researcher with the proposed assessment and intervention and their interest in furthering use of technology in their classrooms to improve writing for their students. The researcher recruited the students by working with their teachers to identify qualifying candidates. A consent form was created to present to students who were potential candidates for this study and their parents to fully inform them of the participation requirements, benefits and risks of the study and to gain their signed consent (see Appendix A). Translated consent forms were identified as a possible need for four of the prospective students' families for this study in potentially three languages. A Spanish translation for both the consent forms and test protocol was completed within the timeline for approval by the SJSU IRB process and the Spanish consent form was sent by mail to two families in the study. Even though written Ukrainian and Somali translations of the consent form were initially pursued for two of the students' parents, resources were not available to obtain these written translations within the limited timeline. However, it was determined that the comprehension of spoken English by these two parents was adequate to understand a verbal explanation of the consent forms by the classroom teacher and to provide an informed signed consent for their child to participate in the study. The approved consent forms were sent home to parents of prospective student subjects for signature and the researcher and/or

teacher of each student followed up with a phone call to answer any parent questions related to the form. Following parent approval of their child's participation in the study, the OT researcher explained the study to each student in the words described in section 4b of the consent form and obtained minor assent (See Appendix A).

Permission to conduct this study was granted by the Kent School District Director of Assessment (see Appendix B), and by San Jose State University (SJSU) Human Subjects- Institutional Review Board (see Appendix C).

Setting

Kent School District (KSD) in Washington State is a leader in educational technology innovation in the nation and has served as the employer of this researcher for the past twenty-two years. As a member of the KSD's Assistive Technology Team, the researcher identified two schools and several special education staff who possessed the aptitude, targeted student population, technology equipment, open-minded attitude and flexible classroom settings to implement the research study. Implementation of this research study also involved several administrative departments within KSD including Special Education, Technology Integration, the Director of Assessment (see Appendix B), as well as two building principals. At a school level, the research study targeted three self-contained special education classrooms at Scenic Hill (SH) and Meridian Elementary (ME) Schools, one primary and two intermediate-aged programs. Staff who assisted with student assessment and technology

interventions included three special education teachers with five or more years of experience and one speech language pathologist (SLP), all possessing extensive technology skills and already having a proven record of integrating technology into their teaching curriculum. The researcher is an OT practitioner with twenty-one years of school district experience and six years on the AT team in Kent School District.

Each targeted classroom had one classroom teacher and two to three Para educators per eight to ten students, depending on level of student need. Each of these classrooms was also supported by OT, PT, and SLP services at least weekly.

The specific technology needed in each classroom setting to carry out this research study included an interactive SMART Board hooked up to a functional classroom computer and access to ten laptop or desktop computers that were reserved twice per week from the building laptop carts or computer labs at the specific times the intervention was conducted. Fully charged laptop computers were set up with wireless access to the student network server to load Clicker 5.2 activity lessons. Extension cords and power strips were available in the event of low computer battery power and computer mice were available for students who could not navigate well with a laptop touch pad. There were up to ten students per session participating in an intervention lesson with three or more adults supporting students during individual work time. Interventions were scheduled during normal writing times in the classroom whenever possible to integrate into

the regular schedule. To build a positive climate and gain support of the principal and other staff in the building, a presentation was given prior to the research study in each school to inform staff and administrators about the purpose, participants, intervention process and location of research activities. Possible future benefits to the staff and other students in the school were also discussed.

Instrumentation

The Developing Writer's Assessment (DWA) is an analytic writing assessment designed to be used annually to help teachers develop competent writers in kindergarten through grade six (Beaver et al, 2002). This assessment helps teachers analyze student writers' strengths and needs so that teachers can effectively plan their instruction to scaffold their students' learning. The DWA was developed and field-tested between 1998 and 2000 in seventeen districts in ten states and one western Canadian province. The authors analyzed thousands of student papers across kindergarten through sixth grade to create the specific descriptors of the DWA Continuum (See Appendix D). The assessment continues to be revised and updated based on feedback from trained educators who have extensive experience using the DWA forms.

The DWA was selected for this study with consultation from three classroom teachers, an SLP, principals, and literacy coaches at the two target schools (ME and SH) and the KSD Director of Assessment. The DWA is currently being piloted school-wide at ME and with fourth graders at SH. Since the teachers of student participants in this study estimated that their students'

writing abilities ranged from emerging kindergarten through second grade, a first grade writing prompt was agreed upon to be used for both the pre- and post-test for all students participating in the study. For the pre-test, the students were first instructed to draw three picture scenes to guide their writing using the first grade DWA storyboard planner form. Next, they wrote a story based on the first grade writing prompt and their pictures using DWA first grade writing paper. For the post-test, the same writing prompt and DWA scoring criteria were used but students produced their writing on the computer using Clicker 5.2 writing support software rather than on DWA writing paper with pencils. The computer was pre-loaded with a Clicker 5.2 writing support grid customized with pre-designed picture and word icons themed to the writing prompt and a talking word processor to help students compose their stories. No additional adult verbal prompts were given beyond the DWA standardized prompts.

The Writer's Self-Perception Scale (WSPS) was originally developed by Bottomley et al (1997-98) so that teachers could assess the affective elements in children's writing for both the overall classroom climate as well as for the children's self-perception of themselves as writers. The five scoring scales of General Progress, Specific Progress, Observational Comparison, Social Feedback, and Physiological States scored very high reliability coefficients on the original version of the assessment, with respective scores of .90, .89, .90, .87, and .91. For the purposes of this study, this qualitative assessment tool has been adapted with the author's permission from the original "Writer Self-Perception

Scale" (WSPS) in order to simplify the language and scoring method to accommodate writers with special needs. With input from teachers participating in this study, scoring language such as "strongly agree", "I don't know" and "disagree" were replaced with visual facial expression icons to facilitate increased understanding by students with special needs. The meaning of each icon was described in basic language aimed at the cognitive level of students in this study. In addition, the original thirty-eight statements on the WSPS assessment were reduced in number to the items that were easiest to understand. In the primary adapted version of the WSPS (see Appendix E), the students were given only nine statements to score on a three-point scale with visual icons. In the intermediate adapted version of the WSPS (see Appendix F), the students were given eighteen statements to score on a five-point scale with visual icons. The adapted versions of the WSPS were administered and scored as both a pre-test and post-test with the directions and statements orally read to the students 1:1 or in small groups to allow maximum level of understanding. There have not been any previous reliability or validity studies done on the adapted versions of the WSPS. However, the strong reliability scores on the original version of the WSPS imply that the adapted WSPS versions may provide a relevant affective measure of student's writing, which were piloted in this research study.

To provide additional data and feedback for the study, the researcher arranged for staff to videotape and take digital pictures of selected technology intervention sessions. These pictures and videos included staff instruction at the

SMART Board, students touching the SMART Board to read an electronic book or complete an interactive writing activity, and students working on laptop or desktop computers to make choices and write using given Clicker 5.2 lesson activities.

Procedures/Methods

The methodology for this study was a quantitative single group pilot study conducted by the researcher (OT and AT Specialist), three certificated classroom teachers and a Speech and Language Pathologist (SLP) in three special education classrooms with students in kindergarten through sixth grade. Using Clicker 5.2 multimedia software and the SMART Board interactive touch screen as teaching tools, four selected staff collaborated with the OT researcher to create themed writing lessons to their students that integrated assistive technology with curriculum.

This research study took place over approximately eleven weeks, including the assessment and intervention periods. In the five months prior to the start of the research study, time was scheduled for the researcher to introduce the proposed research study to target schools, train the selected research staff in use of Clicker 5.2 software, collaboratively create lesson plans for the eight-week intervention period and plan logistics for laptop and technology use in the classrooms. Specifically, initial meetings with prospective classroom teachers for the study and building principals at both schools were held in September and October, 2008, to discuss the research study proposal, estimate time

commitment, budget and technology resource needs, and review prospective assessment tools and student profiles. The two principals scheduled a formal 30-minute presentation during their staff meetings in November and January for the researcher to share information on the Clicker 5.2 research proposal to give background information to staff and prepare them to support the study at their respective schools.

To prepare the OT researcher for staff training, curriculum planning and research study implementation, ten hours of formal class training on use of the SMART Board was completed in May 2008 and a 10-hour refresher course on Clicker 5.2 software was audited in early October, 2008. Starting in mid-October and continuing into February, the researcher offered 35 hours of various 1:1 and small group training opportunities on Clicker 5.2 software to the four main research staff. Training time for each staff person ranged from 8.5 hours to 12.5 hours with an average of 11 hours each. In addition, staff spent time planning with the researcher around assessment tools, lesson ideas, schedules, and computer access issues starting in early September, 2008 and continuing throughout the research study until May 2009. In the fall, the planning meetings averaged approximately once per month for 30-60 minutes (in addition to Clicker 5.2 training sessions) and then the frequency increased to 2-3 times per month in January through March, 2009 during the intervention period. However, as the research study launched in February and the researcher spent more time in the classrooms, many details were coordinated through informal meetings on

intervention days and e-mail. Starting in January, the researcher spent at least four hours per week at one school (for one classroom) and eight hours per week at the other school (for 2 classrooms). The researcher worked with one or more staff at a time in planning and creating Clicker 5.2 lessons. However, two of the more tech-savvy staff voluntarily spent 10-20 hours of additional individual programming time at home or after school creating new or customizing existing Clicker 5.2 activities for the themed lesson interventions. These two staff (teacher and SLP) particularly enjoyed learning how to custom create new activities and kept in close communication with researcher for support. The researcher assumed more of the Clicker 5.2 custom programming burden when staff couldn't find time but the custom grid layout design and content almost always came from direct teacher input ahead of time. During the winter vacation in December, the researcher downloaded numerous Clicker 5.2 format electronic books and writing activities that might be included in the study. With input from the research staff on weekly theme ideas, the researcher designed a detailed intervention schedule and lesson plan (See Appendix G) which took into consideration the scheduled classroom writing time, computer laptop availability, and staff schedules. Informal weekly meeting time continued with teachers during the eleven-week research study to coordinate the details of parent communication, assessment and ongoing refinement of lesson plans.

Following approval by the KSD and the SJSU IRB, consent letters were sent out to prospective students' parents for signature (See Appendix A). The

student participants approved for participation in this research study first took a pre-test, then participated in an eight-week writing intervention using technology, and finally took a post-test at the conclusion of the eight-week study. The pre-test and post-test both consisted of administering the DWA (see Appendix D) and either the primary (see Appendix E) or intermediate version of the WSPS (see Appendix F).

Teachers were given written and verbal instructions on how to administer the DWA pre-test and assisted the researcher in collecting and scoring student assessment data. The pre-test was given using paper and pencil in a 1:1 or 1:2 setting with DWA standard writing paper and a storyboard drawing template. Each student was given the same writing prompt, “Today you are going to write a story about an animal...” The post-test was administered in a 1:1 setting with use of a desktop computer and a custom Clicker 5.2 writing activity grid set with four animal choices so that the same DWA writing prompt as the pre-test could be given. However, unlike the blank template writing paper used in the pre-test, the computerized writing grid set provided visual and auditory supports for the students. This electronic writing template featured speech feedback, picture support, color-coded buttons, left to right sequenced word choices, word banks, punctuation buttons and navigation arrows. After initial instructions and orientation to the custom post-test writing activity, students were required to work independently to navigate through each page, select and sequence word choices with the mouse and add punctuation to compose their own story (see Appendix

H). The researcher scored each student's post-test animal story according to DWA criteria, even though the DWA was not field-tested with use of computer-generated text for writing.

The intervention period of the study consisted of forty-five minute writing lessons two times per week over two months. During the intervention period, the students were expected to participate in an interactive group lesson, where they were asked to take turns touching the SMART Board to help navigate and complete multimedia reading and writing tasks with teacher instruction. Next, each student moved to an individual computer station to compose independent work on a given multimedia writing task related to the group lesson using Clicker 5.2 software. At the close of each session, each student-generated Clicker writer document was saved on a student server for future printing and data reference.

Data Analysis

At the end of an eight-week intervention period, the students' pre- and post-test assessment results were scored and compared according to specified criterion. For the DWA, the writing level was scored on a continuum from 1.0 to 12.0 using detailed descriptors in the areas of conventions and content. The writing stage was categorized as emerging, early writer, transitional or advanced writer (See Appendix D). For the Primary Writer Self-Perception Scale (See Appendix E), scores were totaled in three areas of General Progress(GPR), Social Feedback (SF) and Psychological States(PS), whereas the Intermediate Writer Self-Perception Scale (See Appendix F) scores were totaled in five areas

of GPR, Specific Progress (SPR), Observational Comparison (OC), SF and PS. The raw score totals of all subtests on the WSPS were converted to percentages and compared from pre to post-test.

To illustrate comparison of pre- and post-test scores, the results of each assessment were entered on a table to illustrate descriptive statistics for each student using score ranges, percentiles and means. A data graph was created to illustrate the average expected growth trajectory on the standardized DWA compared with the actual growth pattern from the study. Data analysis techniques consisted of data graphs, data tables, visual analysis, and statistical significance. In addition, group inferential statistics were calculated using a paired *t*-test to determine whether there were significant pre- to post-intervention differences in performance on the DWA total score, and DWA subtests (conventions, spelling, precise word choice and number of sentences) as well as whether there were significant differences on the Writer Self-Perception Scale. (Kielhofner, 2006).

Additionally, the researcher created a thirteen-question summative online evaluation survey (See Appendix I) to gather specific feedback from the four teaching staff that assisted with conducting this study. This survey was given after the post-assessment phase and was supplemented by holding an informal debrief meeting with participating teachers and specialists to discuss the strengths and weaknesses of the assessment and intervention program in order to plan effective follow-up activities. One of the teachers had a student intern who

also filled out the survey as a fifth respondent since she was present and helped teach Clicker 5.2 intervention lessons during her internship. The researcher documented the results of the online survey in the form of both a bar graph and narrative comments. More detailed results are discussed in the results and conclusions sections of this thesis.

Chapter Four

Results

Writing Improvement

In the research participant sample, twenty-two out of the twenty-eight original students met criteria to be included in the final study statistics. Criteria included having the ability to independently access a computer with a mouse or touchpad, writing goals on their IEP and a minimum of fifty percent attendance for intervention sessions. The actual attendance data of the twenty-two research subjects averaged eight-eight percent (see table 1). To measure the quantity and quality of each student's writing, the researcher administered a pre- and post-test using the Developing Writer's Assessment (see Appendix D).

The official DWA writing level scale starts at 1.0 for emerging writers and expands to 12.0 for transitional writers and is designed for students aged Kindergarten through sixth grade. On the pre-test, the range of scores for research participants was 1.0 to 6.6. In contrast, the post-test scores ranged from 3.5 to 6.1, indicating a smaller variance and generally higher scores overall. When examining the writing tasks in smaller components, it was noted that the most significant change occurred with the total number of sentences composed with an average increase of five sentences per student. Use of precise words in writing increased by an average of 2.8 words, percentage of correctly spelling words increased by 51%, and use of conventions improved by 40%. Appendix J shows a raw data comparison of pre- to post-test data for each student.

Table 2

Paired t-test for Changes in DWA and Writing Component Scores

(a) Descriptive Statistics

		Mean	Std. Deviation	Std. Error Mean	Range
DWA	Pretest	3.318	1.7522	.3736	1-6.6
	Post-test	5.014	.6556	.1398	3.5 – 6.1
CONV	Pretest	30.0455	42.09228	8.97410	0-100%
	Post-test	71.6364	34.90742	7.44229	0-100%
SP	Pretest	48.0000	39.83059	8.49191	0-100%
	Post-test	99.5909	.95912	.20449	97-100%
PWC	Pretest	2.0909	2.02153	.43099	0-6
	Post-test	4.8182	1.70814	.36418	2-9
#SENT	Pretest	7.5455	3.47408	.74068	0-9
	Post-test	2.5455	2.66775	.56877	1-15

(b) Paired Samples Correlation

		Correlation	Sig.
DWA	Pre/post	.772	.000
CONV	Pre/post	.210	.349
SP	Pre/post	-.136	.547
PWC	Pre/post	-.023	.921
#SENT	Pre/post	.706	.000

c) Paired-test

		t	Sig. (2-tailed)
DWA	Pre/post	-6.054	.000
CONV	Pre/post	-4.004	.001
SP	Pre/post	-6.054	.000
PWC	Pre/post	-4.781	.000
#SENT	Pre/post	9.499	.000

Note. $N = 22$ for all calculations. Df = 21 for all pairs. DWA = Developing Writer's Assessment; CONV = conventions; SP = spelling; PWC = precise word choice; #SENT = number of sentences.

Paired *t*-test scores for the DWA and the number of sentences pre- and post-test indicated significant growth and positive correlation (see Table 2), indicating that multimedia writing support software helped improve the quantity and quality of written productivity for the research participants. These scores support the validity of the DWA as a good developmental assessment tool as well as imply that the DWA is a sensitive enough measure to detect small changes in emerging writers, including those with developmental delays. However, when looking at the other writing components measured, the precise word choice (PWC) and spelling (SP) areas showed no correlation, even though there was significant growth from pre to post-test. Thus, the Clicker 5.2 post-test grid may not be a good tool for measuring a student's spelling or precise word choice progress in isolation because spelling and whole word choice support were built-in to the grid page template. Likewise, the writing component scores for conventions (CONV) showed low correlation since punctuation options were visually available as button options to encourage students to click on them.

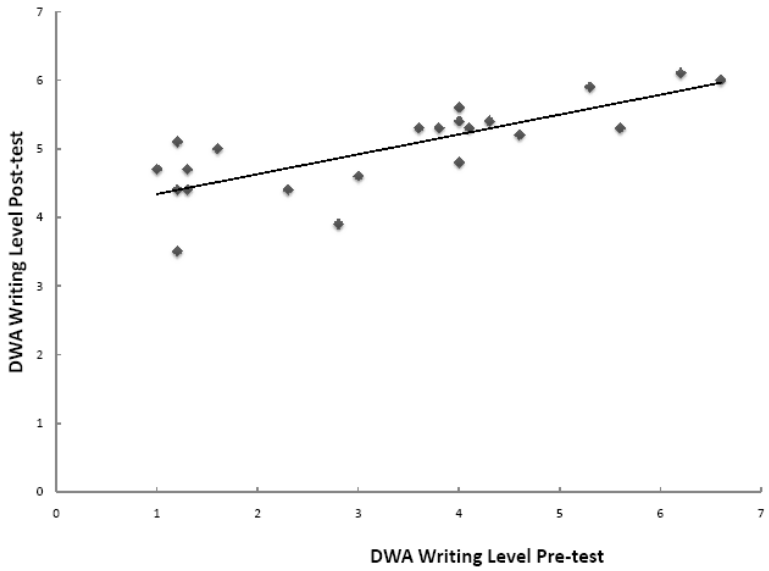

Figure 1. Distribution of Pre- and Post-test Scores on the DWA.

There was greater overall growth with younger emergent writers who could compose very little with paper and pencil and less growth with older early/transitional writers who could already compose sentences independently with paper and pencil (see Figure 1). However, both emergent and early/transitional writers significantly increased the number of sentences they produced using Clicker 5.2 writing support software and the computer.

Writer Self-Perception

The researcher surveyed student participants regarding their feelings, opinions and perceptions about writing both before and after the research intervention period. Students were given the Writer's Self-Perception Scale (WSPS) in either a primary or intermediate adapted version (See Appendix E and

F) to assess their writer self-perception. Table 3 shows that there was virtually no change between pre- and post-test scores. The average pre-test percentage score was 84% compared to the post-test average of 86%.

Table 3

Writer Self-Perception Scale Pre to Post-test (N = 22)

Student #	*WSPS pre-test*	*WSPS post-test*
1	77%	100%
2	92%	100%
3	100%	100%
4	100%	96%
5	100%	100%
6	100%	100%
11	50%	94%
12	78%	71%
14	77%	53%
15	63%	88%
16	90%	81%
17	80%	46%
19	90%	88%
20	69%	86%
22	95%	99%
24	44%	52%
25	100%	100%
26	91%	100%
27	91%	90%
28	91%	88%
29	100%	100%
30	62%	69%
AVG score:	84%	86%

Staff Perceptions

Five staff persons filled out a thirteen-question online survey to assess their opinions and perceptions about the effectiveness, strengths and

weaknesses of the research study intervention. The staff also met with the researcher in person for a debrief session a few weeks after the conclusion of the study to share perceptions, ideas and future aspirations related to technology, reading and writing. Clicker 5.2 Research Staff Survey results (see Appendix I) showed very positive feedback from all staff. All of the respondents rated Clicker 5.2 as a very effective tool for individual written expression and rated the combination of SMART Board and Clicker 5.2 as a very effective group instructional tool for writing. All of the respondents said they are more likely to use technology for classroom instruction in the future because of participation in this research study and they would recommend use of Clicker 5.2 to other special education and general education teachers. The Clicker 5.2 features that were most helpful for their students were speech feedback, custom grid sets and picture supports. All of the staff expressed technical and logistical concerns about continuing to check out laptop computers from one of their school's mobile checkout carts without additional technology support, as well as having too few desktop computers available in the classroom for students to practice writing using Clicker 5.2 templates. Finding the time in their busy work schedule to plan lessons and set-up computers for student use was a major barrier identified by the staff.

Informal interviews during an in-person debrief held one month after the research study intervention revealed that two of the staff have continued to reserve computer labs and laptop carts for group computer lesson activities using

Clicker 5.2 and other technology despite technical challenges. Two of the staff expressed the intention of creating new themed curriculum units next school year for teaching with use of the SMART Board, Clicker 5.2 software and other multimedia software and websites. They felt confident in their ability to locate Clicker 5.2 pre-made activities resources and to customize activities as needed for future student interventions. Five of the staff expressed interest in attending a ten-hour Clicker 5.2 advanced class over the summer to continue lesson planning, choosing and creating Clicker 5.2 lessons for next year.

Chapter Five

Discussion

Relating Results to Literature and Practice

The positive quantitative results (see Table 2) of this research study reinforce the findings of other related research studies examining the use of computers and software tools such as word processing (Outhred, 1989; Hetzroni & Shrieber, 2004; Wanzek el al, 2006), word prediction (Handley-More, 2003; Tam, 2005), multimedia (Anderson-Inman, Knox-Quinn & Horne, 1996; Daiute & Morse, 1994), picture support and speech feedback (Martin, 2007) features to improve the quality and quantity of student written productivity. For occupational therapists, it adds further evidence that assistive technologies are often effective alternatives and/or supplements to handwriting with paper and pencil for struggling writers (Handley-More, Deitz, Billingsley, & Coggins, 2003; Hetzroni & Shrieber, 2004; Tam, 2005; Wanzek, Vaughn, Wexler, Swanson, Edmonds & Ae-Hwa, 2006). The collaborative nature of this study also supports the effectiveness of a collaborative service delivery model for OT's in the schools (Swinth & Handley-More, 2008; Swinth & Hanft, 2007). In the online post-research survey (see Appendix I), teachers expressed a strong benefit of working closely with a knowledgeable team member (in this case, an OT with AT expertise) who could support the development of relevant lesson plans to address student learning needs, support use of innovative technology equipment and model effective intervention techniques in the context of a classroom.

The non-significant results of the study on the adapted WSPS (see table 3) may indicate that the developmentally delayed students in this study do not have the maturity or insight to discriminate a change in their feelings and opinions about their own writing. Another factor is that the student's self-perception about writing may not have changed significantly in only three months because they did not have a long enough intervention time with the technology to significantly change self-perception. Finally, many students participating in this study had behavior challenges and poor self-esteem about writing that may have affected their attention, understanding and consistency of selecting answers. The original WSPS was written and validated for general education students in the intermediate grades (Bottomley et al, 1997-98) and it was assumed that a similar assessment could be conducted with developmentally delayed students using an adapted picture-icon scale, fewer items and simplified instructions. However, these results lead to the conclusion that the adapted WSPS was not a sensitive enough measure for addressing the qualitative issues for this group of developmentally delayed students.

Strengths of the Study

This research study had the strength of a strong data sampling of twenty-two students from three different classrooms at two different schools. These students demonstrated good enthusiasm, consistent participation and appeared to give their best effort throughout the assessment and intervention period. Three certificated teachers, one student teacher and one speech language pathologist

contributed a variety of rich background experiences, expertise and resource networks that supported each phase of the study. In addition to this strong core staff support, this study had the benefit of support from the local school district administrators, building principals, and technology departments who provided budget, equipment, staff time, and troubleshooting for each issue that came up related to the study. These administrators also observed technology interventions, provided communication channels to share ideas and get support from other building staff, and provided positive feedback to researcher and support staff. Another advantage of this study was having a nine-month school year for planning and implementation with school staff who voluntarily committed their time and energy to carrying out the research study activities and were genuinely interested and committed to increasing use of technology in their classrooms. Finally, this researcher was fortunate to work in a school district with good access to technology. Each classroom had an interactive SMART Board and 2-3 classroom computers as well as access to reserving the laptop cart or computer lab for full class technology interventions.

Limitations of the study

Limitations of the research study were that there was no control group and the student participants were selected with nonrandomized methodology for a single group pilot study. The researcher specifically recruited classroom teachers who showed interest and aptitude with use of technology and whose schools and principals were supportive of the study. A challenge in selecting and

designing assessment tools and intervention activities was the range of student ages from Kindergarten through sixth grade and developmental writing levels from pre-primer through second grade. In particular, the adapted Writer Self-Perception Scale (WSPS) seemed to have limited effectiveness with the developmentally delayed younger student population in measuring change in writer self-perception.

When analyzing the results of the DWA, there may be limitations in interpretation because the researcher measured two different writing methods in the pre and post-test (handwriting versus computer output) but attempted to score both writing samples with the same scoring criteria of the DWA. The researcher created one Clicker 5.2 custom animal writing template for the DWA post-test to assess all the students, regardless of writing level. The template started off with easier grid page layouts with pre-determined sentence content choices and then gradually increased in complexity and number of writing choices with each successive page. Although this custom animal writing grid set was effective for the younger and lower performing writers, it may have been limiting for the highest 20% of the writers who might have shown more self-initiative and creativity in their content with a more open-ended format. The post-test may have had too many sentence structure and content supports built into the first few grid pages for these higher functioning students. With additional time, this researcher would have created a transitional writer version of the post-

test with sentence starters for guidance to get started, themed word banks, and more opportunities for typing words and creating original content ideas.

Another limitation of this study was the need for extensive training and planning time to prepare for the eight-week intervention with limited extra pay resources. Even though the SMART Board technology was new in each classroom, the existing computers and laptop carts were older and needed constant troubleshooting and technical support. The laptop carts were particularly cumbersome due to logistics such as retrieving from another storage area, turning on and setting up each laptop ahead of time with software activity lessons for each session, having an alternative power source available in case of low batteries, and contending with intermittent network access issues to student server. The researcher spent a considerable amount of extra time assuring that laptops were set up and functional for each classroom intervention lesson, yet this support would be difficult to duplicate in the classroom for continued laptop use after the research study without additional staff resources.

Suggestions for Future Research

The results of this study suggest that further research is needed in the area of assessment tools for measuring the effect of technology-based writing supports. In particular, future research might focus on conducting more trials of qualitative assessment tools to determine the efficacy of assessing younger children's feelings and perceptions about writing. Special education teachers need to identify and trial a variety of general education quantitative assessment

tools (such as the DWA) to collect writing data for children with developmental delays in order to establish whether these tools can be effective research measures for their students. Using a writing assessment tool that can be adapted to meet the needs of all students on one continuum builds a connection between general education and special education as well as providing exposure to general education curriculum for special education students as mandated by IDEA 2004.

To build upon the results of this research study, the same methodologies could be used to set up an experimental research study with a larger randomized sampling, a control group and an experimental group, to more accurately measure the effects of multimedia technology on reading and writing. Grant writing and procurement would be a valuable resource in funding larger more-in-depth studies.

The idea of collaboration for training, lesson planning and implementation could be further explored with a study looking at the difference in teacher use of technology, given a supportive collaborative training model versus a standard individualized teacher lesson planning and implementation model. Lastly, there is a need for future studies on comparing teacher use of an interactive SMART Board as a group instructional tool for reading and writing versus traditional small group teaching methods utilizing books, papers and pencils. Data could be taken on active student participation, attention to task, as well as individual student written responses given these two teaching methods and tools.

Practice or Clinical Applications

The positive results of this study imply that occupational therapists should pursue assistive technology adaptations for their students who are struggling readers and writers that provide supportive features such as speech feedback, picture support and custom grid sets. These supports make it easy to scaffold writing support to accommodate a variety of writing levels in one classroom. The use of these supports appears to make a significant difference in the independent writing productivity of students with autism, developmentally delay, learning disabilities and multiple disabilities. Occupational therapists are essential team members in a collaborative classroom approach to writing and should focus their interventions on supporting the teacher and students in their natural classroom environment using available technologies, coordinating lesson planning and providing training whenever possible. OT's should continue to pursue client-centered practice with the pediatric population through informal interviews with students, staff and parents, consideration of client's perceptions, providing motivating intervention activities and continuing to trial qualitative assessment tools such as the Canadian Occupational Performance Measure (COPM). Communication and teamwork with teachers and other professional support staff can lead to more intentional and research-based interventions, ability to take meaningful data, creative lesson planning, improved student engagement and increased satisfaction of all team members.

Conclusions

Results of this research study demonstrate that the use of multimedia writing support software and the computer with developmentally delayed elementary-aged students had a significant positive impact on the quantity and quality of written productivity. Although the DWA provided a useful quantitative measurement tool for this mild to moderately delayed student population, the adapted WSPS did not prove to be as effective. In the future, a more commonly used tool such as the COPM or verbal student feedback to custom designed questions may produce better qualitative results. However, qualitative and quantitative feedback from teaching staff did provide valuable feedback about student performance, perceived value of the intervention and empowerment to pursue continued technology use in the future. The collaborative service delivery model appeared to be both very desirable and effective for the staff and students involved in this research study. The combination of team collaboration and expertise, the power of assistive technology to engage students and adapt to their learning needs, and the diligent effort to document evidence of student success, all contributed toward validating relevant occupational therapy interventions in this study.

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Appendix A
SJSU Cover and Consent Letter for Participation in Research page 1 of 3

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Dr. Heidi Pendleton

Post-Professional Program Director:
Dr. Pamela Richardson

January 21, 2008

Dear Parent,

My name is Rose Racicot and I have been an occupational therapist in Kent School District for 21 years and part of the Assistive Technology Team for the last 7 years. I am currently in my second year at San Jose State University in the Post-Professional Master's Degree Program in Occupational Therapy and proposing a research study to carry out in the Kent School District with schools and staff who are familiar to me.

I need your help in conducting a study of "the effect of multi-media writing support software on written production" in your child's classroom. The results of this study should increase your child's written productivity skills using technology writing supports in the classroom and improve their self-perception and confidence about writing.

You should understand that your child's participation is voluntary and that choosing not to participate in this study, or in any part of this study, will not affect you or your child's relations with San Jose State University or with Kent School District. Your child has the right to not answer any questions he/she does not wish to answer on the evaluation tools.

The results of this study may be published, but any information that could result in your child's identification will remain confidential.

If you have questions about this study, I will be happy to talk with you. I can be reached at (253)373-7028 (work), (253) 854-3320 (home), or at Rose.Racicot@kent.k12.wa.us. Complaints about the research may be presented to Pamela Richardson, PhD, OTR/L, FAOTA, San Jose State University, Department of Occupational Therapy, (408) 924-3088. Questions about a research subjects' rights, or research-related injury may be presented to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, at (408) 924-2427.

Please sign and date the enclosed consent form on page two to give permission for your child to participate in this study. Also, please initial the first page to indicate you have seen and read the contents. I will review with your child what will be required from them to participate in the study and have them sign on page 2 if they agree. You are also encouraged to discuss this with them.

Sincerely,

Rose Racicot, OTR/L

Rose Racicot, OTR/L
San Jose State University Graduate Student
Occupational Therapist
Assistive Technology Team
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SJSU Cover and Consent Letter for Participation in Research page 2 of 3

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San José, CA 95192-0059
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Fax: 408-924-3088
Internet: http://www.sjsu.edu/ot

Department Chair:
Dr. Heidi Pendleton

Post-Professional Program Director:
Dr. Pamela Richardson

Consent Form (for Child Participants)

Agreement to Participate in Research

Responsible Investigator(s): Rose M. Racicot, San Jose State University student.
Title of Protocol: The Effect of Multi-media Writing Support Software on Written Production

1. Your child has been asked to participate in a pilot research study investigating the effects of using multi-media writing support software as a writing tool in their special education classroom. The purpose of this study is to explore the effects of Clicker 5 multi-media writing support software on the quality and quantity of writing productivity for students who have mild to moderate developmental delays.

2. Your child will be asked to participate in classroom writing lessons with his/her teacher and this researcher that include group lessons taught at the interactive Smartboard using Clicker 5 software, followed by individual writing practice on a computer loaded with Clicker 5 software and pre-designed writing activities. This instruction will be conducted in his/her homeroom classroom and/or the computer lab at your child's school. Lessons will be presented in 40 minute sessions, 2 times per week for 8 weeks and may be video recorded for data, evaluation and teaching purposes. There will be a pre-test and post-test to measure your child's progress. Evaluations and interventions will be videotaped for data collection and teaching purposes.

3. The risks involved in this study are no more than would be encountered in your child's routine classroom instructional activities at school. The software and hardware are already available and supported by the Kent School District for your child's use.

4. The possible direct benefits to participation in this study are improved navigational use of the Smart board, computers and Clicker 5 software, improved quantity and quality of written production and an increased confidence in writing ability.

5. Although the results of this study may be published, no information that could identify your child, your family, or you will be included. A student identification number will be used in the study.

6. There is no compensation for participation in this study.

7. Questions about this research may be addressed to Rose M. Racicot at (253) 854-3320 or by e-mail Rose.Racicot@kent.k12.wa.us . Complaints about the research may be presented to Pamela Richardson, PhD, OTR/L, FAOTA, San Jose State University, Department of Occupational Therapy, (408) 924-3088. Questions about a research subjects' rights, or research-related injury may be presented to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, at (408) 924-2427.

8. No service of any kind, to which you and/or your child otherwise entitled, will be lost or jeopardized if you choose not to participate in the study.

9. Your consent for your child to participate is being given voluntarily. You may refuse to allow his or her participation in the entire study or in any part of the study. Your child has the right not to answer questions that he/she does not wish to answer on given assessments or interviews. If you allow his or her participation, you are free to withdraw your child or ward from the study at any time, without any negative effect on your relations with San Jose State University or with the Douglas C. Memorial School. Your child also has the right to withdraw from the study at any time.

Initial ____

SJSU Cover and Consent Letter for Participation in Research page 3 of 3

San José State
UNIVERSITY

College of Applied Sciences and Arts

Department of Occupational Therapy

One Washington Square
San José, CA 95192-0059
Voice: 408-924-3071
Fax: 408-924-3088
Internet: http://www.sjsu.edu/ot

Department Chair:
Dr. Heidi Pendleton

Post-Professional Program Director:
Dr. Pamela Richardson

Consent Form (for Child Participants)

10. Minor assent statement: Since the students targeted to participate in this student are functioning at a developmental level of 2nd grade or less, I would ask them to participate in this study by explaining the following:
"I would like you to help your teacher and I learn about different ways to help you with your writing using words and pictures on the computer. We will use the new Smart board in your classroom for your teacher to teach group writing lessons two times per week and then have you try some special writing activities on a laptop computer. We will also test your writing and ask you how you feel about writing. Will you agree to work hard and show us your best writing using the computer with pictures and words for about 3 months?"

_____ _____
Signature of Child Date

11. At the time that you sign this consent form, you will receive a copy of it for your records, signed and dated by the investigator.

- **The signature of a parent or legal guardian on this document indicates:**
  a) approval for the child to participate in the study,
  b) that the child is freely willing to participate, and
  c) that the child is permitted to decline to participate, in all or part of the study, at any point.
- **The signature of a researcher on this document indicates agreement to include the above named subject in the research and attestation that the subject's parent has been fully informed of the subject's rights.**

_____
Name of Child

_____ _____
Parent or Guardian Signature Date

_____
Relationship to Child or Ward

_____
Full Mailing Address

_____ _____
Investigator's Signature Date

Appendix B
Kent School District Consent Letter

KENT SCHOOL DISTRICT

Date:	October 22, 2008
To:	Rose Racicot, Kent School District 415 Whom it May Concern, San Jose State University
From:	Bob Isenberg, Director of Assessment RD Isen
Re:	Request to Conduct Research in KSD Research is Approved Fr. 22 Oct 08 through 21 Oct 09 RDI
Research Topic:	The Effect of Multi-Media Writing Support Software on Written Production
Research Objective:	Explore effects of writing support software on quality and quantity of writing productivity for students who have mild to moderate developmental delays.
Request from:	Rose Racicot, Master's student @ San Jose State University and KSD TOSA in Assistive Technology
Subjects:	Primary grade students served by SPED whose IEPs require writing goals and have ability to access computers. Researcher is already working with SPED staff at Scenic Hill and Meridian Elementary
Methodology:	Data Analysis using word counts, word sequencing, and sentence structure analysis; SBRS Writing grades, DWA (available at ME and limited use at SH), and, possibly, DRA Word Analysis subscores.

The effectiveness of adaptive software in improving student learning is of interest to both the applicant and to the district. While the applicant is not a "disinterested party" as she is a district teacher working with adaptive, her research approach should provide useful information to SPED staff. Ms. Racicot's research work is essentially her current KSD work. Data would be stripped of student identifiers for her research (record numbers rather than names and IDs).

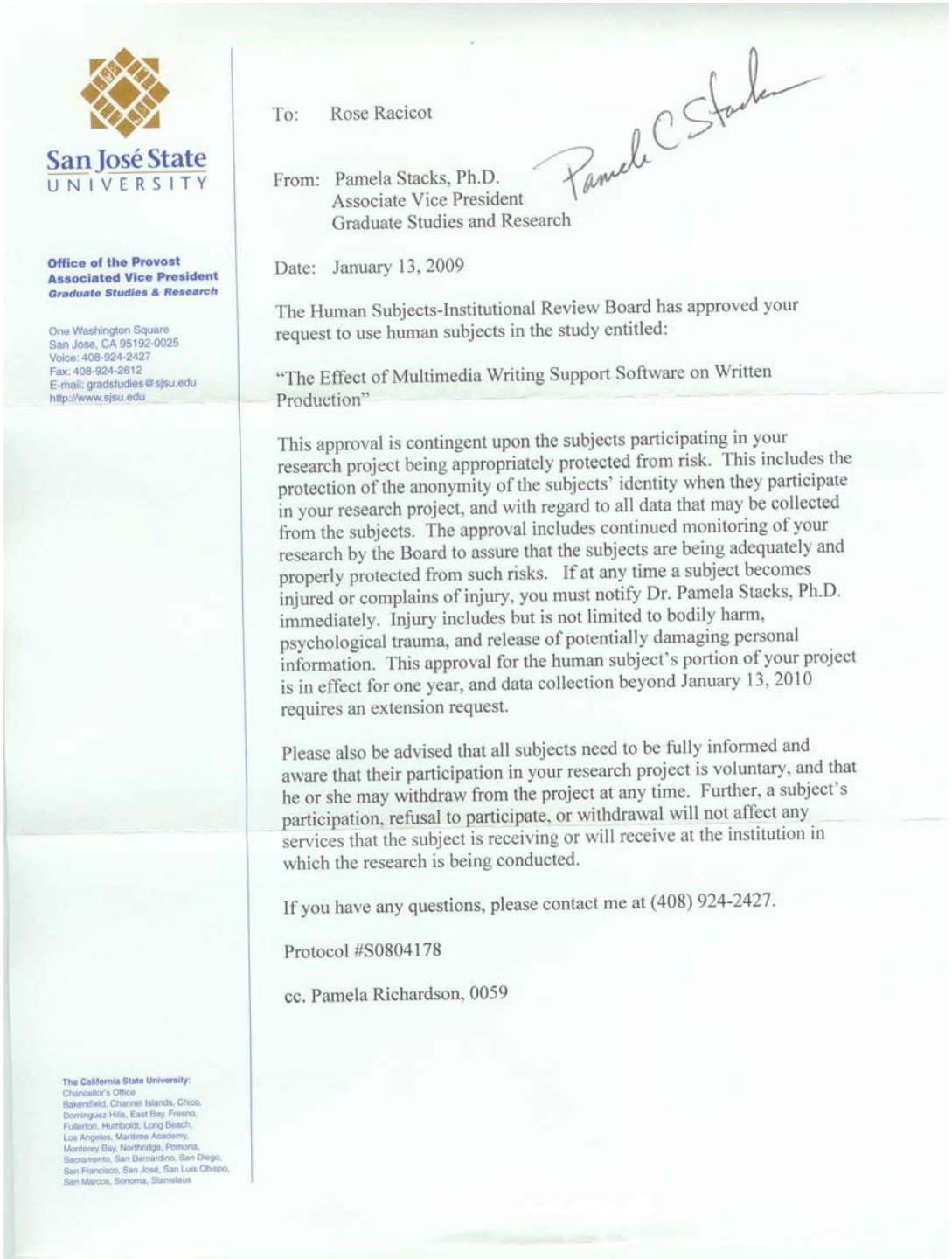
Note that the original proposal included some staffing considerations. Approval of the research proposal does not in any way mean approval of any allocation of staffing or of any additional expenditures by KSD.

cc: Laura Madeo, Executive Director, Instructional Services
Kimberly Halley, Director, Special Services

Instructional Services
12033 SE 256th Street
Suite A-300
Kent, Washington
98030-6643
253-373-7080

H:\Research_external\Racicot\researchapprovalmemoRacicot_SanJose.docr - rsi 10/22/2008

Appendix C
San Jose State University Institutional Review Board Approval Letter



San José State
UNIVERSITY

Office of the Provost
Associated Vice President
Graduate Studies & Research

One Washington Square
San Jose, CA 95192-0025
Voice: 408-924-2427
Fax: 408-924-2612
E-mail: gradstudies@sjsu.edu
http://www.sjsu.edu

To: Rose Racicot

From: Pamela Stacks, Ph.D.
Associate Vice President
Graduate Studies and Research

Pamela C Stacks

Date: January 13, 2009

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"The Effect of Multimedia Writing Support Software on Written Production"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Pamela Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond January 13, 2010 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2427.

Protocol #S0804178

cc. Pamela Richardson, 0059

Appendix D
Developing Writer's Assessment Page 1 of 7

DEVELOPING WRITER'S ASSESSMENT K – 6

Name _____ School _____

Directions: Write the date on the line beside the grade level, using the suggested color. Use the same color to circle or highlight the appropriate descriptors on the continuum. Then record the level and stage.

		Date	Level	Stage
(Purple)	Kindergarten			
(Red)	First Grade			
(Green)	Second Grade			
(Blue)	Third Grade			
(Purple)	Fourth Grade			
(Red)	Fifth Grade			
(Green)	Sixth Grade			

	Emerging Writer 1	Emerging Writer 2	Emerging Writer 3
CONVENTIONS	*1.0–1.5*	*1.6–2.7*	*2.8–3.7*
Sentence Structure	Includes no evidence of intended message	Includes 1 intended word or phrase	Includes 1 intended simple sentence
Directionality, Spacing, and Punctuation	Places squiggles, other shapes, letterlike shapes, and/or letters randomly	Places letterlike shapes or letters in a left to right direction and may have a space between 2 words	Places letters and/or words in a left to right direction and leaves spaces between 3 or more words; may attempt punctuation
Letter Formation and Capitalization	Forms squiggles, other shapes, and/or letterlike shapes	Forms mostly uppercase letters; may form 1 word using lowercase letters	Forms 2 or more words using lowercase letters
Spelling	Represents words using letterlike shapes and/or letters with no letter–sound correspondence to the intended word; dictation needed to read all words	Represents 1–2 words by recording at least 1 dominant sound; may spell 1 word conventionally; dictation needed to read most words	Represents most words by recording 1 or more dominant sounds; may spell 2–3 different words conventionally; dictation needed to read some words
CONTENT			
Supporting Details	Includes no evidence of intended articles or modifiers	Includes 1 intended article and/or modifier	Includes 2 intended modifiers
Word Choice	Includes no evidence of intended words	Uses 1–3 intended high-frequency/routine words	Uses 4 or more intended high-frequency/routine words

Appendix D

Developing Writer's Assessment Page 2 of 7

DEVELOPING WRITER'S ASSESSMENT K – 6

	Early Writer 4	Early Writer 5	Early Writer 6
CONVENTIONS	*3.8–4.7*	*4.8–5.7*	*5.8–6.7*
Sentence Structure	Includes 2–4 simple sentences and/or 1 compound or complex sentence	Includes at least 5 simple sentences and/or 2 compound or complex sentences	Includes 3 compound and/or complex sentences
Sentence Variation	Begins all sentences with the same word	Varies the way 2–3 sentences begin	Varies the way 4–5 sentences begin
Punctuation	Ends 1 sentence or the story with a period	Ends 2–4 sentences with periods; may use other forms of punctuation appropriately at times	Ends at least 5 sentences with periods; may use other forms of punctuation appropriately at times
Capitalization	Capitalizes first word in 1 sentence; may capitalize other letters inappropriately	Capitalizes first word in 2–4 sentences; may use other forms of capitalization appropriately at times	Capitalizes first word in at least 5 sentences; may use other forms of capitalization appropriately at times
Spelling	Spells 4–8 different words conventionally; dictation needed to read a few words	Spells 9 or more different one-syllable words conventionally	Spells 3–5 different two-syllable words conventionally
CONTENT			
Opening	Begins with an action or a fact in the first of 2–3 related thoughts or sentences	Begins with an action or a fact in the first of 4 or more related sentences	Creates a brief context or introduction with 1 opening sentence
Transitions	Uses 1 transitional word or phrase to connect thoughts (Note: No transitional word or phrase is scored level 3.)	Uses 2 different transitional words or phrases to connect thoughts or ideas	Uses 3 different transitional words or phrases to connect thoughts or ideas
Development of Ideas	Uses a glimmer of at least 1 strategy to develop an idea	Uses 1 strategy somewhat effectively to develop an idea	Uses 1 strategy somewhat effectively and at least a glimmer of 1 other strategy to develop ideas
Supporting Details	Includes 3–4 different modifiers	Includes 5 or more different modifiers	Supports 1 idea with details in at least 3 sentences
Word Choice	Uses 1 precise word that is more exact in meaning	Uses 2 precise words that are more exact in meaning	Uses 3–4 precise words that are more exact in meaning
Closing	Stops with no ending after 2 or more related thoughts or sentences	Signals ending with "The End"	Creates a logical ending or resolves the problem in at least 1 sentence; may include "The End"

Appendix D
Developing Writer's Assessment page 3 of 7

DEVELOPING WRITER'S ASSESSMENT K – 6

	Transitional Writer 7	Transitional Writer 8	Transitional Writer 9
CONVENTIONS	*6.8–7.7*	*7.8–8.7*	*8.8–9.7*
Sentence Structure	Includes 4–6 compound and/or complex sentences	Includes at least 7–9 compound and/or complex sentences	Uses a variety of sentences, including 10 or more compound and/or complex sentences
Sentence Variation	Varies the way 6–7 sentences begin	Varies the way 8–9 sentences begin	Varies the way 10–12 sentences begin
Punctuation	Ends at least 6 sentences with periods and uses 2 other forms of punctuation appropriately most of the time	Uses 4 forms of punctuation appropriately most of the time	Uses 5–6 forms of punctuation appropriately most of the time
Capitalization	Capitalizes first word in at least 6 sentences and uses 1 other form of capitalization appropriately most of the time	Uses 3 forms of capitalization appropriately most of the time	Uses 4 forms of capitalization appropriately most of the time
Spelling	Spells 6–8 different two-syllable words conventionally	Spells 9 or more different two-syllable words conventionally	Spells 3–5 different multi-syllable words conventionally
CONTENT			
Opening	Creates a context or introduction somewhat effectively with 2 opening sentences	Creates a context or introduction somewhat effectively with at least 3 opening sentences; may be paragraphed	Creates a context or introduction generally effectively with at least 3 opening sentences; may be paragraphed
Transitions	Uses 4–5 different transitional words, phrases, and/or clauses to connect thoughts or ideas	Uses 6–7 different transitional words, phrases, and/or clauses to connect thoughts or ideas	Uses 8–9 different transitional words, phrases, and/or clauses to connect thoughts or ideas
Development of Ideas	Uses at least 2 strategies somewhat effectively to develop ideas	Uses at least 1 strategy generally effectively to develop ideas	Uses 1 strategy generally effectively and at least 1 other strategy somewhat effectively to develop ideas
Supporting Details	Supports 2 ideas with details in at least 3 sentences; may be paragraphed	Supports 3 ideas with details in at least 3 sentences; may be paragraphed	Supports 4 ideas with details in at least 3 sentences; may be paragraphed
Word Choice	Uses 5–6 precise words or phrases that are more exact in meaning	Uses 7–9 precise words or phrases that are more exact in meaning	Uses at least 10 precise words and a few figurative phrases somewhat effectively to clarify ideas and/or create visual images
Closing	Creates a brief closing (wrap-up, summary, conclusion) with at least 1 sentence; may include "The End"	Creates a somewhat effective closing (wrap-up, summary, conclusion) with at least 2 sentences; may be paragraphed	Creates a generally effective closing (wrap-up, summary, conclusion) with at least 2 sentences; may be paragraphed

Appendix D
Developing Writer's Assessment page 4 of 7

DEVELOPING WRITER'S ASSESSMENT K – 6

	Advancing Writer 10	Advancing Writer 11	Advancing Writer 12
CONVENTIONS	*9.8–10.7*	*10.8–11.7*	*11.8–12.0*
Sentence Structure	Uses a variety of sentences, including 8–10 complex sentences	Uses a variety of sentences, including 11–14 complex sentences	Uses a variety of sentences, including 15 or more complex sentences
Sentence Variation	Varies the way 13–16 sentences begin	Varies the way 17–20 sentences begin	Varies the way 21 or more sentences begin
Punctuation	Uses 7–8 forms of punctuation appropriately most of the time	Uses 9–10 forms of punctuation appropriately most of the time	Uses 11 or more forms of punctuation appropriately most of the time
Capitalization	Uses 5–6 forms of capitalization appropriately most of the time	Uses 7 forms of capitalization appropriately most of the time	Uses 8 or more forms of capitalization appropriately most of the time
Spelling	Spells 6–10 different multi-syllable words conventionally	Spells 11–15 different multi-syllable words conventionally	Spells 16 or more different multi-syllable words conventionally
CONTENT			
Opening	Constructs an effective context or introduction with at least 3 opening sentences; may be paragraphed	Constructs an effective opening paragraph with at least 4 sentences	Constructs a creative, effective opening paragraph with at least 5 sentences
Transitions	Uses 10 or more different transitional words, phrases, and/or clauses to connect thoughts or ideas	Uses a variety of transitional words, phrases, and/or clauses within and between some paragraphs generally effectively	Uses a variety of transitional words, phrases, and/or clauses within and between some paragraphs effectively
Development of Ideas	Develops topic using at least 2 strategies generally effectively	Develops topic using at least 1 strategy effectively and at least 1 other strategy generally effectively	Develops topic using at least 2 strategies effectively
Supporting Details	Supports 5 ideas with details in at least 3 sentences; may be paragraphed	Structures 3 unified, cohesive paragraphs of at least 4 sentences	Structures 4 or more unified, cohesive paragraphs of at least 4 sentences
Word Choice	Uses at least 10 precise words and other figurative language generally effectively to clarify ideas, create visual images, and/or evoke emotional responses	Uses at least 15 precise words and other figurative language generally effectively to clarify ideas, create visual images, evoke emotional responses, and/or share insights	Uses at least 20 precise words and other figurative language generally effectively to clarify ideas, create visual images, evoke emotional responses, and/or share insights
Closing	Constructs an effective closing with 3 sentences; may be paragraphed	Constructs an effective closing paragraph with at least 4 sentences	Constructs a creative, effective closing paragraph with at least 5 sentences

Appendix D
Developing Writer's Assessment page 5 of 7

Writing Prompts from DWA

Kindergarten: Draw a picture of your favorite thing to do at school and then w**rite** about this.

(Do you want them to write first and then draw?)

1st
Today you are going to write a story about an animal. It could be about a bear, a tiger, a dog, a snake, a horse, or any other animal. The story can be true or make believe. First you will draw pictures on your storyboard to help you plan your animal story.

2nd
Think about an animal that you like. It could be a bear, a tiger, a dog, a snake, a horse, or any other animal. Choose any animal you like. Write a story about the animal. You may tell what your animal is like and what happens to it. The story can be true or make-believe.

3rd
Writing Topic 1:One day on a school field trip you get lost, write a story about how you got lost and what you did after that.

Grade 4
Writing Topic 1: One morning you open your front door and find a box with writing on it. In several paragraphs write a story about what happens when you open the box.

Writing Topic 2: A Special Person
Think about one special person in you life. The person may be a parent, a brother, a sister, a grandparent, a teacher, or even a coach. Write about that special person. Describe your special person and explain why this person is so special to you.

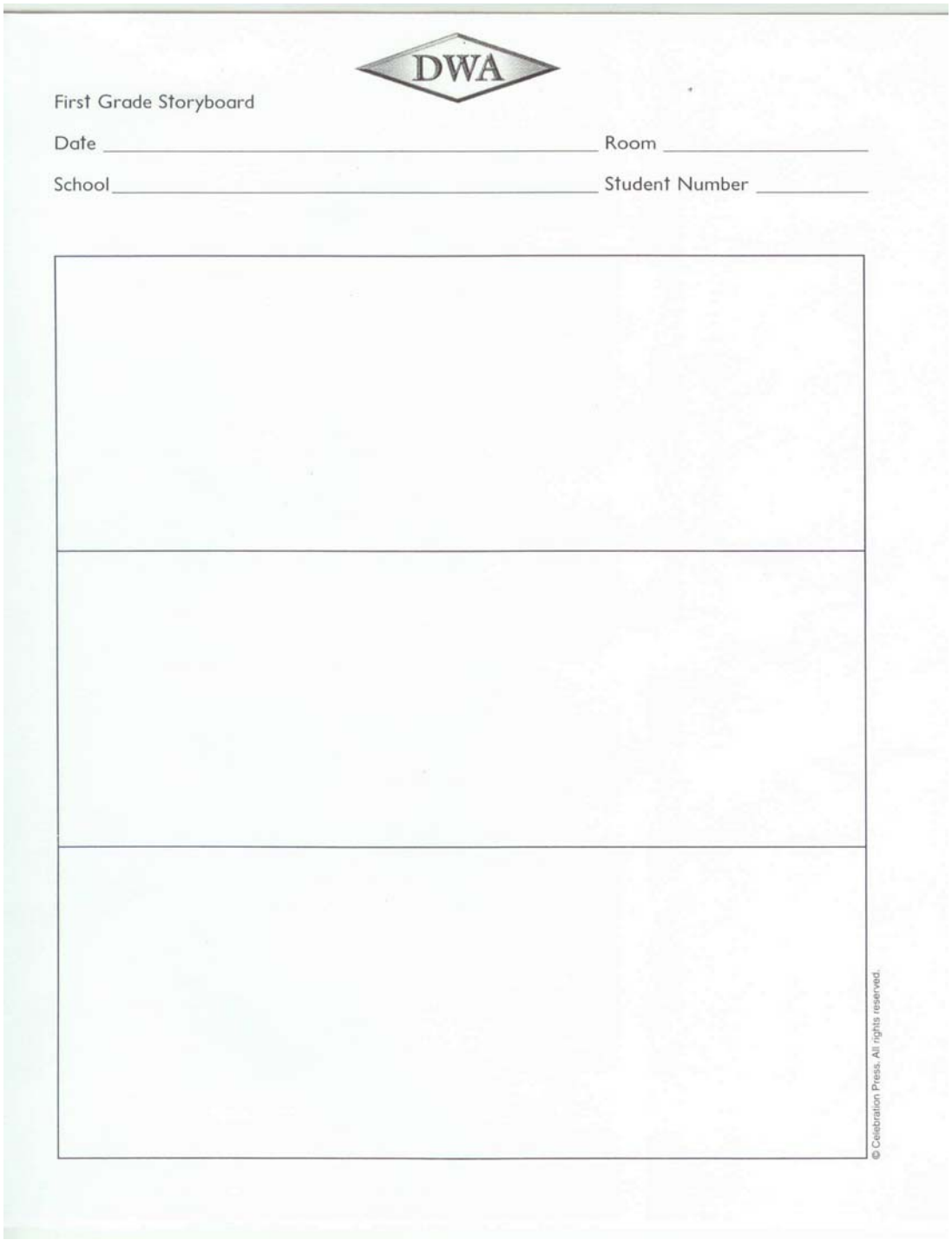
Writing Topic 3: A Special Interest
There may be a topic of special interest to you. You may know a lot about an important person, a place, or even a certain animal. Write a letter to a friend and tell the information you know about your special interest. Help your friend understand why this topic is so interesting to you.

Grade 5
Writing Topic 1: A Personal Experience
Think about a personal experience that you have had. Your personal experience may have been a sad time, a happy time, or even a scary time. Write about your personal experience so that others may understand why this was such a memorable time.

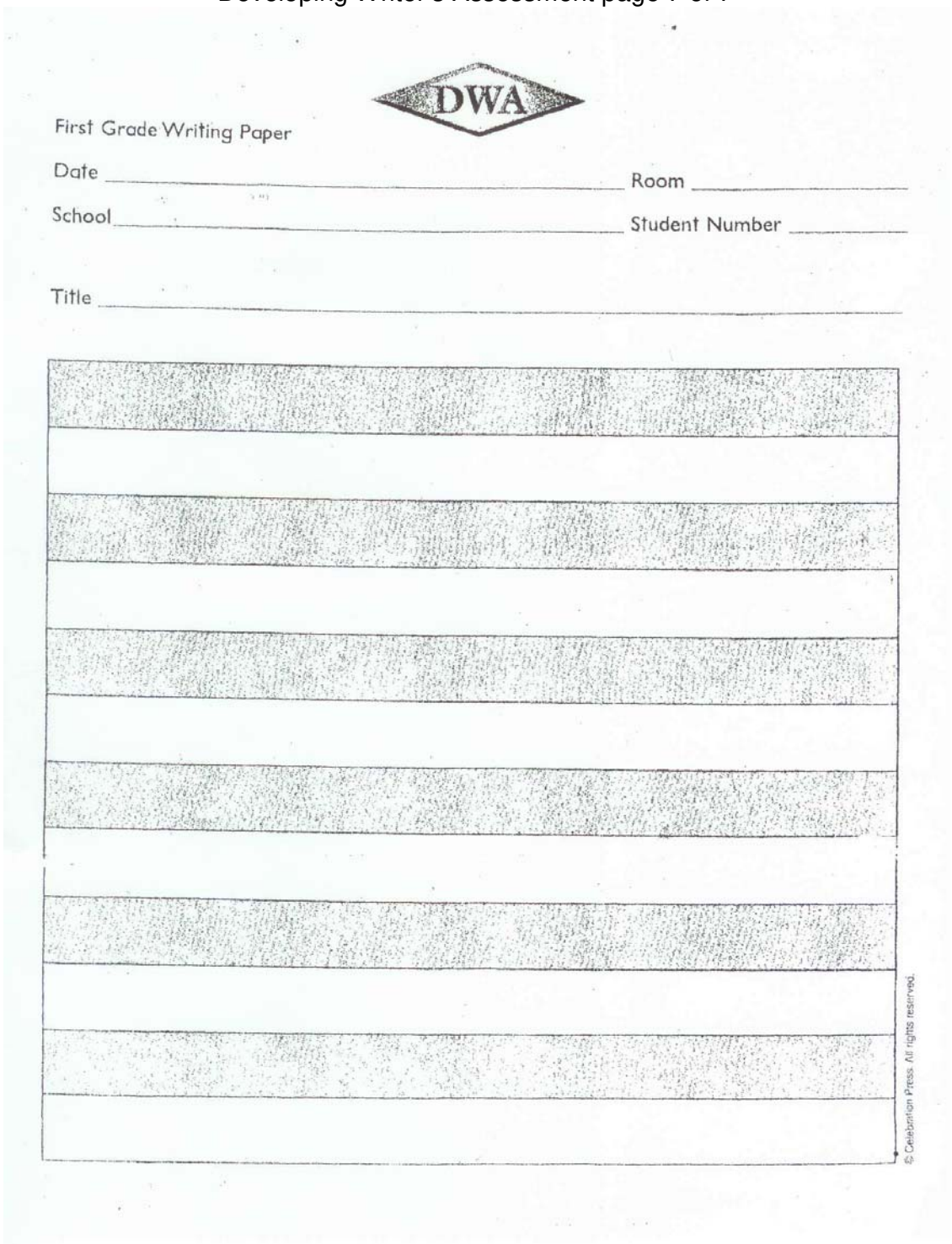
Writing Topic 2: Something I Find Interesting
You have learned many interesting things during the past year. You may have learned about your state, an important person in your country the environment, or a place like the desert. Chose one topic and tell what you have learned and why it is interesting to you.

Grade 6
Writing Topic Expository 1: Something I Love to Do

Appendix D
Developing Writer's Assessment page 6 of 7



Appendix D
Developing Writer's Assessment page 7 of 7



Appendix E

The Primary Writer Self-Perception Scale
(Shortened and adapted with picture scoring)

Listed below are statements about writing. Please read each statement carefully. Then circle the letters that show how much you agree or disagree with the statement. Use the following scale and/or symbols:

Good	
I don't know	
Not all that great	

Example: I think Batman is the greatest super hero.			

If you think that Batman is good, circle the smiling face.	
If you can't decide whether or not Batman is the greatest, circle the unsure face.	
If you think that Batman is not good, circle the sad face.	

*Adapted by Rose M. Racicot, OTR/L on 11/13/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

The Primary Writer Self-Perception Scale
(Shortened and adapted with picture scoring)

1. I am getting better at writing.			
2. I enjoy writing.			
3. My teacher thinks I am a good writer.			
4. Writing is easier for me than it used to be.			
5. I think I am a good writer.			
6. I write better now than I could before.			
7. Writing makes me feel good.			
8. I need less help to write than I used to.			
9. People in my family think I am a good writer.			

*Adapted by Rose M. Racicot, OTR/L on 11/13/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

The Writer Self-Perception Scale scoring sheet
(for simplified primary version 11/13/08)

Student Name_____

Teacher_____

Grade_____Date_____

Scoring Key: 3 = Good (GO)
2 = I don't know (IDK)
1 = Not all the great (NG)

_____

Scales

General Progress (GPR)	Social Feedback (SF)	Psychological States (PS)
1._____	3._____	2._____
4._____	9._____	7._____
5._____		
6._____		
8._____		

Raw Scores

Raw Score		
_____of 25	_____ of 10	_____of 10

Score Interpretation	GPR	SPR	OC	SF	PS
High					
Average					
Low					

*Adapted by Rose M. Racicot, OTR/L on 11/1/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

Appendix F

The Intermediate Writer Self-Perception Scale
(Shortened and adapted with picture scoring)

Listed below are statements about writing. Please read each statement carefully. Then circle the letters that show how much you agree or disagree with the statement. Use the following scale and/or symbols:

Great	
Good	
I don't know	
Not all that great	
Yuk, NOT good	

Example: I think Batman is the greatest super hero.					

If you are really sure that Batman is the greatest, circle the laughing face.	
If you think that Batman is good but maybe not great, circle the smiling face.	
If you can't decide whether or not Batman is the greatest circle the unsure face.	
If you think that Batman is not all that great, circle the sad face.	
If you are really sure that Batman is not the greatest, circle the yuk face.	

*Adapted by Rose Racicot, OTR/L on 11/1/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

The Intermediate Writer Self-Perception Scale

1. I write better than other kids in my class.					
2. I like how writing makes me feel inside.					
3. I am getting better at writing.					
4. People in my family think I am a good writer.					
5. My writing has improved.					
6. I enjoy writing.					
7. My teacher thinks I am a good writer.					
8. Writing is easier for me than it used to be.					
9. When I write, I feel calm.					
10. My sentences stick to the topic better now.					

*Adapted by Rose Racicot, OTR/L on 11/1/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

The Intermediate Writer Self-Perception Scale

11. People in my family think I write pretty well.					
12. I think I am a good writer.					
13. I write better now than I could before.					
14. Writing makes me feel good.					
15. Other kids think I am a good writer.					
16. I put my sentences in a better order than the other kids.					
17. I need less help to write than I used to.					
18. The words I use in my writing are getting better.					

*Adapted by Rose Racicot, OTR/L on 11/1/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

The Writer Self-Perception Scale scoring sheet
(for simplified version 11/13/08)

Student Name_____

Teacher_____

Grade_____Date_____

Scoring Key: 5 = Great (GR)
4 = Good (GO)
3 = I don't know (IDK)
2 = Not all that great (NG)
1 = Yuk, NOT good (YNG)

_____

Scales				
General Progress (GPR)	Specific Progress (SPR)	Observational Comparison (OC)	Social Feedback (SF)	Psychological States (PS)
3._____	10._____	1._____	4._____	2._____
5._____	18._____	16._____	7._____	6._____
8._____			11._____	9._____
12._____			15._____	14._____
13._____				
17._____				

Raw Scores				
Raw Score _____of 30	_____ of 10	_____of 10	_____ of 20	_____ of 20

Score Interpretation	GPR	SPR	OC	SF	PS
High					
Average					
Low					

*Adapted by Rose Racicot, OTR/L on 11/1/08 from the original Writer Self-Perception Scale (Bottomley, Henk, & Melnick, 1997) with permission from the author.

Appendix G
Schedule and Lesson Planning Table page 1 of 3

Date: Week of... ME: M and W SH: T and Th	Week and Lesson Numbers	Theme	Clicker 5 Books	Clicker 5 writing activities	Additional related Interactive Clicker 5 activities
Jan 5-9, 2009	Lesson Planning with Rose – choose DWA prompt, lessons, set up computer time for next few weeks to let students practice and work out technology details.				
Jan 12-16, 2009	Computer trial with students using online "Starfall" program, troubleshoot laptop set-up, lesson plan with Rose				
Jan 21-22, 2009	Received IRB approval on Jan 21 and mailed consent forms to parents on Jan 22nd				
Jan 19-23, 2009 ME (M,F) SH (T, Th) (No School Jan 28th)	Trial Lesson	Test run with Clicker 5 and computers (NOT "official start")	"Susan Laughs"		2. All about ME grid
Jan 26-30th, 2009	Administer Assessments	DWA	WSPS		
Feb 2-6, 2009 ME Jill (M, W at 10am) SH Roxanne (T, Th at 1:40) SH Mary (T, TH at 10:50am)	Week 1, Lesson 1 & 2	Winter/Snow	"All you Need for a Snowman"	1.Snowman sizes with picture cues (writing) – ALL 2. Snowman pronouns and verb tenses 3. Book Report - Snowman	1. Build a Snowman 2. Snowman, Same or different
Feb 9-13, 2009 ME Jill (M, W at 10am, conferences pm) SH Roxanne (T, Th at 1:40pm) SH Mary (T, TH at 10:50am)	Week 2, Lesson 3 & 4	Family, Valentine's Day, Love	"I Love you with all my Heart"	1. Book Report –I Love you (Rox/Jill) 2. Valentine's Day Advanced write (Jill, Rox) 3. Valentine's Day Poem -write (easy) 4. Valentine Cards – write (Mary)	1. Valentines Same/Different (Mary, Rox, Jill) – easy, cute songs 2. Valentine Words (Mary) 3. Valentine Sequencing (Mary)

Appendix G
Schedule and Lesson Planning Table page 2 of 3

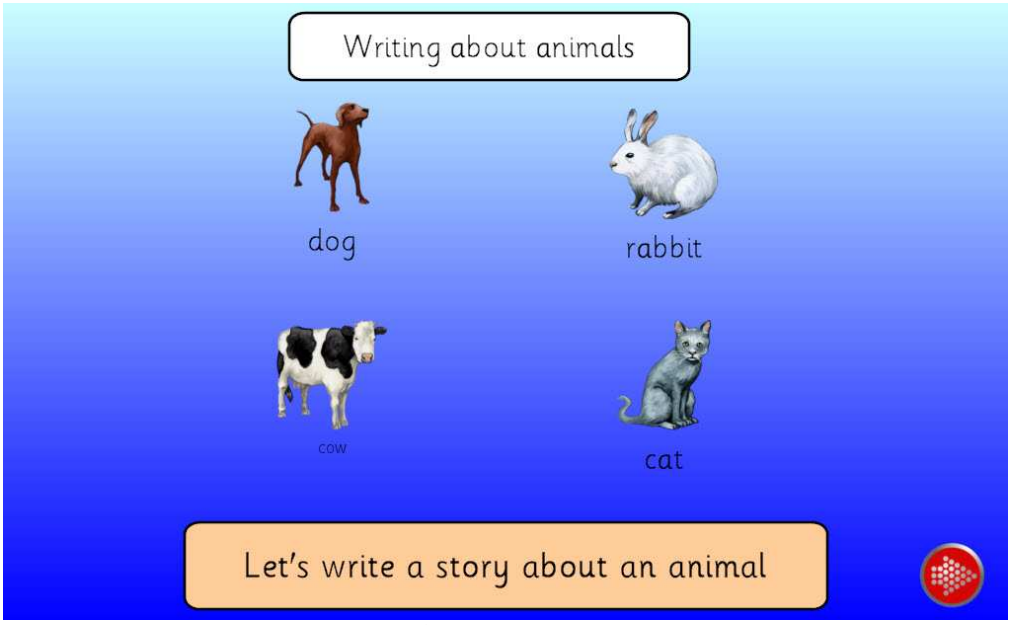
Feb 23-27, 2009 Normal schedule ME 1:50pm M, W SH 10:50am and 1:40pm T, Th	Week 3, Lesson 5 & 6	All About Me and You (friendship)	"We all sing with the same voice"	1. *All About Me Book Writing grid (Mary, Rox, Jill) 2. Book Report – We All Sing (Rox/Jill) 3. "wh" questions custom grid for "We All Sing" (Mary)	1. Simon Says levels 1, 2, 3) – Everyone
March 2-6, 2009 Normal schedule	Week 4, Lesson 7 & 8	Pets/ Animals	"COW"– (Tues- Rox) "Animal Babies" – (Roxanne -Thurs & Jill -Mon) "Polar Bear, Polar Bear" – (Mary-Tues & Jill -Wed)	1. *Pets Read, Hear and Write: W/Th (Rox/Jill and Mary) 2. *Animal Counting (Jill-Mon, Mary-Tues) 3. Book Report COWS (Rox –Thurs)	1. Animal Babies custom Matching- goes with Animal Babies book (Jill & Mary) 2. Listening to Match Animals (Mary-Tues)
March 9-13, 2009 Normal schedule	Week 5, Lesson 9 & 10	Weather	"Wind Blew" (Mary and Rox/Jill -Tues) "About Clouds" (Rox/Jill- Thurs)	1. *Weather Write: Read, hear, Write (Jill/Roxanne, Mary) 2. *Cloud Pictures Read and Write (Jill/Rox)	1. *Reading a Thermometer(Jill/Rox) 2. What is the Weather like(calendar)? (Mary) 3. * Weather Similes 4. My Weather Report Forced order (Mary) 5. Matching Weather Pairs (Mary)

Appendix G
Schedule and Lesson Planning Table page 3 of 3

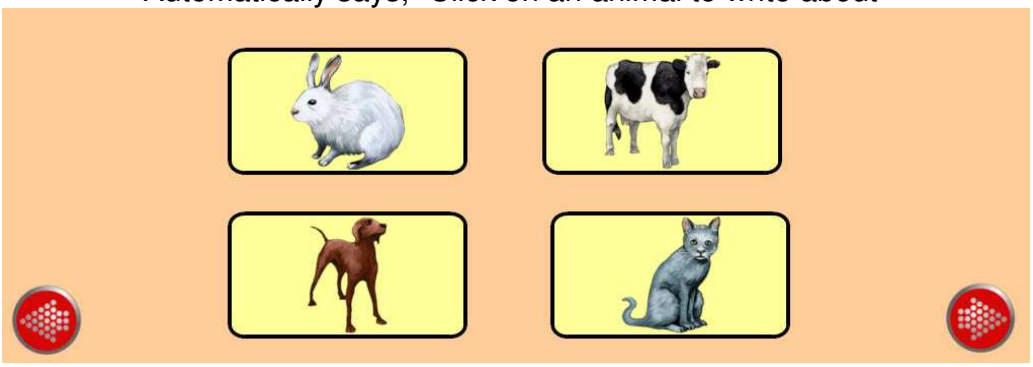
March 16-20, 2009 Normal schedule	Week 6, Lesson 11 & 12	Food	"Bread, Bread, bread"(Rox/Jill) "Peanut Butter and Jelly" (Mary)	1. Food – read and write (ALL) 2. Nutrition – beg (Mary) or *Advanced (Rox/Jill) 3. Custom Book Report-BREAD (Rox/Jill)	1. Food/Word match (Mary) 2. Let's make PB & J (Mary) 3. Leprechauns (St. Patrick's Day writing)-ALL (time-permitting)
March 23-27, 2009 ME normal 1:50pm SH Roxanne, T, Th 10:00-10:40am Mary: 10:50-11:30am due to conferences pm	Week 7, Lesson 13 & 14	Chickens, Spring	"Chickens to the Rescue"	1. *About Chickens (ALL) 2. *Wh.Chickens grid- (ALL)custom designed to book 3. Free Writing Wordbank (Rox)	1. Spring flowers_colours (ALL) 2. Animal names (Mary) 3. Spring Poem Cloze (ALL)
March 30-April 3, 2009 Normal schedule	Week 8, Lesson 15 & 16	Spring/Plants/Flowers	"Plants" – book embedded with writing activity (ALL) "Reason for a Flower" (Rox)	1. Plants writing	1. Spring Break – beg (Mary)or Adv (Rox/Jill) 2. Spring Flowers Colours - ALL
April 13-22, 2009	Re-administer DWA and WSPS, then Score, collect data samples and organize in files				
May 4th, 2009	Send out online Clicker 5 Research Team Survey via e-mail to 5 staff				
May 8th, 2009	Debrief with research team, review online research team survey results, future planning, Rose gathers input for thesis paper				

Appendix H
DWA Clicker Post-test Grid Set – page 1 of 4

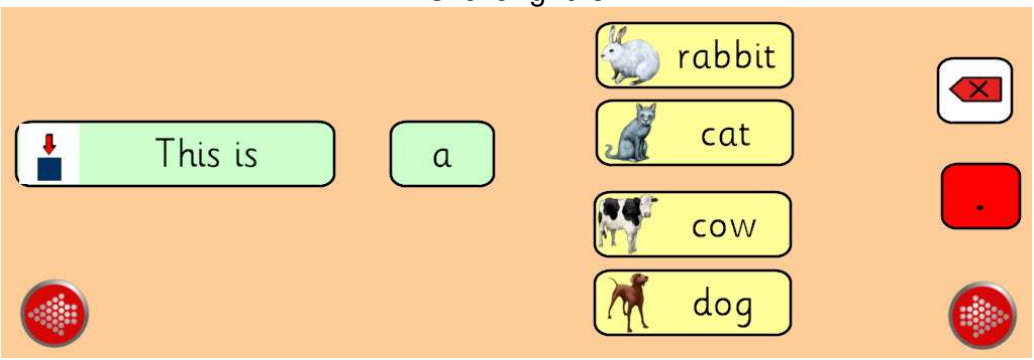
Clicker Grid 1



Clicker grid 2
Automatically says, "Click on an animal to write about"



Clicker grid 3



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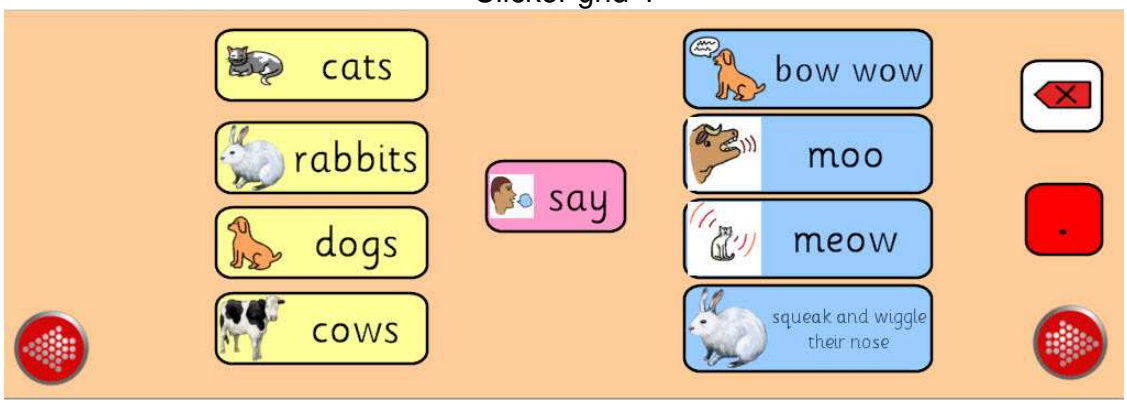
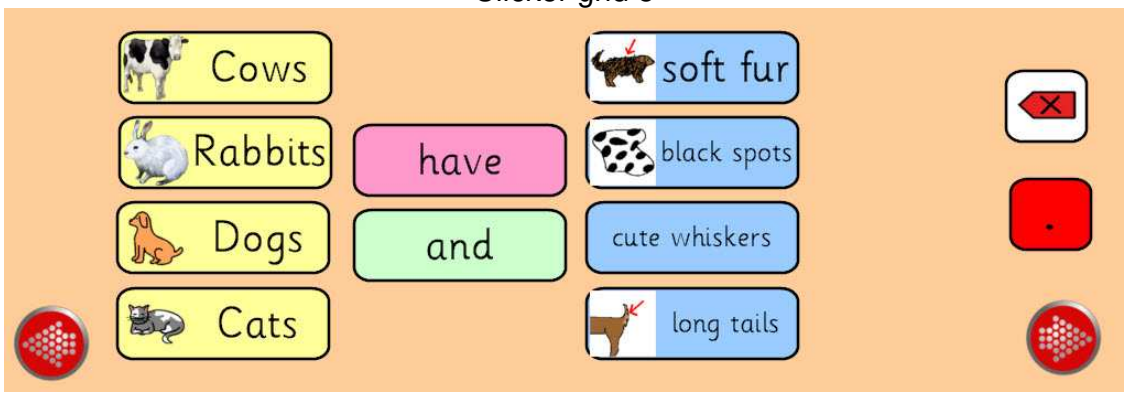
DWA Clicker Post-test Grid Set – page 2 of 4

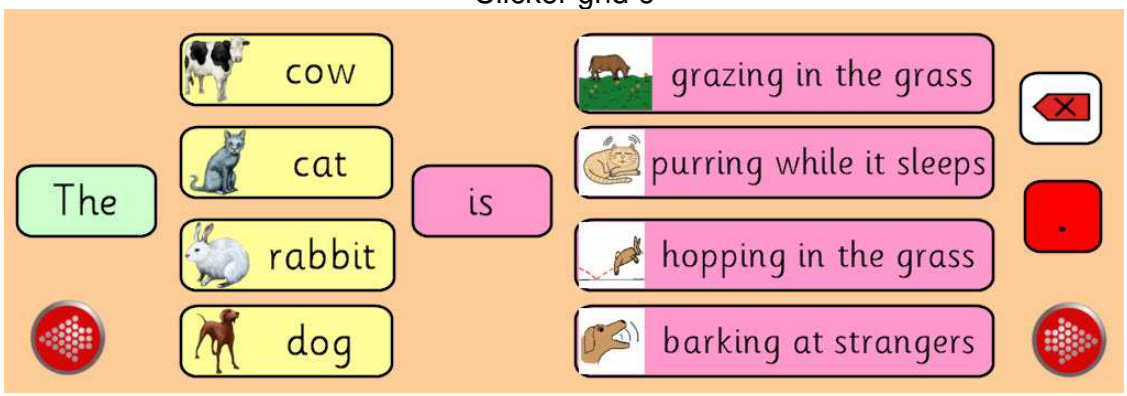
Clicker grid 4



Clicker grid 5



Clicker grid 6



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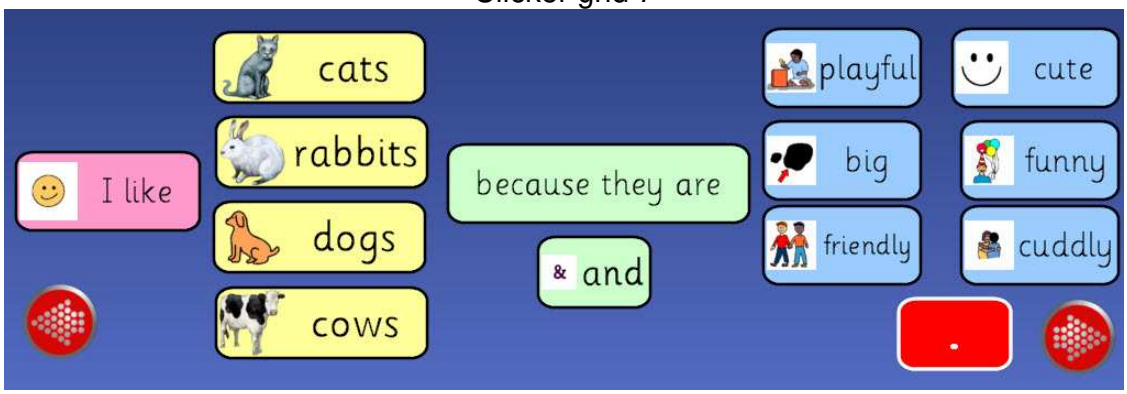
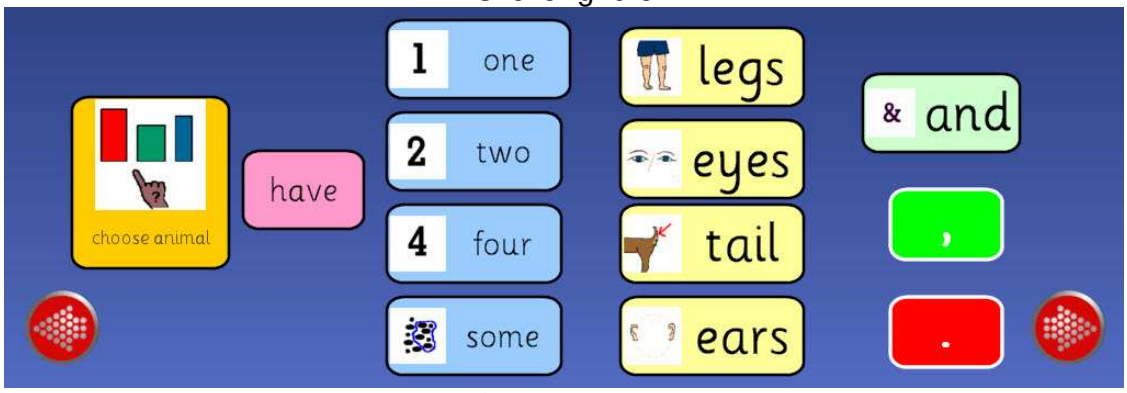
DWA Clicker Post-test Grid Set – page 3 of 4

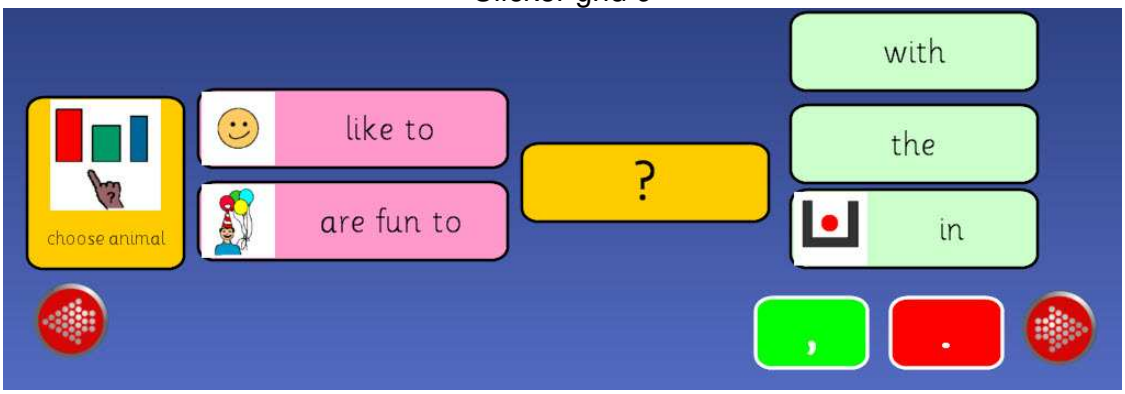
Clicker grid 7



Clicker grid 8



Clicker grid 9



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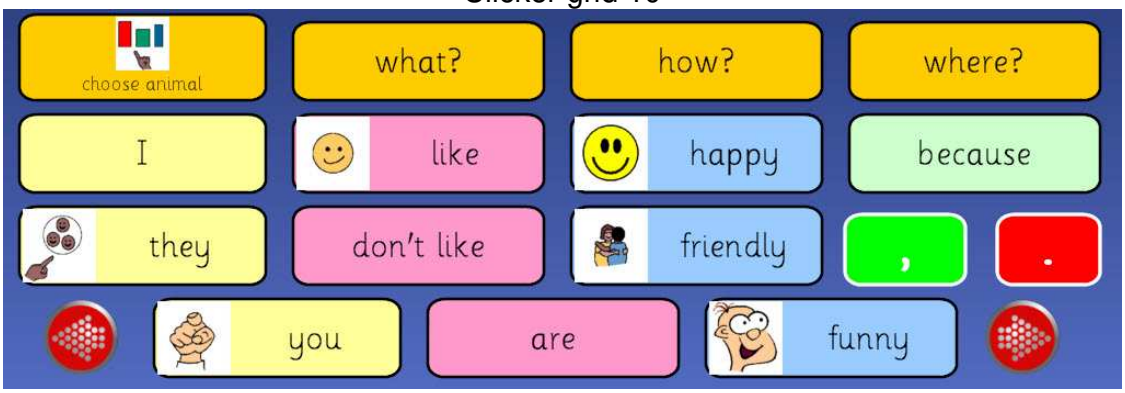
DWA Clicker Post-test Grid Set – page 4 of 4

Clicker grid 10



Clicker grid 11

*Clicker 5 grids reproduced with permission from Crick Software
*Literacy Support Pictures™ courtesy Slater Software

Appendix I

Clicker Staff Research Survey –page 1 of 3

Clicker 5 Research Staff Survey

Respondents:	5 displayed, 5 total	Status:	Closed
Launched Date:	05/03/2009	Closed Date:	05/10/2009

1. Do you think Clicker 5 activities presented on an accessible computer provide an effective individual written expression tool for your students?

	Response Total	Response Percent
Very Effective	5	100%
Effective	0	0%
Neutral	0	0%
Ineffective	0	0%
Very Ineffective	0	0%
Other, please specify	0	0%
Total Respondents	5	

2. How would you rate the use of an interactive Smart board with Clicker 5 activities as an group instructional tool for writing? Why?

	Response Total	Response Percent
Very Effective	5	100%
Effective	0	0%
Neutral	0	0%
Ineffective	0	0%
Very Ineffective	0	0%
Other, please specify	0	0%
Total Respondents	5	

3. Which of the following Clicker 5 features were most helpful for your students?

	Response Total	Response Percent
Speech Feedback	5	100%
Custom Grid sets	5	100%
Picture Support	5	100%
Word banks	0	0%
On screen keyboard	0	0%
Other, please specify	0	0%
Total Respondents	5	

4. Have you noticed an increase in motivation with your students to produce written work when given access to the computer and Clicker 5 software activities versus paper and pencil?

	Response Total	Response Percent
Very Significant	3	60%
Significant	1	20%
Neutral	0	0%

Appendix I

Clicker Staff Research Survey –page 2 of 3

Insignificant	0	0%
Very Insignificant	0	0%
Other, please specify	1	20%
Total Respondents	5	

5. When using Clicker 5 software on the computer during a writing lesson, do you think your students stayed engaged longer than when writing with paper and pencil?

	Response Total	Response Percent
Strongly Agree	4	80%
Agree	1	20%
Neutral	0	0%
Disagree	0	0%
Strongly Disagree	0	0%
Other, please specify	0	0%
Total Respondents	5	

6. Did you notice overall improvements in your students written quantity and quality when using Clicker 5 software and the computer versus paper and pencil?

	Response Total	Response Percent
Very Significant	3	60%
Significant	1	20%
Neutral	0	0%
Insignificant	0	0%
Very Insignificant	0	0%
Other, please specify	1	20%
Total Respondents	5	

7. Which of the following writing components showed the most improvement when students produced writing with Clicker 5 and the computer versus paper and pencil?

	Response Total	Response Percent
Quantity of writing (number of sentences)	5	100%
Spelling	2	40%
Use of conventions	2	40%
Word Choice	1	20%
Sentence structure	4	80%
Other, please specify	0	0%
Total Respondents	5	

8. Are you more likely to use technology for classroom instruction in the future as a result of participation in this research study? How?

	Response Total	Response Percent
Very Likely	5	100%
Likely	0	0%
Neutral	0	0%

Appendix I

Clicker Staff Research Survey – page 3 of 3

Unlikely	0	0%
Very Unlikely	0	0%
Other, please specify	0	0%
Total Respondents	5	

9. Do you think you received adequate training on how to locate, select and/or create Clicker 5 reading and writing activities to continue using this technology for classroom instruction in the future? What additional support or training will you need in the future?

	Response Total	Response Percent
Strongly Agree	3	60%
Agree	1	20%
Neutral	0	0%
Disagree	0	0%
Strongly Disagree	0	0%
Other, please specify	1	20%
Total Respondents	5	

10. Describe how collaboration and team planning around developing Clicker 5 curriculum lessons was beneficial to you as a teacher/ESA?

Total Respondents 5

11. What was the best part of participating in this research study as a teacher/ESA?

Total Respondents 5

12. What was the most challenging part of participating in this research study? Any suggestions for improvement?

Total Respondents 5

13. Would you recommend use of Clicker 5 software with the computer/Smartboard to other special education and general education teachers?

	Response Total	Response Percent
Strongly Agree	5	100%
Agree	0	0%
Neutral	0	0%
Disagree	0	0%
Strongly Disagree	0	0%
Other, please specify	0	0%
Total Respondents	5	

Appendix J
Quantitative Pre to Post-test Raw Data for Writing - Page 1 of 2

Student #	DWA Pre	DWA Post	CONV Pre	CONV Post	#SENT Pre	#SENT Post
26	6.6	6	100%	100%	5	15
27	6.2	6.1	71%	100%	7	15
15	5.6	5.3	91%	100%	9	9
24	5.3	5.9	83%	100%	6	11
14	4.6	5.2	66%	89%	3	9
11	4.3	5.4	100%	78%	3	9
12	4.1	5.3	0%	100%	5	7
4	4	5.6	50%	89%	2	9
6	4	4.8	100%	12%	3	8
28	4	5.4	0%	89%	3	8
20	3.8	5.3	0%	90%	5	9
29	3.6	5.3	0%	75%	3	8
17	3	4.6	0%	75%	1	4
30	2.8	3.9	0%	0%	1	5
1	2.3	4.4	0	89%	0	9
16	1.6	5	0%	66%	0	6
19	1.3	4.4	0%	75%	0	4
25	1.3	4.7	0%	100%	0	7
2	1.2	3.5	0	0	0	1
3	1.2	4.4	0	0	0	2
5	1.2	5.1	0	83%	0	6
22	1	4.7	0%	66%	0	5

Note. DWA Pre = Developing Writer's Assessment pre-test; DWA Post = Developing Writer's Assessment post-test; CONV Pre = conventions pre-test; CONV Post = conventions post-test; #SENT Pre = number of sentences pre-test; #SENT Post = number of sentences post-test

.

Appendix J
Quantitative Pre to Post-test Raw Data for Writing - Page 2 of 2

Student #	SP Pre	SP Post	PWC Pre	PWC Post
26	100%	99%	5	8
27	96%	100%	5	4
15	92%	100%	6	4
24	31%	100%	4	4
14	40%	97%	3	5
11	96%	98%	2	4
12	43%	97%	5	4
4	100%	100%	4	7
6	31%	100%	3	4
28	66%	100%	1	4
20	95%	100%	1	6
29	60%	100%	2	4
17	100%	100%	3	3
30	60%	100%	0	2
1	30%	100%	1	6
16	16%	100%	0	7
19	0%	100%	0	5
25	0%	100%	0	4
2	0	100%	1	4
3	0	100%	0	9
5	0%	100%	0	5
22	0%	100%	0	3

Note. SP Pre = spelling pre-test; SP Post = spelling post-test; PWC Pre = precise word choice pre-test; PWC Post = precise word choice post-test.