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Stylus For Fine-Motor Development

Nathan Larry Rose
Worcester Polytechnic Institute

Shane Thomas Whittaker
Worcester Polytechnic Institute

Thomas R. Ward
Worcester Polytechnic Institute

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Completed by:

Shane Whittaker, Nathan Rose, Tom Ward

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Torbjorn Stansen Bergstrom

Mechanical Engineering Department

Abstract

The objective of this project was to improve the writing ability of children, between the ages of 4-6 by encouraging proper grip techniques and practice through the medium of touch screen technology. The rationale of the project was to produce a stylus that enforces the proper grasp development and is intuitive and enjoyable for children to use. The methods we used were, field testing children in a classroom environment, interviewing child care professionals and elementary school teachers, and research of the professional literature on the occupational development of grips, emerging usages of touch screen devices in homes and school for children, and declining writing ability for children occurring in the United States. The results were the creation of two stylus models for two different target groups. One designed for individual case and another designed for general classroom usage. The conclusions reached by the team are: fine motor development has been decreasing in children between the ages of 4-6 in the United States, children are using touch screen technologies at an increasing rate, and the styluses developed by the team will improve children handwriting writing development.

Executive Summary

Purpose

The purpose of our project was to bring a product through the stages of design, prototyping, testing and manufacturing. We successfully completed all of these stages of product development, and through this, demonstrated the application of the skills, methods, and knowledge we have gathered throughout our previous time enrolled at Worcester Polytechnic Institute. This was the only major consideration at the start of our project, prior to any research or work being completed.

Research

To determine the scope, topic, and methods relating to our project, we began with a brief period entirely dedicated to research. Through conversation with an educational specialist (who is also a parent of one of our group members), we discovered a problem to focus our project on. She claimed that young children were becoming increasingly deficient in developing writing skills over recent years. Through further research, we found that many other educational professionals publicly stated similar sentiments, statistics relating to this issue, and a correlation between increasing technology usage and lowering graphomotor ability in children.

With a problem identified, as well as the evidence supporting it, we then worked to find a solution. A stylus, if designed to encourage proper grip techniques, may be utilized with technology such as tablets to facilitate writing ability development. Research into existing products and patented technologies found no effective stylus or product currently existing.

Before we began design, we continued to study relevant academic literature and professional testimonies. After building a comprehensive summaries of the literature on United States children's declining writing ability, increased use of touch devices and increased use of occupational therapy, we were able to begin the design process.

Design, Prototyping, and Testing

Having sufficient information to develop an initial prototype, we began a repeating cycle of design, prototyping, and testing. Our initial designs were shaped to encourage the use and development of recommended writing postures. We settled on four preliminary designs and utilized a decision matrix to predict the most effective design based on our ranked design criterion. Once a preliminary design was chosen, we moved on to the prototyping phase. The prototypes for the stylus bodies were created either using aluminum or PLA plastic material based on time constraints, while the grips were molded silicone. Once we had a usable prototype we conducted field tests and interviews to inspire our next design. Throughout the project's lifecycle we would repeat this process approximately three times before coming to our final design.

Results and Conclusions

The result of this project are two unique stylus designs: one designed for individual, monitored development and another designed for general classroom usage.

The conclusions reached by our team are:

1. Fine motor development has been decreasing in children between the ages of 4-6 in the U.S.
2. Children are using touch screen technologies at an increasing rate.
3. The styluses developed by the team will improve children’s handwriting writing development.

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1: Introduction

Before designing a stylus to help improve writing ability it is imperative to assess the relevant research, literature and comparable projects. Within this section we will discuss the decline of children's writing ability, current efforts to stem this issue, and the approach we would take to create our own solution.

1.1: Rationale

In order to properly approach this project, it was first important to identify a problem, and then determine a solution feasible for our project goals. In the following sections we address our research methods and results regarding the rationale of our project. We also provide and explain the research, data, and professional opinions gathered that affected the scope of our project, and suggested solution based on this information.

1.1.1: The Problem

As of 2017, 78 percent of American households own a tablet device and 42 percent of children between zero and eight years old own their own tablet[5]. Across the United States, school districts are spending increasing amounts on occupational therapists, and the U.S Bureau of Labor Statistics expects this spending to continue growing much faster than other occupations[7,10,12]. Therapists note that this growth has come with a change in the nature of their profession.

> "Twenty years ago, you could find O.T.'s working with children at hospitals or schools for the blind or the deaf. Now, many pediatric O.T.'s see their role as promoting fitness and enhancing kids' performance in school."
>
> -Christine Berg, Lead Occupational Therapist at the Washington University School of Medicine, St. Louis [11]

This rise is frequently attributed to a growing issue among modern children:

> "In the last five years, I've seen a dramatic increase in the number of kids who don't have the strength in their hands to wield a scissors or do arts and crafts projects, which in turn prepares them for writing."
>
> -Anthony DiCarlo, principal of the William E. Cottle Elementary School in Tuckahoe, N.Y [12]

In recent years an increasing number of educators, pediatricians and parents have noted that children are having a harder time using their hands precisely. Some attribute this to the unmediated exposure to modern technology:

> "During early childhood a child needs fine-motor, gross-motor and physical activity. A parent should devote some time of the day or affordances in the home for the child to have that. You could argue that the iPad is beneficial for developing specific eye-hand and visual-motor skills, but its value is limited. A parent needs to provide activities such as building blocks and puzzles to help with development."
>
> -Dr. Carl Gabbard, director of the Child Motor Development Laboratory at Texas A&M [6]

Decline in Fine Motor Ability

Many professionals in the childcare field have spoken out against the decrease in fine-motor ability observed in their students. Linda Cunningham, an occupational therapist with Lancaster-Lebanon, said:

> "Rather than sit and color the way they used to do, our kids are part of the burst of technology. It's amazing to see a kid who can swipe an iPad, but you put a pair of scissors in their hand and they don't know what to do." [7]

In a typical year, Young and colleague Trisha Pohronezny estimate just **2 of 20** students arrive with enough hand strength and coordination to use scissors. [7] Only about half can hold a pencil correctly, versus the fist-like grasp they should have grown out of by age 3. [7]

Near-constant corrections take valuable time from quick-paced academic programs, while individual sessions to build or strengthen skills require students to miss class, and cost districts a large amount of money. Denver Elementary Principal Angela Marley says occupational referrals to address such deficits doubled over a three to four-year period. The Cocalico school district in Pennsylvania saw its elementary school therapy spending jump from **$85,440** in 2011-12 to **$208,104** in the last school year. [7]

The New York Times reported in February that public schools in New York City saw a 30 percent increase in the number of students referred to occupational therapy, with the number

jumping 20 percent in three years in Chicago and 30 percent over five years in Los Angeles. [10] According to Anthony DiCarlo, principal of the William E. Cottle Elementary School in Tuckahoe N.Y:

> "Almost all our kids come into kindergarten able to recite their letters and their numbers, some can even read. But in the last five years, I've seen a dramatic increase in the number of kids who don't have the strength in their hands to wield a scissors or do arts and crafts projects, which in turn prepares them for writing." [11]

He claims that parent's attempts to push early academic development and new technology on their children is stunting their development of basic functions:

> "I'm all for academic rigor, but these days I tell parents that letting their child mold clay, play in the sand or build with Play-Doh builds important school-readiness skills, too." [11]

Children's Media Use

Mobile media has become a nearly universal part of the children's daily lives across all levels of society. An accurate understanding of the role media plays in children's lives is imperative for promoting child development.

78 percent of American households, surveyed in Common Sense Media's household study, own a tablet. This percentage has increased up from 40 percent in 2013 and just 8 percent in 2011. It was also observed that in 2017, 45 percent of children now have their own tablet device — up from 12 percent four years ago and 3 percent in 2011. [5]

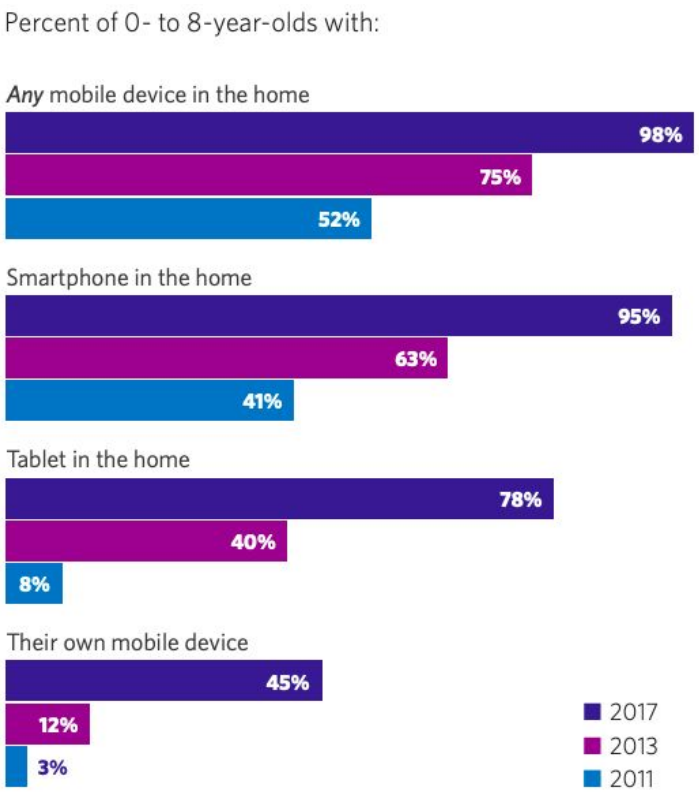

Image 1. Common Sense Media Mobile Devices In Home, 2011-2017

Despite this drastic rise in children's use of mobile technology, the same study found that overall use of media by children has stayed fairly consistent with previous years. The total media time per day from 2011 to 2017 actually decreased from 3:14 to 3:06. [5]

The same study found that the average amount of time 0 to 8 year olds spend on mobile media per day has increased accordingly. From 2011 to 2017 the rate rose from just **5 minutes a day** to **48 minutes a day**. Looking at the 5 to 8 year old range the average daily time spent with mobile media in 2017 jumps to **1 hour and 2 minutes per day**. [5]

Average time spent daily on each activity	Child's age		
	< 2	2 to 4	5 to 8
TV/videos on mobile device	:05[a]	:28[b]	:25[b]
Mobile games	*[a]	:16[b]	:24[c]
Skype/video chat on mobile device	*[a]	:01[b]	:01[ab]
Read on mobile device	:01[a]	:04[ab]	:04[b]
Anything else on mobile device	:01[a]	:09[b]	:08[b]
Total mobile media	**:07[a]**	**:58[b]**	**1:02[c]**

Image 2. Common Sense Media Time Spent With Mobile Media, 2017

Views on Children's media use

Parents tend to have mixed feelings on the impact of technology on their children. Common sense media found that **76 percent of parents agreed** that "*In general, the less time kids spend with screen media the better off they are*" [5]. While that alone would indicate a general trend against child-media, **74 percent of parents agree** that "*[Their] child benefits from the screen media he/she uses*" [5].

Broken down by skill the study found the following:

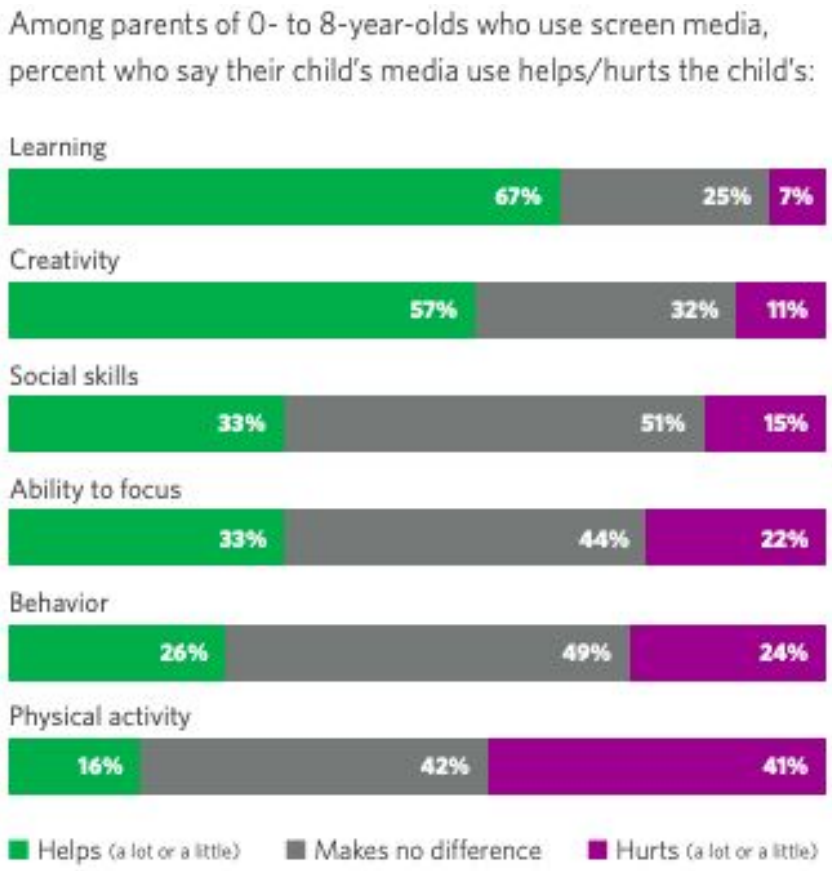

Image 3. Common Sense Media Parents View Of Media Effects, 2017

The average sentiment of parents appears to be that modern media has its place in child development, but uncontrolled indulgence of these media devices hurts the development of certain key skills.

The "American Academy of Pediatrics" has been at the forefront of studying and promoting healthy and balanced media habits for children. In a 2018 article on their website titled: *"Children and Media Tips from the American Academy of Pediatrics"* they have a well written list of modern media-related parenting guidelines. Particularly relevant highlights include:

- **Make your own family media use plan**. Media should work for you and within your family values and parenting style. When used thoughtfully and appropriately, media can enhance daily life. But when used inappropriately or without thought, media can displace many important activities such as face-to-face interaction, family-time, outdoor-play, exercise, unplugged downtime and sleep.

- **Treat media as you would any other environment in your child's life**. The same parenting guidelines apply in both real and virtual environments. Set limits; kids need and expect them. Know your children's friends, both online and off. Know what platforms, software, and apps your children are using, what sites they are visiting on the web, and what they are doing online.

- **Set limits and encourage playtime**. Media use, like all other activities, should have reasonable limits. Unstructured and offline play stimulates creativity. Make unplugged playtime a daily priority, especially for very young children.

An article by The College of Education and Human Development collecting the perspective of various faculty members on this matter seems to share similar sentiments. Professor of learning sciences Dr. Jeffrey Liew discusses his moderate take on children's media:

> "I think technology is like a lot of other objects in our environment. It's about how we use the technology and whether we're using it to enhance our children's development or to hinder it. [...] Mobile devices and technology could have a variety of benefits in early education, but parents' and educators' decisions about whether and when to integrate technologies into their homes or classrooms need to be guided by research and developmentally appropriate practices." [6]

1.1.2: The Solution

As we found above, children are losing fine motor skills that are normally developed through handwriting. Based on all the above evidence, we believe there is a strong desire for a solution to this growing problem. There is reason to believe that this is partially caused by the sudden sharp rise in children's use of touchscreen devices. Regardless, we've found that a growing number of parents, educators and pediatricians agree on the following:

1. Fine motor ability among children is declining, and that is problematic[6,7,11]
2. They believe that the way and amount that children are currently interacting with touch screen media is problematic[5,6,8]
3. These new technologies are beneficial if employed properly[5,6,8]

We believe that a stylus designed specifically to promote the development of a proper writing grip will help solve these issues. In the following section we outline our justification for this belief.

Writing Development Process

To understand why we believe a specially designed stylus can solve the issue we have presented, we first have to explain how writing development works. While there is a good bit of complexity to it, the physical aspect of writing is mostly dependant on muscle development. As children learn to write they are training the many small muscles in their hands for strength, dexterity and coordination. While it seems simple on paper, this is a common developmental hiccup for children. There is of course also the element of language and spelling that can play a part in that,

but child literacy rates are distinct from their fine motor ability and are not the subject of our focus.

There are a number of different models that outline the progression of this, but they consistently follow approximately this progression:

Pencil Grasp Expectations by Age	
1–1½ years palmer-supinate grasp	The crayon is held in a fisted (whole hand) grasp with the wrist slightly bent in towards the body. The arm moves as a whole unit to move the pencil.
2-3 years digital-pronate grasp	The crayon is held with 5 fingers. The elbow remains still while the forearm moves as a solid unit to move the crayon, resulting in large crayon marks. The crayon is held in mid finger shaft rather than close to the tip of the fingers.
3½-4 years static tripod grasp	The pencil is held with four fingers with a slightly elongated (flattened) web-space. The wrist is held still while the hand moves as a unit, and the wrist is straight not extended.
4½-5 years dynamic tripod grasp	The pencil is ideally held with three fingers and with a rounded web-space that allows ideal isolated finger control for precise and refined pencil control, with the pencil movement generated in the fingers only. The wrist is held slightly extended to allow more isolated finger movement, and the forearm is slightly turned over towards the table.
5 years + school entry/ Reception	The ideal pencil skills: A three fingered pencil grip with the fingers or thumb not overlapping the pencil or fingers and no hyper-extension (bending backwards) of finger joints. All pencil movement is generated in the isolated fingers (rather than the shoulder, elbow or wrist) which then allows good fluid pencil movement (fluency) for refined control and size. An upright posture at the desk with shoulders relaxed is also important in supporting appropriate pencil skills.

Image 4. Pencil grasp expectation by age.

This is the theoretical development as children learn how to better manipulate their hands. These positions may seem excessively specific or contrived, but writing is one of the primary means of developing a more fundamental skill. As mentioned in the previous section, teachers are seeing increasing amount of children starting school unable to manipulate scissors [7,11]. These children have not developed the muscles and coordination necessary for the grasping and manipulation of tools. At the low level this means grasping scissors or pinching grapes, progressing to molding clay and drawing (all of which are recommended steps for development), and eventually can build to the use of scalpels and other fine instruments[3,9].

All of these skills have to do with developing strength and coordination with the many small muscles in your hands, and are not typically developed without a push. Children often default to "full fist" grip, where they grasp the utensil with all of their fingers wrapped around the body. This is the most natural starting position as it uses all of your fingers somewhat evenly, requiring little strength, and only requires the dexterity to open and close your hand. To develop their more obscure muscles and the coordination of them, children need to be encouraged to utilize them even though they are not as intuitive[3].

The grip that most professionals treat as the final stage of development is the “Dynamic Tripod” grasp. To understand why it is a useful position it helps to disambiguate the two terms, as well as some of the alternatives:

- **“Dynamic”** has to do with what muscles are controlling the movement. In a dynamic grip uses the thumb, index and middle finger for control, while the other fingers are pressed to the palm.
- **“Static”** is an improper style in which control comes from the wrist, elbow or shoulder.
- **“Lateral”**, where the thumb is used to support the pencil against the middle finger and control comes from the index and middle finger.

- **“Tripod”** refers to grips in which three fingers are touching the pencil.
- **“Quadropod”** refers to grips in which four fingers are touching the pencil.

Certain academics and educators take issue with the dynamic tripod being the norm [13]. The idea is that emphasising the dynamic tripod specifically could discourage people from other positions that are more natural to them. The dynamic tripod is considered a proper grasp because it produces comparatively quick, quality writing without causing pain or fatigue. However studies have shown that there are other grasps that meet the same criteria:

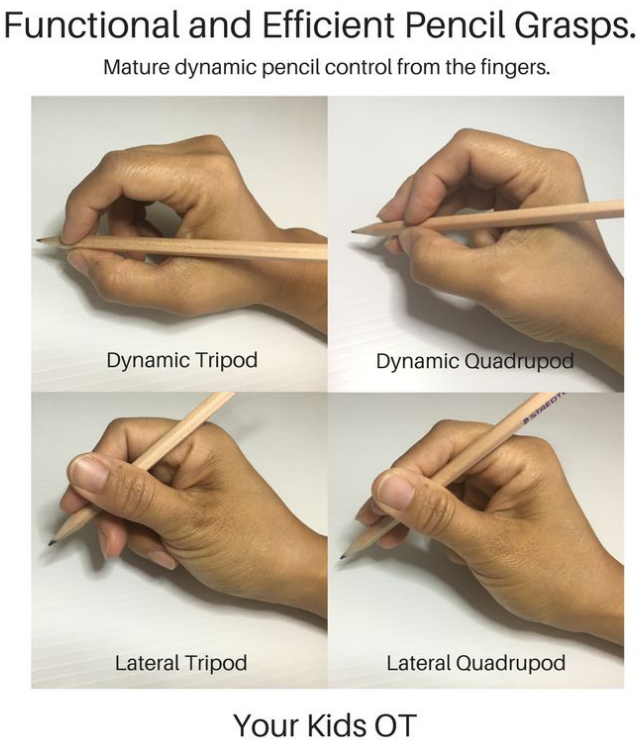

Image 5. Function and Efficient Pencil Grasps

While these other three grips are not as well known, they have shown to perform as well as the dynamic tripod [14].

The researchers that conducted this study suggest that individuals can be better suited to some of these grasps than others; forcing someone to use a posture that does not work for them can cause developmental issues. That said, it is only a problem if individuals are actively being taught not to use one of the "Functional and Efficient" grasps that better suits them. That can be an issue for certain grip attachments that are not designed with other styles in mind. As an example, let's look at a few different pencil grips:

Image 6. Example Pencil Grips

The first grip clearly indicates where to place your fingers, making it effective at encouraging the "Dynamic Tripod" grasp without outside intervention. Unfortunately it almost entirely prevents use of any "Lateral" grasp. The second grip advertises stability for individuals with less dexterous hands, but entirely prevents any type of "Quadrupod" grasp. The last grip is a more common and versatile design. The open grooves suggest finger placements, but leave room for a lateral middle finger or added ring finger. Even though this grip is primarily intended to encourage the "Dynamic Tripod" grasp, it can support the other primary grasps just as well.

The "Dynamic Tripod" position works as a sort of neutral position that easily adjusts into the other primary grasps. The same study that found that the four "Functional and Efficient" grips are equally effective also recommended that the dynamic tripod should be the primary late-stage grip taught to children. They suggested that the other three should be considered as alternatives for children who have a particularly hard time finding a comfortable and effective style [14].

Conclusions

In section 1.2.1 we found that:

- 45% of American children from age 0 to 8 own their own mobile device. This new technology has quickly found its place in homes and the science is only starting to catch up.
- 67% of American parents believe that screen media helps learning, but 74 percent agree that "*In general, the less time kids spend with screen media the better off they are*". The average sentiment among parents and professionals that specialize in child education is that this technology has high potential, but is harmful if implemented without consideration and oversight.
- Professionals that work with children are finding a marked decrease in their hand strength and coordination. Occupational therapy for young children has been booming, and they report that more and more of their time is being spent catching children up on their handwriting ability.

In this section, 1.2.2, we found that:

- Learning to write and developing a proper writing grasp necessitate the development of general hand strength and dexterity. Teaching effective and efficient writing also develops the skills necessary for precision tool use.
- Children don't intuitively develop the coordination and hand strength necessary for effective writing, and need encouragement and oversight to develop an effective writing grasp.

Based on these findings we believe that a stylus engineered to promote ideal hand posture is an effective solution to the decline in writing ability among children. Our stylus should allow them to continue interacting with touch screen devices in a way that is healthier for their development.

1.2: State of the Art

One of the first steps in considering the value and marketability of a new product concept is to research the existing market. In this section we discuss the breadth and quality of stylus designs currently on the market with respect to their ability to encourage fine motor ability in children.

1.2.1: Children's Stylus Market

In this section we discuss the current range of stylus' for children on the market. Most notably we are looking for:

1. How well they promote the use of dynamic tripod or similar grasps
2. What they do to appeal to children
3. Any design trends we can learn from

We also include any notable adult styluses that may reasonably be bought for children. The full range of styli are reduced to archetypes for the sake of conciseness.

The Plastic Cylinders

One major trend in this market is the “thick colorful tube” design. Initially this seems like a solid option. Children tend to have a much easier time handling thick objects before they have developed their hand strength and dexterity. Unfortunately this encourages them to keep using their entire hand to grasp writing utensils and can stunt their development[3].

Image 7. Chalkee(left), Cosmonaut(right)

Ergonomic

The next most apparent trend are the styli that emphasise an “ergonomic” grip of some variety. These grips only loosely embody the term ergonomic. The most that any of them do to encourage a proper writing grasp is have a triangular body with flat padding. Of the styluses reviewed the triangular design does the most to promote a dynamic tripod grasp, but still does not do it as well as most pencil grip attachments on the market.

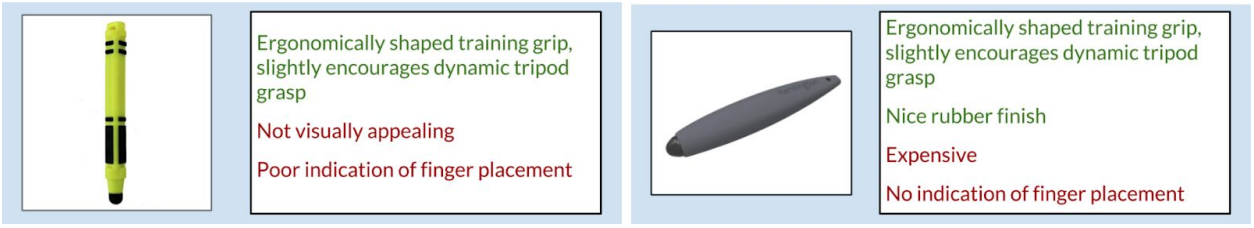

Image 8. Dano AppCrayon(left), Ergo Stylus(right)

Prisms

There are a number of styluses that have little defining them other than being a simple shaft with a tip at its end. Much like a standard pencil or pen without an ergonomic writing grip, these have no features intended to help writing development.

Image 9. Pencil Stylus (left), Alupen(right)

Gimmick

Many of the styluses on the market try to redeem their poor quality with a gimmick that makes them stand out. Other than the gimmick they revolve around, these styluses are not significantly different than other styluses on the market.

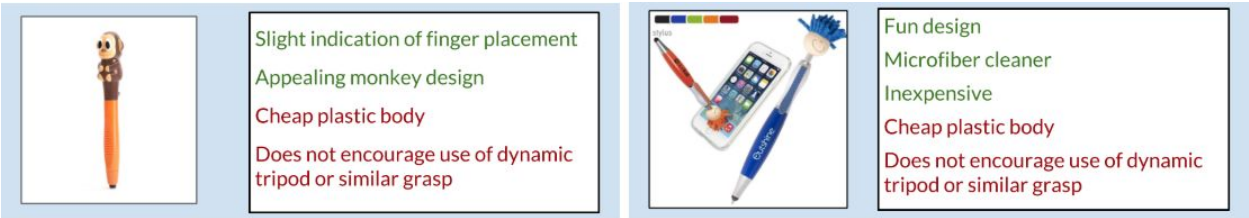

Image 10. Griffin Kazoo Stylus(left), Moptop(right)

1.2.2: Writing Development Market

As discussed in section *1.1: Rationale*, a large part of writing development has to do with general hand strength and dexterity. Because of this, the range of products that occupational therapists use to help build writing skills is large. Many physical toys and puzzles help with this type of development. For our research focused on art tools and writing aids, as they most directly related stylus design. Popular products in these categories that supported fine motor development had some of these features:

- Grips that encouraged specific finger positioning
- Weights that balance the utensil and build finger strength
- Mechanical systems like vibration or movable parts
- Malleable parts and textures that encourage tactile interaction and feedback

Due to the precision required of a tablet stylus, the inclusion of vibration or similar features would be detrimental to our project. The weighted writing tools, or add-on weights serve a similar purpose to the tools using vibration, which is increased feedback. A sense of weight allows a child to more easily feel where the writing instrument is being placed on the writing surface. The weight of our stylus will need to be enough so that it has an appropriate sense of weight without causing unneeded fatigue during extended use.

While considering grip design we observed existing grip based technologies for fine motor development. There exist some writing instruments that are shaped in specific ways to encourage certain grip types at different ages. The most common shape was a triangular prism, which

encourages various forms of the tripod grasp. Additionally, there are add-on grips that can be used with existing pens and pencils. These make up a larger part of the market for writing focused fine motor development. When examining these products, some were simple, and were designed to give standard thickness pencils a wider grip that is easier for a child to grasp. However, some of these add-on grips were more specifically designed, with variation depending on the specific grip type that was sought after. These products are meant to be used one after the other, in a series, as the child further develops their grip. This allows a child to start at a grip that is earlier in the development of fine motor ability, and as they grow and become more skilled, change the add-on grip, to encourage a different grip for the child that allows them to continue developing.

1.2.3: Stylus Mechanical Systems

The base of stylus technology is creating a inductive signal between the stylus and the screen of the touch screen device. There are two ways styluses function, passively and actively.

Active Styluses

Active styluses use electronics like bluetooth or advanced touch software to create a connection between the pen and the screen. They are more expensive than passive styluses, but enable features like pressure sensitivity and palm rejection. The stylus we are currently developing will not be an active stylus as the added time and expenses would far outweigh the benefit. The main focus for us is to establish their dynamic tripod grasp and to encourage using the stylus over their fingers.

Passive Styluses

Passive styluses have no electronics, just conductive material in or on a pen-like structure. A passive stylus will work with any touch-screen. For a passive stylus to work it needs at least a six millimeter diameter circle of conductive material in contact with the screen. Because of this limitation, the main variations passive styluses are their tips. Passive stylus tips come in three main varieties: rubber film, microfiber and transparent disk:

Image 11. Rubber tip(left), Micro-fiber(middle), Transparent Disk(right)

Rubber tipped styluses generally wear out quickly and are soft and squishy, which makes them less accurate. They also require more pressure to use, which would not be ideal for children just learning how to write. The main advantage of a rubber tip is the low price.

Micro-fiber is a major improvement from rubber. They last longer and allow for replaceable tips once they wear out, so you don't have to replace the whole pen. It is more accurate as their conductive properties are better and then tip is more sturdy.

The **transparent disk** tip has a transparent disc that sits at the end of a inkless ballpoint. Being able to see the central point of contact makes this type of passive stylus the most accurate of the three. These styli are more expensive to manufacture than the other two because of their more complicated build.

1.3: Approach

Up to this point we've discussed the purpose of our project, our justification of that purpose, and what others have already done. In the following section we describe the course of action we decided on at the start of of our project. We decided to follow a typical cycle of prototyping, testing and redesign. The initial design would be informed by our research, and following designs would be informed by issues that arise from practical testing.

1.3.1: Initial Design

Before we could start a cycle of prototyping and testing, we would need to create an initial design.To do this we would rely heavily on the research described in section 1.2.2. To briefly summarise, the end goal for teaching handwriting is one of a few variations of hand posture that are particularly good for writing[13]. This is an ergonomic way to utilize a writing utensil, but is also indicative of general hand coordination and strength. The design we would create would need to encourage the use of that grip, which in turn helps develop hand dexterity and strength.

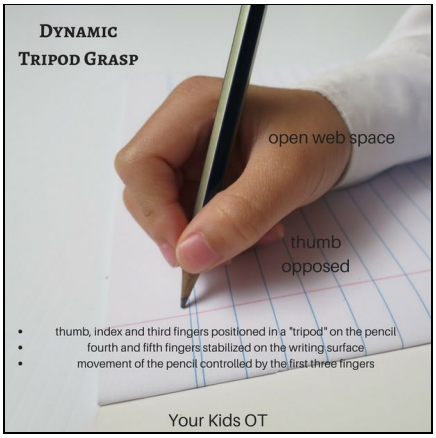

Image 12. Dynamic tripod grasp example

1.3.2: Prototyping and Manufacturing

After developing an initial design to start the cycle with, we would need means and methods of efficiently creating effective prototypes. Based on our own experiences and suggestions from colleagues we collected a set of methods that we would pursue.

3D printing

Using the Foisie Innovation Studio's rapid prototyping lab we would be able to print ABS plastic stylus prototypes the day that we modeled them. These fast, small scale printers could produce mild-complexity designs like a small stylus reliably, with few enough imperfections that they would be plenty sturdy enough for our tests.

WPI's Objet 3D printer is capable of printing more malleable materials like TangoPlus, an extrudable material meant to imitate rubber. This would allow us to somewhat easily

manufacture a grip similar in quality to the pencil-attachment writing aids currently on the market.

Silicone Molding

For the grip we would also attempt silicone molding. Silicon is a class of material that we could pour into any shape we like and have it solidify into something tough and rubbery. That would give us a grip that is durable, flexible, grippable and non-toxic- all of which are ideal features in a grip for children. It would be softer than TangoPlus, which has potential positives and negatives depending on the implementation.

CnC Milling

We identified aluminum as a clear candidate for stylus body material. It is inexpensive, conductive, solid enough to be near unbreakable for children and soft enough that is easily machined. The only compromising factor would be if we chose to prototype designs with certain complex features.

Third Party Parts

Manufacturing a stylus tip ourselves would require an unreasonable amount of time considering that they can easily be purchased for cents on the dollar. Creating a thin, smooth rubber tip of a set size would take a substantial amount of effort and would provide little practical value. This sentiment applies even more so for the microfiber and transparent disk options.

External Prototyping

Paying for a company to manufacture a custom part provides a number of unique benefits. This option would allow us a higher level of precision and quality than we could feasibly recreate in our time frame. It would also enable unique design features that we would not feasibly be able to prototype on our own. That said, the quality and difficulty of the design would have proportional cost and turnaround time. This option would only make sense for features that we could not prototype independently to an effective degree.

Most of the listed methods would involve creating a 3D model in a Computer Aided Design (CAD) software. We would use Solidworks to create these as it is one of the most popular CAD programs and accordingly was the only one that we were all familiar with. The only one of the listed methods that we did not attempt was external prototyping. We researched the feasibility of it for several different processes along the way, but each of them proved to be prohibitively slow or expensive.

1.3.3: Testing and Feedback

We identified two main groups that we would be seeking out to get feedback on our design. First we would visit care facilities to observe children attempting to use the prototype as well as asking the workers for feedback and advice. Second we would seek out various professionals that work in child development, also to ask for feedback and advice on our designs. Doing this would involve two types of research protocol:

Usage Testing

Due to the difficulties communicating with young children, we focused on gathering usage data. We would have children complete a number of common tasks using our prototype. During this time we would record various types of usage data such as grip positioning, how effectively or accurately they write, as well as other notable behavior. This would be done in classrooms and care centers with the explicit consent of the parents of the children, as well as the individuals overseeing the children.

We would conduct our research with no intended number of interviews or tests to reach. Instead we would gather feedback after each iteration until we had enough to develop a substantially improved version.

2: Methods and Results

In the following section we discuss the process we followed in designing and revising our stylus. For each major milestone in our design we discuss the methods taken to reach that point followed by the results of those methods. These milestones include determining and modeling our first official design as well as the following three major iterations on it.

2.1: Initial Design And Prototype

A decision matrix and pugh matrix were utilized to weigh our initial stylus designs. We prototyped the design that scored the highest and then field tested it at a preschool in Salem NH.

2.1.1: Decision Matrix

We decided on five criteria for our stylus:

Durability	Longevity is important since parents would not want something cheap for their children.
Manufacturability	We intend to produce multiple different designs in a short period of times so it is essential to consider ease of manufacturability.
Portability	Stylus needs to be easily-accessible when they want to interact with a touchscreen. Parents will likely be concerned with their child losing the stylus since it is small.
Aesthetic	We want children to want to use this.

Wow factor	A unique element that people can immediately identify as setting it above the competition.

In order to determine how much each criteria should weigh we ordered our individual priorities using the Pugh decision matrix model.

Shane's Rankings:

Criteria	Durability	Cost	Portability	Aesthetic	Wow factor
Durability	-	0.0	0.0	0.5	0.5
Cost	1.0	-	1.0	0.5	1.0
Portability	1.0	0	-	0.0	0.5
Aesthetic	0.5	0.5	1.0	-	1.0
Wow factor	1.0	0.0	0.0	0.0	-
Results:	**3.5**	**0.5**	**2.0**	**1.0**	**3.0**
Percent weight	**0.35**	**0.05**	**0.2**	**0.1**	**0.3**
Sum of results:	10.0				

Tom's Rankings:

Criteria	Durability	Cost	Portability	Aesthetic	Wow factor
Durability	-	0.0	1.0	0.0	0.0
Cost	1.0	-	1.0	1.0	1.0
Portability	0.0	0	-	0.0	0.0
Aesthetic	1.0	0.0	1.0	-	0.5
Wow factor	1.0	0.0	1.0	0.5	-
Results:	**3.0**	**0.0**	**4.0**	**1.5**	**1.5**
Percent weight	**0.3**	**0**	**0.4**	**0.15**	**0.15**
Sum of results:	10.0				

Nathan's Rankings:

Criteria	Durability	Cost	Portability	Aesthetic	Wow factor
Durability	-	0.0	0.0	0.5	1.0
Cost	1.0	-	0.0	0.0	1.0
Portability	1.0	1	-	1.0	0.0
Aesthetic	0.5	1.0	0.0	-	1.0
Wow factor	0.0	0.0	1.0	0.0	-
Results:	**2.5**	**2.0**	**1.0**	**1.5**	**3.0**
Percent weight	**0.25**	**0.2**	**0.1**	**0.15**	**0.3**
Sum of results:	10.0				

By averaging the results of our individual matrices we received a prioritization of our design criteria that reflected our combined values:

Rank Ordered Design Goals					
Sum of Pughs:	**Durability**	**Manufacturability**	**Portability**	**Aesthetic**	**Wow factor**
30.0	9.0	2.5	7.0	4.0	7.5
	0.3	**0.083333**	**0.23333**	**0.13333**	**0.250000**
Durability > Wow factor > Portability > Aesthetic > Manufacturability					

Next we wanted to contextualize our new prioritization. We chose a diverse and representative set of stylus concepts from those that we had brainstormed and ranked them on each criteria:

Criteria	**Weight**	**"Spinner"**		**"Bumpy"**		**"Rings"**		**"Quality"**	
Durability	0.3	2	0.6	4	1.2	1	0.3	5	1.5
Manufacturability	0.083333	2	0.166666	2	0.166666	2	0.166666	5	0.41667
Portability	0.23333	2	0.466666	3	0.699999	3	0.699999	3	0.699999
Aesthetic	0.13333	3	0.39999	1	0.13333	4	0.53332	1	0.133333
Wow factor	0.250000	3	0.75	2	0.5	3	0.75	1	0.250000
Score		**2.383322**		**2.699995**		**2.449985**		**3.00000**	

2.1.2: Manufacturing Process

In order to produce the various design concepts, prototypes, and final prototypes, we utilized a wide variety of different types of part creation. These included, the WPI McDonough Maker Space and Fitzgerald Prototyping Lab, the WPI Rapid Prototyping Lab, WPI's Washburn Shops, as well as some silicone molding completed ourselves. We expected to utilize the McDonough Maker Space for only early concepts due to the fast turnaround time on parts, and once a design was more complete, to fully machine the necessary parts in the Washburn Labs. However, we found ourselves constantly switching between these different options depending on how quickly, what quality, and what material we needed our parts.

We believe that, despite some initial setbacks regarding turnaround time between some of our different manufacturing options, our manufacturing as a whole went well. Additionally, due to the similarities of some of our designs, making changes to CAD and CAM software was not very difficult. For these reasons, we were able to effectively and efficiently bring new designs from concept to prototype very quickly, and the ability to do this was absolutely necessary for the success of our project.

Given the information we now know regarding these different manufacturing options, we would now be able to more effectively manage the difference in turnaround time between these options, and would have a better understanding of the limitations, and best uses of each manufacturing option.

2.1.3: Results

In this section we will discuss the results of our initial design model and prototype.

The design that scored the highest in this model was known as the “Quality Pen”. This pen had the most simple design out of all of our concepts, focusing on basic function and quality over frills and features. Based on these results we decided to focus our design efforts on functionality, setting aside extra features and aesthetic until after the grip has been properly iterated.

The Quality Pen’s simple design allowed for efficient iteration. The schematic for the initial design is as follows (measurement in mm).

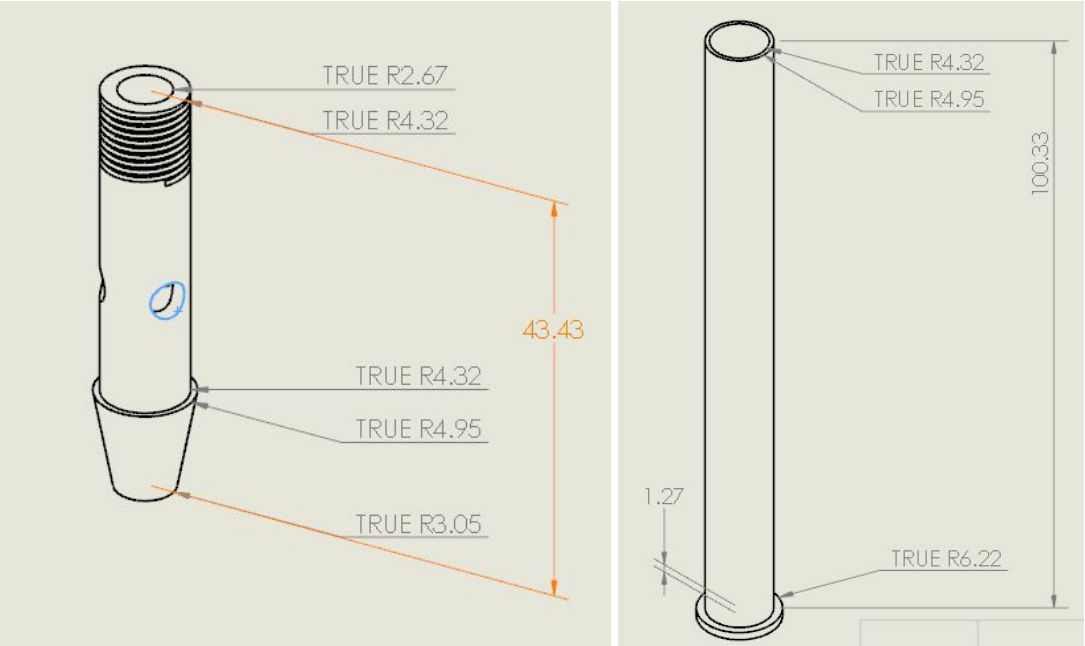

Image 13. Schematic for initial design

The total length of the Quality Pen was 143.76 mm. The diameter for the body and grip was 12.44mm. The body is sectioned to allow the grip to be slotted in securely without having to

stretch it excessively. The holes present in the grip section were intended to house electronic sensors to notify the user when their fingers are in the correct position. We decided against this in our final prototype since this feature drastically decreased manufacturability. The next photo is of our initial grip design.

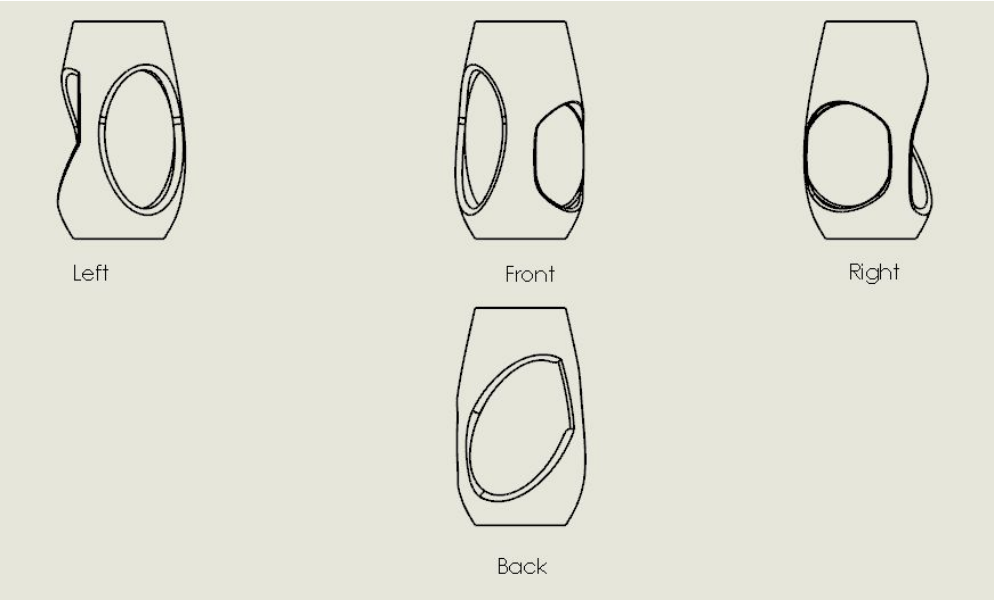

Image 14. Initial Grip Design

The grip had three wedges to enforce the dynamic tripod grasp. The thumb wedge had the largest radius. The index finger was the longest and then middle finger was slightly slanted.

The body of the first prototype was CNC machined out of aluminum, allowing it to be lightweight and durable. This served as an effectively high quality prototype to demonstrate our idea, but we found that the turnaround time was prohibitively slow for rapid testing and iteration. The grip of this prototype was made by mixing silicone in 3D printed molds. While manipulating silicone proved to be a skill in itself, our eventual successes became nearly flawless and quick to produce. Once solidified, the silicone was durable and comfortable to hold.

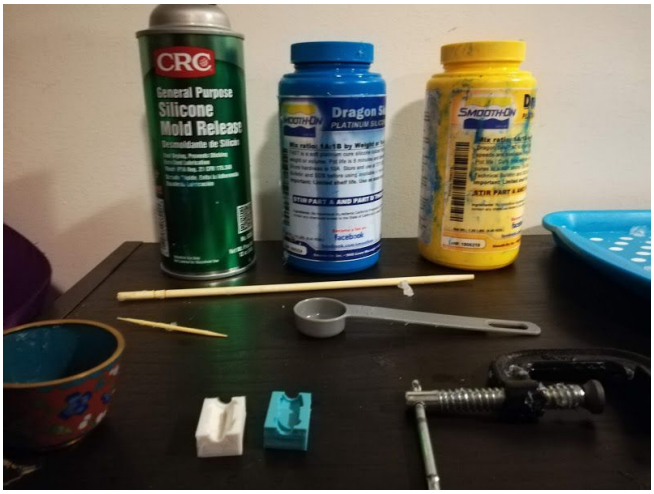

Image 15. Silicon molding setup

Lastly, for the tip we ordered generic microfiber tips and modeled the stylus based on their thread size.

Image 16. Initial prototype

2.1.4: Field Test, Interviews and Analysis

Our first field test involved eleven children between the ages of three and five. We individually asked them to write their name using their finger on an Ipad Mini 4 that was provided.

Image 17. Field testing stylus at pre-school in Salem NH

After they completed that task we asked them to do it again utilizing our stylus instead. We gave no instruction on how to hold it. This was done in order to asses how intuitive our grip design was and how far along their natural pencil grasp had developed. The majority of the children had a difficult time grasping our stylus as it was too large for their hands. The grip was also not as intuitive as we would have liked since no child held it properly. This field test also demonstrated that the age group of three to five may be too young as none of them had progressed to the dynamic tripod grasp.

2.2: First Revision

Based on the feedback from out first design, we decided to make the grip triangular to be more intuitive for the dynamic tripod grasp. Ideally, this would communicate visually and textually that they should place one finger on each side. Additionally we made minor adjustments to further distinguish the three finger slots. Most notably the thumb slot was further distinguished from the other two, the idea being that if they could understand thumb placement the other two would follow naturally. We also shrunk the body to the size of a golf pencil based on advice from one of the onlooking teachers. For this iteration we kept the same microfibre tip.

2.2.1: Results

The schematic for our first iterative design is as follows (measurements in mm)

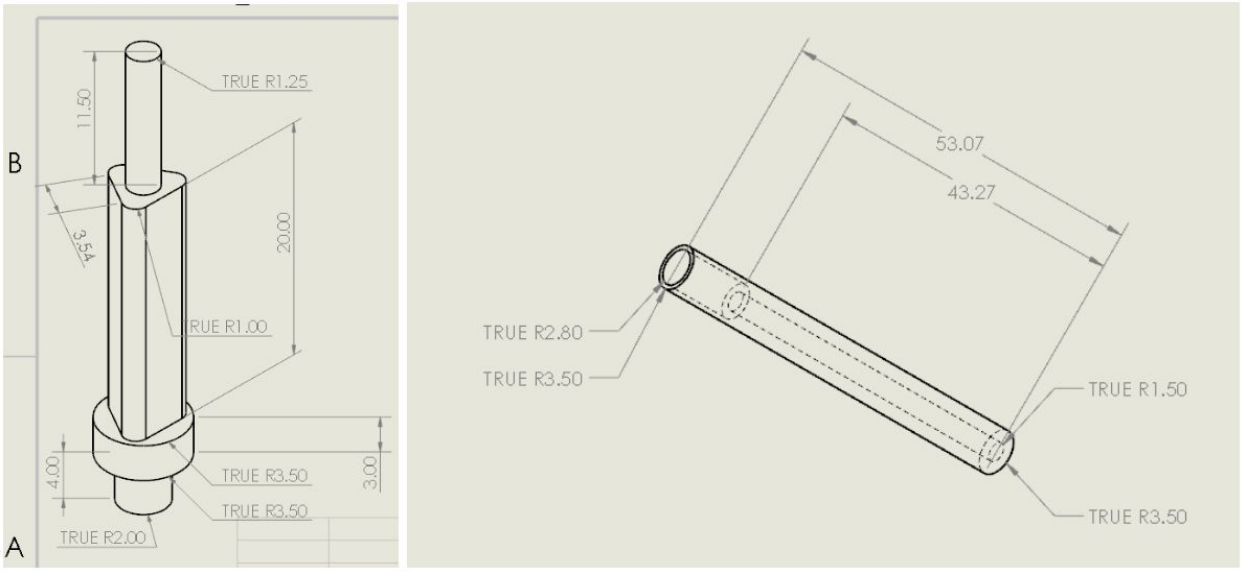

Image 18. Schematic for first iterative design

The length was decreased from 143.76 mm to 91.57 mm. The diameter decreased from 12.44 mm to 7 mm.

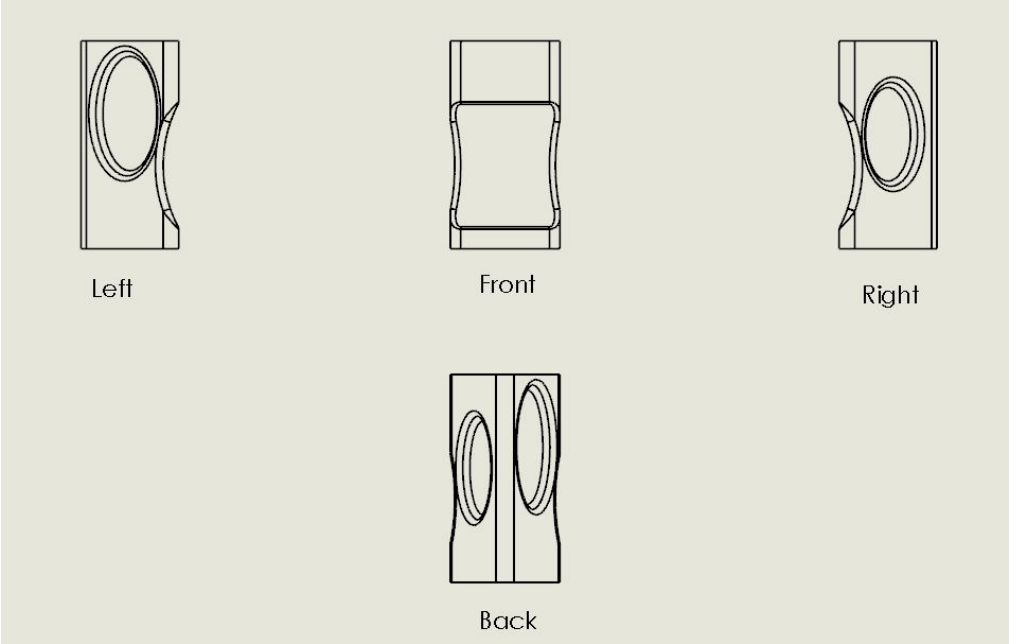

Image 19. Drawing of first grip iteration

The triangular grip was designed to encourage the three finger grasp. It was reduced in length from 35_{mm} to 20_{mm}. The wedges for their fingers were also reduced accordingly.

Image 20. Prototype of first iteration

This body was made out of PLA plastic and printed in using the Ultimaker 3 rapid prototyping printer. While certainly made for a better body, the practical difference for testing purposes was negligible. Switching to PLA plastic for our rapid iterations gave us a much quicker turnaround, allowing us to re-design, prototype and test multiple times in a week. The grip was made of the same silicone mixture we used for out first prototype, and was manufactured using the same techniques.

2.2.2: Analysis

This prototype was not tested. The triangular grip was difficult to mold correctly and it was less comfortable to hold then the cylindrical shape. The size of the body was also too small.

2.3: Second Revision

One major change for this design is the incorporation of the disc type stylus tip. The children had a much easier time using this design because it doesn't require as much force and feels more similar to a pencil/pen. We decided to revert back to a cylindrical shape in order to improve the quality of our silicone molded grips and the textual feel of the grip. We also added ridges between finger wedges in order to replicate the effect of having a triangular grip. The size was increased slightly. To simplify the design model was also reduced to one single body instead of two connecting pieces.

2.3.1: Results

This third iteration was 102.30 mm in length and had diameter of 6.6 mm. It was larger than the first revision but, smaller than the initial design. The tip was simplified to basic pen shape. This was allowed due to our incorporation of the disc type stylus tip.

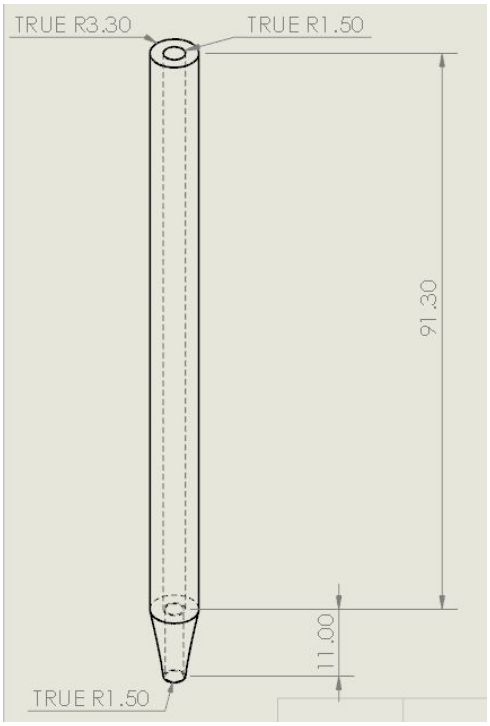

Image 21. Schematic for second iteration body

The grip from our initial design was returned and then shrunken down by 20%. Three narrow ridges were added in between the wedges to replicate the effect of the triangular grip from the first iteration.

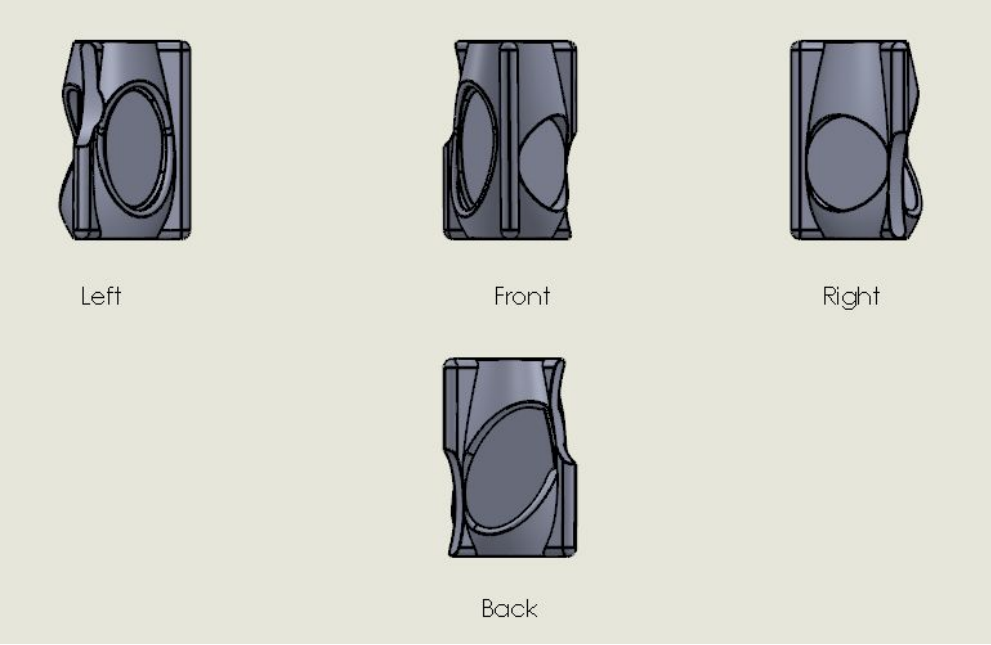

Image 22. Drawing of second iteration grip

The pen body prototype was made out PLA plastic and printed form the Ultimaker 3 Rapid Prototyping printer. The slight increase in size and reduced complexity made the print come out much cleaner, with few noticeable imperfections. The grip was created using the same silicone mixture as used previously.

Image 23. Second iteration prototype

2.3.2: Field Test, Interviews and Analysis

We asked children from ages four to seven to try out our stylus design. We discovered that this was the ideal range for this grip as about 50% of that group were able to use the grip as intended.

While field testing this iteration we interviewed 12 teaching staff members from various education centers. The majority of the staff we talked to were teachers for kindergarten age students (four to five). They all noted that the writing ability of their students has decreased throughout their time as child care professionals. They suggested we look at different type of grips and writing improvement devices that they use in their classrooms. One technique was to stick a plastic golf ball around a pencil. This would develop grasping muscles as well as a pincer grasp.

2.4: Third/Final Revisions

That golf ball technique inspired our third iteration of the grip. The sphere above the finger intrusions makes the child grasp around the sphere, similar to holding a small ball. This requires further grasping strength while still encouraging a proper grip. We believe this design will be the most beneficial for writing development as well as muscle development. While conducting those last sets of interviews we found out that the elementary students in Salem NH regularly use touch screen tablets during school time. Based on that knowledge we researched into whether other elementary schools in the United States use tables. We found that and found that 19% of

american elementary schools have touch screen tablets and use them regularly, while as a whole 78% of elementary age kids use tablets regularly(CITE). So in addition to our stylus design devoted to proper grip and fine-motor development(GBG Stylus), we designed a stylus for everyday use in the classroom(CRG Stylus). That classroom design was made much simpler and more manufacturable so I could be mass produced and used by everyone regardless of writing skill. .

2.4.1: Results

The final stylus body has the same dimensions as the second iteration. Both the GGB Stylus and CRG Stylus use the same body. The CRG Stylus is symmetrical so righties and lefties can use it. It was also made without intense indentation so someone at any stage of their grip development can use it, i.e. every student in a classroom.

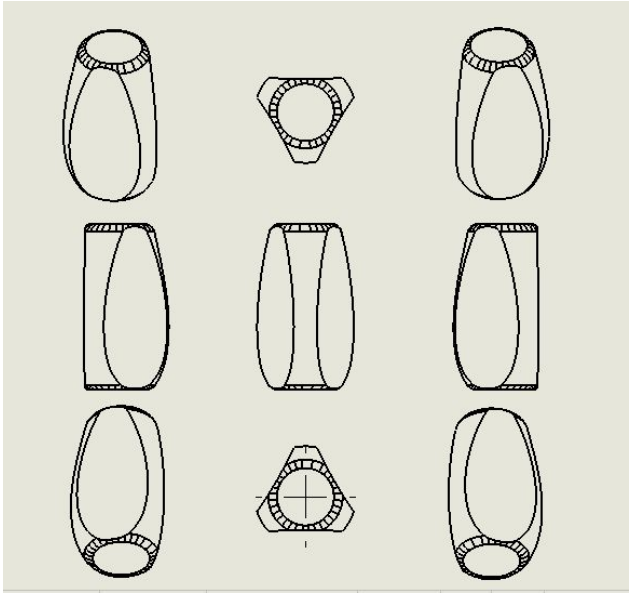

Image 24. Final iteration for classroom grip

The version designed for optimal grip development has three large indentations that are made to encourage the dynamic tripod grasp.

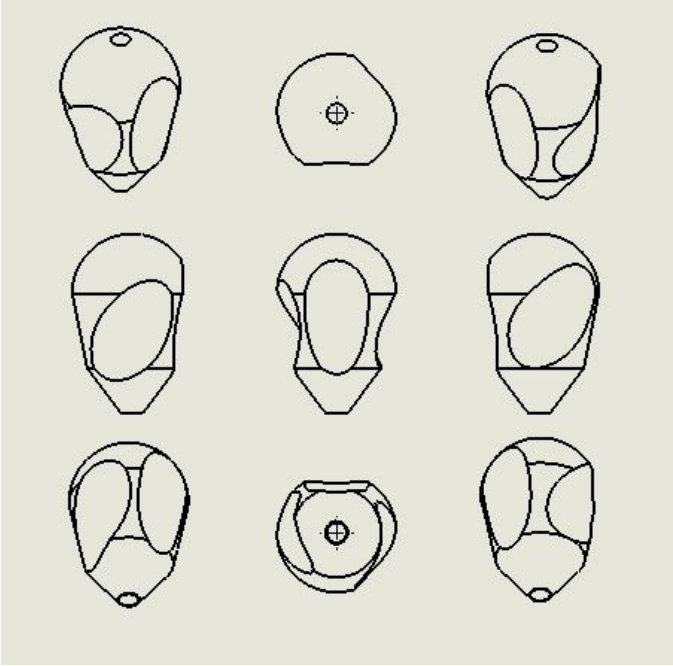

Image 25. Final iteration for Golf Ball Grip

We prototyped the Golf Ball Grip using tangoplus material on the Objet 3D printer. This made i sturdy enough for kids to grab onto it but squishy enough for comfort.

3: Discussion and Conclusions

This section presents the final conclusions of our project, and the closing discussions relating to them. These conclusions are based on the research, testing, and results of our work that we have collected. The conclusions and discussions within this section determine the total success of our project. Based on the discussion below and all written above that supports that discussion, our last conclusion states that our stylus encourages proper writing technique. This was the focus of the design, and this result is proof of the success of both the design, and the project as a whole.

3.1: Discussion

Written below are the discussions directly relating to the conclusions described in section 3.2. Important points, data, and results from sections above are referenced in summary of the significance of the conclusion being discussed. Not all relevant information is brought up and discussed here. Earlier sections of the report pertaining to specific facets of our projected may be viewed in order to explore more detailed descriptions, results, and methods.

3.1.1: Writing development in children is decreasing.

We initially got the idea for this project from a grade school teacher who expressed how her students writing ability has been decreasing over the the course of her teaching career. This inspired us to begin researching the academic literature on writing development and societal trends toward decreased writing ability in adolescents. This research, in addition to our field testing at a preschool in Salem NH confirmed her observation that the writing development in

children is decreasing. From here we decided to begin researching why that decrease is occurring and ways to appeal to children in order to improve their writing abilities.

3.1.2: Children are using technology more, especially touch screen devices.

While researching why their writing ability has been decreasing we found studies concluding that the use of technology is becoming increasingly prevalent in adolescents. Our interviews with parents and teachers in Salem NH confirmed this conclusion as the majority of kids we talked to had been familiar with touch screen devices such as tablets and smartphones. The elementary school in the town we surveyed, Salem NH, had incorporated tablets into their classrooms and used them regularly. This inspired our secondary stylus designed specifically for mass student use in the classroom. The next step was to determine how to design a grip that will encourage proper writing technique and develop their fine-motor ability effectively.

3.1.3: Our stylus encourages proper writing technique.

Through market studies we found existent grips on the market designed for pencils that claim to improve grip development. We based our initial grip on those designs and iterated it three times throughout this projects life cycle. Our final grip design encourages proper grip while also aiding in muscular development. Our research into fine-motor development clearly states that writing with a pencil/grasping a cylinder is helpful for development the muscles needed to learn to write properly. The children who used our stylus grasped the stylus properly and utilized it effectively to draw on a tablet.

3.2 Conclusions

Our conclusions are as follows:

1. Writing development in children is decreasing.
2. Children are using technology more, especially touch screen devices.
3. Our stylus encourages proper writing technique.

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Appendix A: Process

Below is an account of our work A-Term that culminated in this project's objective.

The primary purpose of our project was decided to have the most to do with our design process and also potential personal development. We wanted to find the project that would be the best fit for our collective combination of current talent, intellectual motivations, and skills we wished to develop. At the start of our project, our goals and plan were vague, but knew we wanted to get valuable real world experience, mechanical design experience, and working practice in a group project environment, bringing a project from conception to conclusion. We wanted absolute and practical experience of the engineering process.

We each had ideas for the specific product we could create/innovate but, we were not confident that would fully satisfy the goals we set when we began. In order to better value, and then rank these different ideas, we were encouraged, by our adviser to read "One Simple Idea" by Stephen Key [15]. After reading the book we designed a plan to bring a product all the way from a 'simple idea', to a completed prototype. We utilized this plan throughout the life cycle of this project. The plan is as follows:

Stage 1 - Initial research

“Product should either solve problems, address needs, or satisfy desires”

“Instead of creating a new market for your idea; create a new idea for an existing market.”

Does is solve a common problem in specific market?

Does it have something that makes it stand out?

Does it have a large market?

Does it use common production methods and materials?

Stage 2 - Market research

Who are competitors, major and small?

How does my idea compare and contrast with other products in market?

What value does it offer that the other competitors do not?

How large is market?

Who are primary customers?

Why are they going to buy it?

Where are they going to buy it?

How much will they be willing to pay for it?

What are primary sales?

Stage 3 - Manufacturing/Prototype

How will it be manufactured?

What will it cost?

Interview people and companies who have produced similar product

Prototype

Computer model

Intellectual property protection:

Provisional patent application - give you patent pending for one year

Stage 4 - Licensing

Identify potential licenses

Putting foot in door

Selling benefit of idea

The first idea we began to pursue was to adapt the Japanese kotatsu table for the United States. This would have involved adapting an established, and popular design for a new market, and ensuring this design was manufacturable. The major issues we ran into was lack of information on a market, as well as lack of innovation, and design challenge.

This led us to pivot to a different idea involving helping young kids develop their fine motor skills. One piece of advice from Stephens Key's "One Simple Idea" was to look at problems you encounter and think of creative ways of how to solve them. One of our relatives runs a pre-school and she expressed how the fine-motor ability of her students are gradually getting worse each year. This led us to begin researching this issue and we found many other

professionals agreed. Due to continued research, we determined this problem was viable and a product designed to solve it would satisfy the goals we originally set for the project.

Appendix B: Survey Information

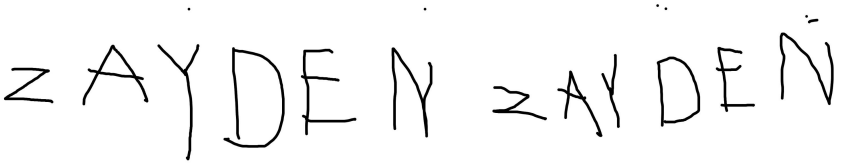
Drawing App used: Draw.ing Pad

Survey 1:

1. Use their finger to write name
2. Use the stylus write name

- Note whether they used grip effectively
- Note if there is a trend of consistently using improperly
- Note if they write with their fingers better than the stylus
- Ask them if they have used touch screen devices before

Images: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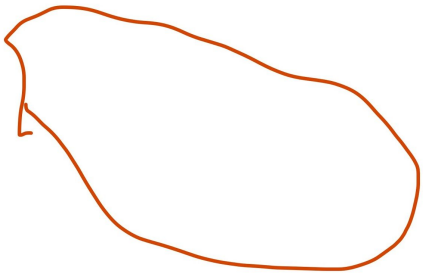
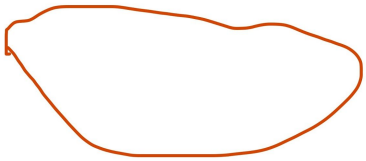
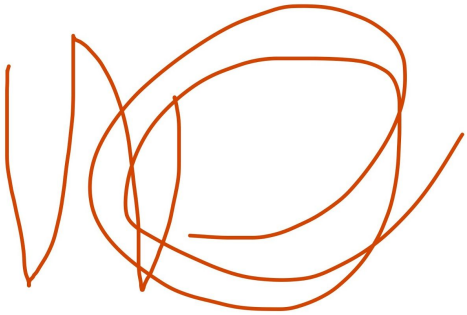
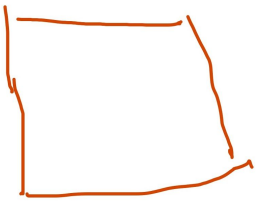
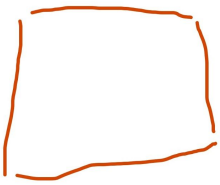
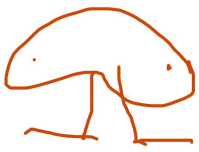


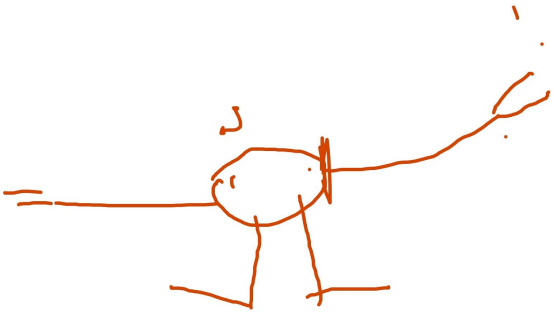


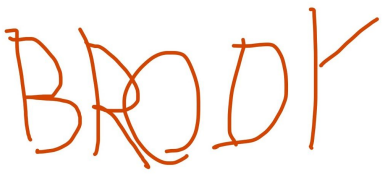


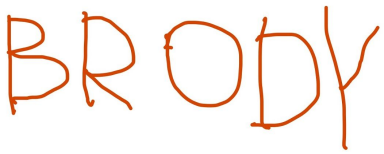


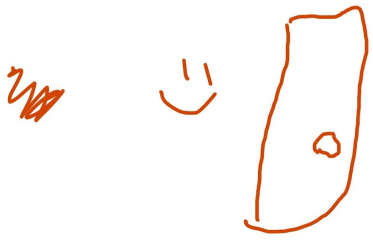


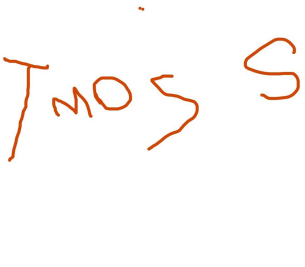


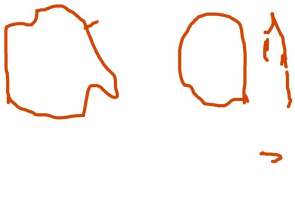













January 23rd 2019
TODAYS WEATHER

Survey 2:

1. Ask them to write their name with the stylus

- Note whether they used grip effectively
- Note if there is a trend of consistently using improperly
- Note if they write with their fingers better than the stylus
- Ask them if they have used touch screen devices before

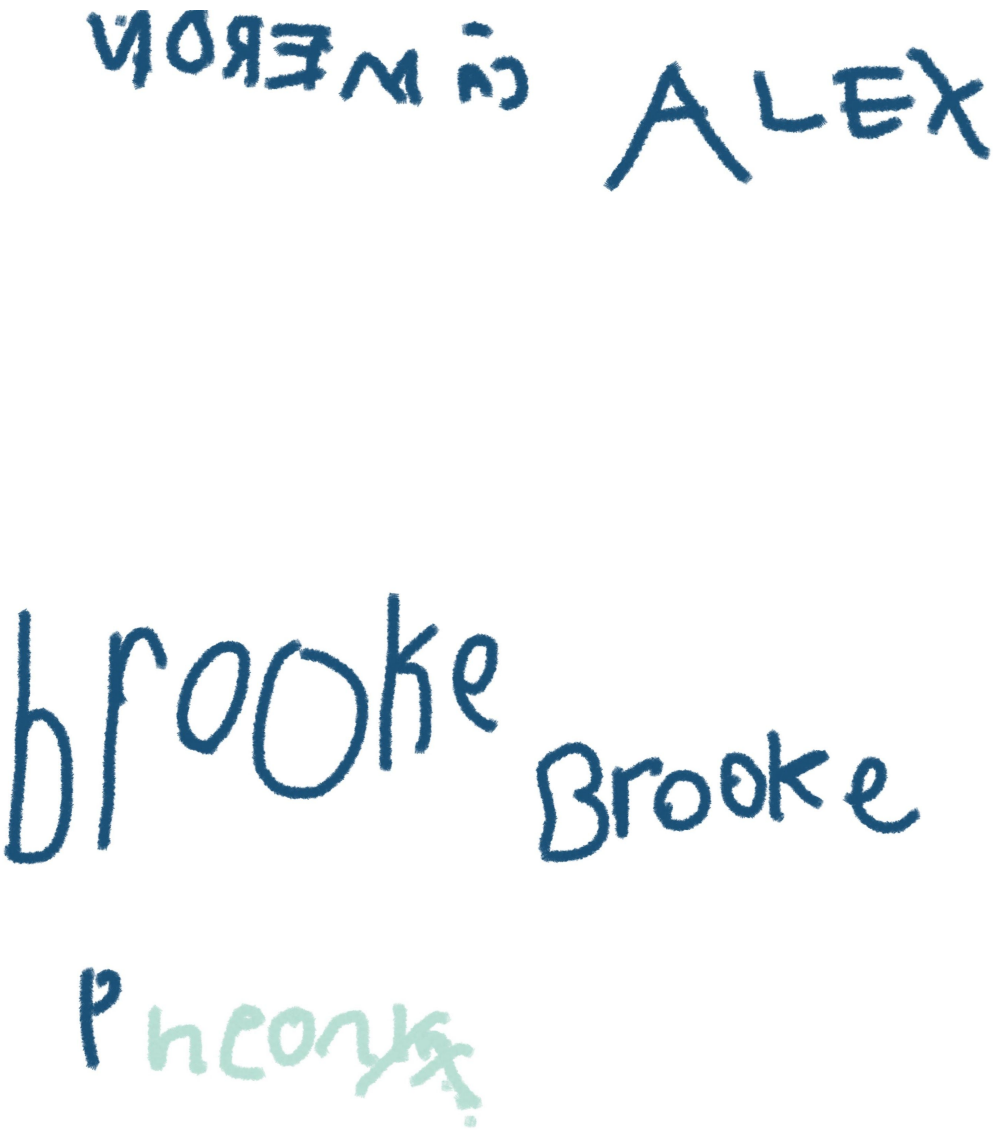
Images:


Mi Chrisō
Video
LUKE
Olivia Mariah

Brayden JACOB

perek madison

WILLIAM Enzo


ALEX
brooke
Brooke

INTERVIEWS, PLEASE FORMAT

Has the ability of your students decreased in general over the years?

If so, why do you think that is - tech?

Have you ever considered utilizing tablets or touch screen devices in the classroom?

Do you think a stylus will be helpful?

Jen Crane

Has the ability of your students decreased in general over the years?

If so, why do you think that is - tech?

Have you ever considered utilizing tablets or touch screen devices in the classroom?

We've thought about using tablets in the classroom, but cost, not a fan of screen time for underaged kids. (Enough screen time at home)

Do you think a stylus will be helpful?

Denise Morelli

Has the ability of your students decreased in general over the years?

When they type they are better than when writing now.

-All they want to do is make laptops, pretend to use computers, dont want to write anything, really like technology

If so, why do you think that is - tech?

Kids dont really get handouts as much, they do everything on computers and are much more involved in tech

-After 3rd grade they dont really write as much or focus on writing and do everything on computers

Have you ever considered utilizing tablets or touch screen devices in the classroom?

It would be good cause some students work better with technology and some will want to learn more with technology, more involved. Some students dont want to write anything.

Absolutely have seen an increase in technology.

Do you think a stylus will be helpful?

Catherine Sumari

Has the ability of your students decreased in general over the years?

Very good knowledge of technology now. This specific teacher doesnt work with older students so hasnt seen full writing development

-Kids pretend whiteboards are tablets

If so, why do you think that is - tech?

It's still important they stil learn technology, but writing should come before technology. They get fine motor skills from writing, so it's better to write first

Have you ever considered utilizing tablets or touch screen devices in the classroom?

I think technology is important in teaching, it will never stop and should be incorperated, but it should be limited. Some public teachers are expected to use too much technology. Knows a teacher who teaches english but too much technology is used.

Students who dont have access to computers have better imagination and creativity\

Karen Tate

Has the ability of your students decreased in general over the years?

Yes, I think so. Even at early development. A lot of interest in technology. At home kids have a lot less interest in crayons, markers, painting. Less interest in writing instruments, so dont even know how to use them at all when they first come to preschool

If so, why do you think that is - tech?

Have you ever considered utilizing tablets or touch screen devices in the classroom?

Have used tablets at times very rarely as a tool/teaching aid, but not direct interaction with children. We're here to teach them, not have the computer teach them.

Do you think a stylus will be helpful?

In elementary ages yes, but not as much in the preschool ages. Hard enough to get them to use crayons and basic writing tools. However, ny tool that teaches these handwriting skills will be useful.

Audra

Has the ability of your students decreased in general over the years?

Yes, I do.

If so, why do you think that is - tech?

We dont concentrate as much on writing abilities any more. Ciriculum is changed so much. In the last decade we've increased the ciriculum, it used to be more fun based. It used to be

preschool, kindergarten, 1stgrade, now standards are moved down so previous requirements in 1st grade are for kindergarten for general knowledge and skills. It used to be that preschool and kindergarten were for socialization but now its more ciriculum based.

Technology affects handwriting skills, absolutely.

Have you ever considered utilizing tablets or touch screen devices in the classroom?

I think touchscreen would help the learning environment because kids love technology and they would be more engaged and excited. Kids have to learn to write, but if they could use their tablet they would be so much more enthusiastic.

Do you think a stylus will be helpful?

Absolutely, because its too difficult to learn- Anything that makes it easier for them to learn... they get frustrated easily so anything that helps them learn would be better.

Brittany

Has the ability of your students decreased in general over the years?

Pretty much stayed the same.

If so, why do you think that is - tech?

Does tech affect handwriting?

Absolutely. Kids would rather play games on tablets and touchscreens. Dont want to color as much.

Have you ever considered utilizing tablets or touch screen devices in the classroom?

I like the idea but would not suggest all the time, or as a replacement to traditional hand writing teaching.

Do you think a stylus will be helpful?

Absolutely, whne I was watching the tests, I think it would definitely help. It helped how the students held writing instruments and improved how they wrote on the tablet.

Lisa

Has the ability of your students decreased in general over the years?

Decreased in general. Own kids are also decreased. Teaches a wide range of students. They dont need to write anymore. Fine Motor has decresed greatly.

If so, why do you think that is - tech?

Totally! Kids dont even want toys anymore, they want iphones, ipads, tablets. They all want electronics now.

Have you ever considered utilizing tablets or touch screen devices in the classroom?

I would love to use one for generalized teaching, but kids would love it. They would definitely use it.

Do you think a stylus will be helpful?

I think so because of all the different ways kids learn, some will definitely benefit from it.

Mrs. Moeshen

Has the ability of your students decreased in general over the years?

Decreased. I started an afterschool club "Caligraphy club" to improve students penmanship. Talked with graphic designers, because penmanship isnt being taught as much, a lot less graphic designers in the workplace. It's something people are missing.

If so, why do you think that is - tech?

Oh yeah, definitely. Kids are typing more. They complain about taking notes because they arent writing as often. In the past ten years more complaints and less ability. They now would rather take pictures of notes on phones than write them.

Have you ever considered utilizing tablets or touch screen devices in the classroom?

Technology like tablets are used every day in the classroom, and usage has gone up over the years, specifically last two years. 10 years ago, technology was once a week used in the class room.

Do you think a stylus will be helpful?

Yeah I think so. I think that would be very helpful.

(parent)

Does he use tablets or touchscreen devices?

Yes, and he uses learning apps, (sesame st writing learning app)

Worry about cost, how easy it would be broken

If it came with device that would be perfect.

Allie Kisiel (middle school)

Has the ability of your students decreased in general over the years?

Decreasing. Has decreased over the years with tech

If so, why do you think that is - tech?

Probably technology. They are so used to typing and texting. There's like no cursive.

Have you ever considered utilizing tablets or touch screen devices in the classroom?

Good idea, cause everything is converting to technology anyways, so its a way to keep handwriting and technology together.

Pretty much everything is on a computer, they barely write anything at all anymore, except for math, and sometimes notes.

Each class has a laptop cart.

Kids with visual impairments use tablets.

Do you think a stylus will be helpful?

It would be a good idea. A lot of kids past a certain age dont care as much any more, but a stylus would help encourage good writing over time and help them.

Debbie Carver

Has the ability of your students decreased in general over the years?

Handwriting ability is weaker, they type a lot. Not as good as when I was a kid, it's messier. They know more words though. Have a larger vocabulary due to technology.

If so, why do you think that is - tech?

Yes. It's good and it's bad.

Have you ever considered utilizing tablets or touch screen devices in the classroom?

All for it, but schools are against. Used to allow 15 minutes a day fo tech, but not anymore. But I think its good for them. They focus better on tablet than paper. Public schools very against it. Private is more receptive. Not really a big increase in technology.

Do you think a stylus will be helpful?

Great.

Writing Trials-

Tim: Held pen above grip, and then repositioned to have one finger on grip and others above.

Brooke:

Marcos: Held above grip and incorrectly.

Christian: Almost held grip correctly, was rotatedwrong

Aiden: Started holding correctly, rotated as he used it.

Luke: Held far above grip

Tayla: Good grip placement, very good handwriting, Senior Highschooler.

Need grip areas to be really obvious