Box Stencil

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Executive Summary

Problem: Students with dysgraphia and dyslexia have trouble maintaining neat handwriting, so much so that regular free handwriting becomes hard to read. These impairments can hinder math learning and mastering concepts because students cannot properly write out problems, and subsequently have issues learning and internalizing the material. With the help of our client Ms. Heile, representing the North Shore School District #112, and students at middle schools in Highland Park, IL, we developed a stencil that assists students with dysgraphia and dyslexia write out their math work.

Requirements: From our observations students need a way to plot number lines and axes, as well as provide a simple way to write out algebraic expressions. In addition, the design needs to withstand the wear and tear of a student's normal school day.

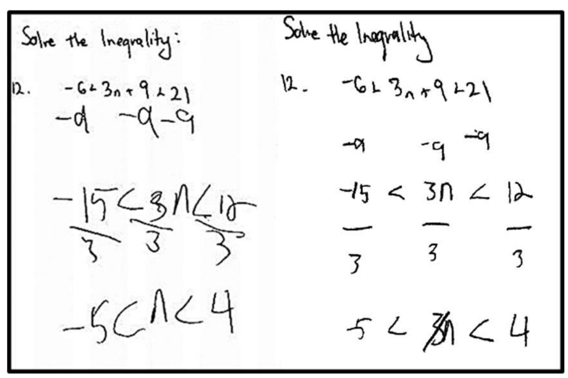
Results of Testing: After testing several designs, a simple stencil proved most effective in assisting students with their math work (see image below).

Design Overview: The stencil features rows of character boxes (see above picture) of varying width that allow students to write one to three characters per space on the same horizontal line. The rows are evenly spaced so there is no vertical overlap in their writing.

Components	Benefits
Material type: polycarbonate	Flexible, can be safely bent 90° or more
Dimensions: 8 ½" x 3 ⅞"	Evenly spaced rows for neat computations
Lines for fractions and number lines between character rows	Allows user to draw number lines,bars and plot axes

Before

After



Delivered to our Client:

We are providing our client with a copy of our Box Stencil for testing. Our computer aided design (CAD) file of the stencil, along with instructions for fabrication, are also provided to the client.

Introduction

Our team worked with middle school students with dysgraphia from Highland Park, IL. From our observations, we determined that character spacing and drawing straight lines proved to be the most difficult part of math work for our users. Through ten weeks of development that included user-observation, prototype design, creation, and revision, we developed a viable prototype solution to assist students with dysgraphia in writing mathematical expressions by hand.

Dysgraphia is a handwriting impairment that causes students to have trouble maintaining neat handwriting, so much so that regular free handwriting becomes hard to read. Today, students with dysgraphia can write out essays and extended responses on any computer. However, these technological solutions do not allow students to efficiently communicate math work.

The Box Stencil solves the challenges students with dysgraphia face while writing out their math problems. It encourages evenly spaced writing along the same horizontal line and provides a simple way to draw straight lines for coordinate axis or fractions. It measurably improves the legibility of students' work without interfering with their process.

Figure 1: The Box Stencil in use

Users and Requirements

Users

The users of our product are students with dysgraphia and dyslexia. These students are 6th through 8th grade and have enough of an impairment with these conditions to require an Individualized Education Plan (IEP). They are integrated with normal classes and have one class period during the day where they can work on homework in a resource room- a classroom with special education teachers as the facilitators. The students' math classes deal with concepts such as arithmetic, geometry, probability, basic algebra and trigonometry. They have a wide range of handwriting abilities and each have different problems with keeping their work organized.

Requirements

In order to create a meaningful solution to our user base, we identified these characteristics as essential to our product:

- *Organized*

  Students should be able to organize their work so that they can read it and communicate their ideas. The key functionality of the design is to create a tool for students to write their work so it is legible, can be re-read to themselves, as well as understood by others.

- *Assistive*

  There needs to be a feature that helps students graph axes, curves, and points, as well as allow them to label as needed.

- *Intuitive*

  The product, either physical or software based, should not be complicated to use or implement. For physical solutions, this means students should not have to make annoying adjustments to switch between lines, or have to constantly alter the device. For software solutions, this means no tricky graphing functions or complicated interfaces. The focus here is simplicity and ease of use.

- *Unobtrusive*

  Any solution will be used by students on a daily basis in a classroom, which is also a social environment. Our solution should not draw attention to the student, as well as should not be large or bulky, which will make it a pain to transport.

- *Durable*

  Students live a mobile and active life. Our solution will need to be designed to keep up with this, as well as the wear and tear that comes with a student who might not pay a lot of attention to how he handles his math tools. So, our solution should be constructed from durable materials as well as built to last in the many ways a student might transport it.

- *Economically Feasible*

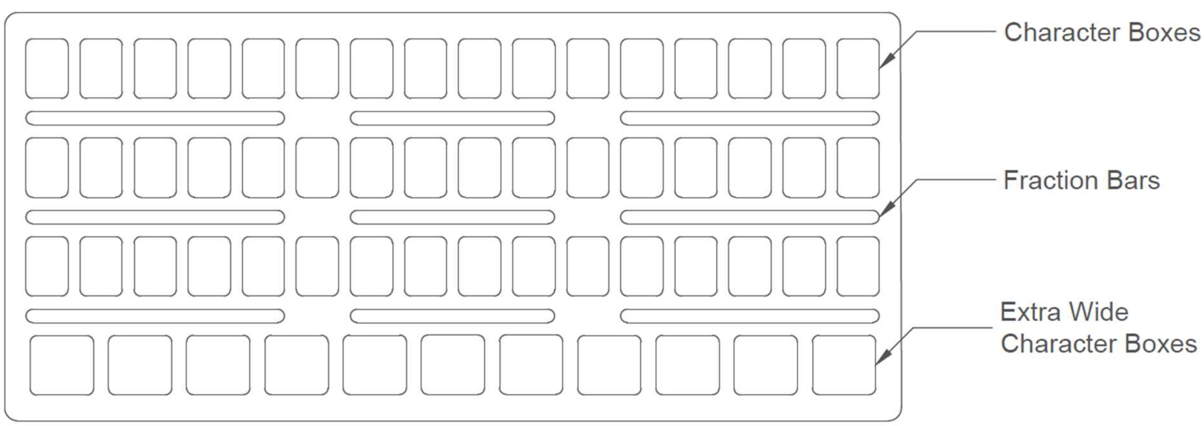
  Our solution cannot be expensive to manufacture, purchase, or repair. This means that our materials, for a physical solution, have to be cost effective.

Design Concept

The Box Stencil is a specialized stencil that helps the user space out their characters when writing. The stencil spans the width of a regular 8.5” by 11” sheet of paper, and the individual boxes are the height of two lines on standard college ruled notebook paper. It is constructed out of 3/32” thick clear polycarbonate. In the design, there are three types of boxes: character boxes, fraction bars, and extra wide character boxes. Character boxes are the width of 1 to 2 characters. These compose the first three rows of boxes of the stencil. The bar boxes are the horizontal segments in the design. They can be used to draw fraction bars and straight lines, such as a 1-D number line or 2-D coordinate axis. Extra wide character boxes compose the bottom row of the stencil. These modified boxes are 50% wider to accommodate 2 to 3 characters per box, for writing things such as three digit numbers.

The user can use this stencil on either blank printer paper or college ruled notebook paper. He or she would then write math characters in each box, thus spreading out the work evenly across the page.

Figure 2: A diagram of the Box Stencil’s Features



The Box Stencil is constructed from polycarbonate, a material rigid enough to provide an effective physical barrier to writing instruments but flexible enough to withstand the stress that students will subject it to. The design places a hard barrier to their writing, while allowing them enough leeway to write efficiently. We noticed that users would avoid using a product when they started feeling restricted or felt annoyed about how much it slowed them down. This design minimizes noticeable interference with the writing process while still improving our users’ legibility.

This design is easy to use because it has only a few features that are clearly defined. A brief instruction manual is all that is needed to teach anyone how to use it. Most of the features of the stencil are intuitive - a fact confirmed by our users being able to determine the function of the features on the design without any instruction. Overall, the concepts of this design are intended to limit the amount of restrictions, make the process of writing neater, and make the stencil easy to use.

Design Rationale

Our users have difficulty spacing their characters horizontally and vertically, but are capable of writing individual characters legibly. They are able to plot functions and points effectively without an aid, but have issues drawing straight lines. The design of the Box Stencil emphasizes consistent horizontal and vertical spacing.

Finally, the design effectively improved the legibility of the users' math work. This was accomplished by evenly spacing out the boxes so that all of the written characters are evenly spaced. This has major benefits both in class and on homework, as the users will now be able to communicate their thought process clearly to their teachers.

Three iterations of the Box Stencil were tested. When we gave the first iteration of our design to a student to use, he preferred this instrument over any of our previous iterations. While the stencil did slow him down slightly in writing the problems, it also assisted the student in spacing his characters evenly and drawing straight line-- two of the major issues our users face when writing free hand. His work became perfectly spaced and legible when using the Box Stencil.

Our original mock-up was only 5” wide by 3.5” tall, had no supports for the fraction bars or widened boxes in the bottom row, and was made out of clear acrylic. This made the stencil very flimsy and required to user to hold down the stencil with one arm while writing. Several modifications were made to account for these problems. First, the stencil was extended

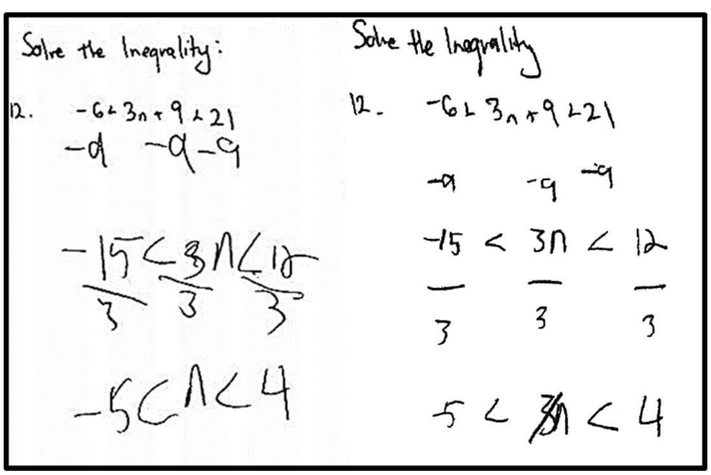


Figure 3: Samples of student work
On the left, a student's free hand work.
On the right, a student's work using the Box Stencil

horizontally to match the width of standard letter paper. Second, the boxes on the bottom row were enlarged to provide space for three digit numbers. Next, each fraction bar was split into

three segments to strengthen the stencil, and lastly, the inner and outer corners of the stencil were rounded. These rounded corners minimize sharp changes in the material, improving the flexibility of the stencil, as well as reducing the likelihood of a fracture along the corners.
As shown above, the stencil can bend 90° or more without incurring any damage. The product is manufactured out of 3/32” thick polycarbonate, a material far more flexible than the original 1/16” thick acrylic. The polycarbonate was cut with a water jet, however, the original acrylic stencil was cut from a laser. While this change does make production more difficult, the flexibility gained by using polycarbonate as our material far outweighs this drawback.

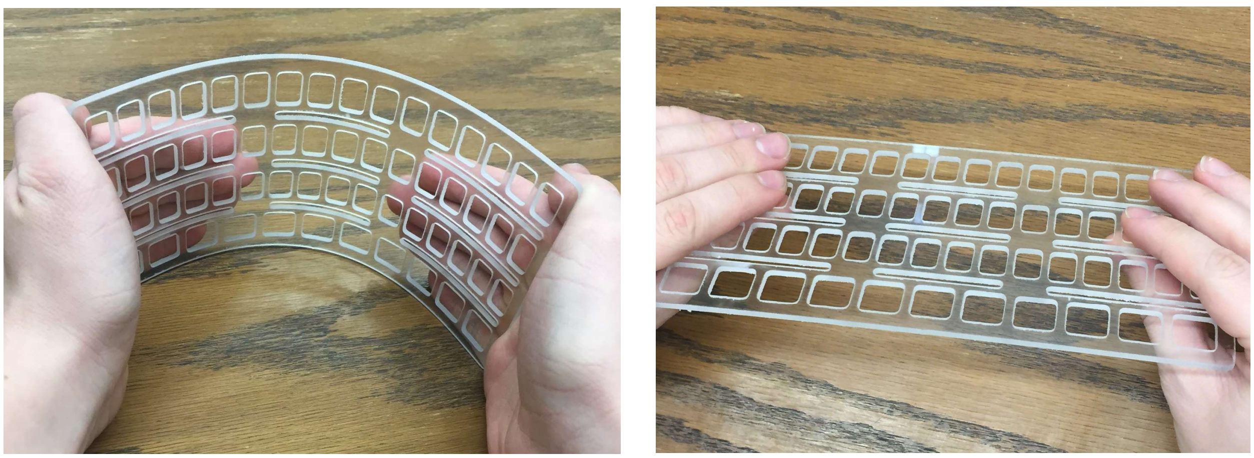


Figure 4: The flexibility of the Box Stencil. On the left, the Box Stencil bending at nearly 90 degrees. On the right, the Box Stencil is not permanently bent after extreme bending

Key Criteria

The finished design is not obtrusive in any way. It is a thin and small polycarbonate stencil that does not call attention to the user and does not cause any major interference in a traditional classroom setting.

The polycarbonate material used for the stencil is flexible enough to bend severely without breaking. If this material breaks, it will snap instead of shatter.

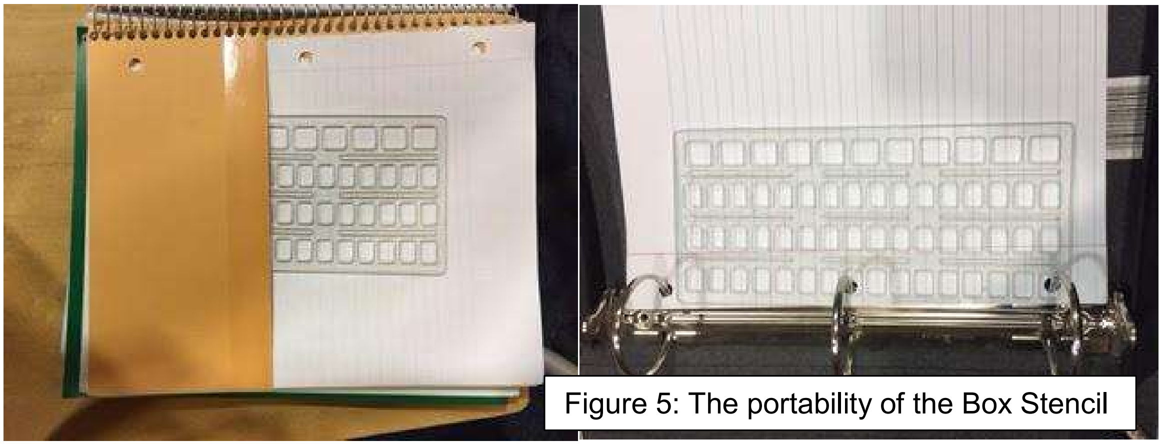


Figure 5: The portability of the Box Stencil

The design is also very portable. It can fit in the rings of a 3 ring binder and easily slide into a backpack or folder. It is wide enough to keep itself from sliding around too much during transport yet still compact and lightweight.

Additionally, the stencil is intuitive and easy to use. When testing the design, the user knew how to use the stencil without any instruction, and had no difficulty using it for its intended purpose. Writing in the stencil causes no major problems with the flow of the users' work. The transparent polycarbonate allows the user to easily view previous work, even if the stencil covers those areas.

Conclusion

The Box Stencil meets the requirements outlined for our product. We came up with a physical solution to our user's problems rather than a virtual one. The prototype is effective and is easy to use. It is also relatively cheap to manufacture and very durable. Lastly, the design is not obtrusive and does not call attention to the user when he or she may use it in class.

We are providing our client with a copy of our Box Stencil for testing. Our computer aided design (CAD) file of the stencil, along with instructions for fabrication, are also provided to the client.

The remaining appendices detail our design process, observations, and research into this challenge. Instructions for use and fabrication are also included at the end of this report.

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Appendix A: Project Definition

Mission Statement:
To develop a feasible solution to allow middle schoolers with impaired handwriting to communicate their mathematical knowledge in class and on assignments and tests.

Project Deliverables:
A solution - either physical or software-based - that allows students to work through math problems.

Constraints:
- Focus more on design rather than feasibility to construct within our 10 week time-frame (i.e. cannot code entire application within project duration)
- The solution must minimize the amount of time the students need to spend communicating their ideas
- Must be elegant and non-obtrusive
- Limited budget

Users: Students with dysgraphia and dyslexia at Highland Park middle schools.

Requirements	**Specifications**
Organization	• Students should be able to organize their work so that they can read it and communicate their ideas
Graphing/Number Lines	• Should have a feature that helps the students graph points and label them

	clearly. ● Should be able to make solid and hollow circles and shade in either side of the point on the number line
Easy to use	● Should not slow down the students to the point where they can't focus on math ● Should be intuitive
Elegant and unobtrusive	● Should not draw attention to the user ● If physical, not very big
Durable	● Built to last ● Especially if physical, designed to withstand mobile and active life of a middle school student (e.g. will not break in backpack)
Economically efficient	● emcompasses the above specifications without high manufacturing cost, or cost to users ● replaceable parts if necessary ● if cheap, easily reproducible

Failure Modes and Effect Analysis (FMEA) Chart

Use Case Scenarios	**Design Implications**	**Design Solution**
Writing	Translucent stencil on paper (design intended)	Intended use

As straight edge	(design intended)	Intended use
Transporting (in backpack)	potential for stencil to break at weak points	Use appropriate width for sturdiness, add extra support to weak points
Cut through surfaces	use corner to cut or pierce items like tape, paper etc..	potential positive use; file edges to be dull in excess to rounded
Break and become sharp, use as weapon	break stencil, edges become jagged and potentially harmful	either make stencil hard to break, design so when snaps it snaps easily
Spin on pencil tip	spin from pencil tip, could fling off and potentially cause harm	curve edges to reduce potential harm if flings off, engrave advisory warning

Appendix B: Secondary Research

What is Dysgraphia?

There are many different forms of dysgraphia. Some students rely too little on sound when writing their words while others rely too heavily on sound. There are also students who have a mix of both. The end result is impaired handwriting, the most important part of dysgraphia and of our project.[1]

Individuals with dysgraphia can write neatly if they put extensive effort into it, but too much effort on penmanship can lead to poor pencil grip.[2] A fact sheet from The International Dyslexia Association states that dysgraphia is condition that makes it more difficult for children to acquire the ability to write proficiently.[3] For students with dysgraphia, writing causes processing fatigue. Processing fatigue occurs when so much is going on in someone's head that they cannot focus on particular task. This causes the students to have trouble maintaining good handwriting while trying to solve math work because of the multitasking required to do both tasks simultaneously. Our client mentioned that some of her students were twice exceptional, meaning they may lack handwriting skills but are otherwise intellectually gifted in specific areas.

Causes of Dysgraphia

Orthographic encoding is a primary cause of dysgraphia. Orthographic encoding is the brain's process of storing the rules and words of a language in the working memory while writing. When this encoding isn't working properly, it becomes more difficult to focus on the task of writing while also permanently encoding unfamiliar words. Dysgraphia is primarily caused by the mind struggling to process writing, with motor skill disabilities being a secondary cause. Children with dysgraphia are also more likely to have ADHD, dyslexia, and selective language impairment.[4]

Dysgraphia is also caused by deficiencies in memory and motor skills. Handwriting takes time to learn, and children with dysgraphia struggle greatly with this. They tend to hold writing instruments in a non-traditional fashion and place the paper in an odd position when trying to write. This causes them to struggle to process what they are writing and how they are writing at the same time.[5] Overall, dysgraphia is caused by the brain struggling to manage the processes of writing as well and fine motor skills that are used in writing.

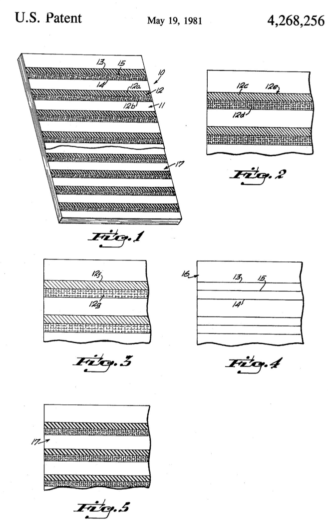
Existing Solutions

Remedial Training

Previous attempts to use remedial handwriting training have proven to improve legibility, but most of these studies take long periods of time to produce significant results. [6]

Existing Patents

Figure 6: Patent #4268256



There are several previous patents on solutions to help remedy the effects of dysgraphia. The first was issued in 1981. It is a specialized paper template with multiple colors and differing lengths of vertical line stripes, one length and color for lower case letters, the other length and color for capital letters. It is designed not as a single implementation but as a sequence of progressive implementations. As the student progresses, the lines are supposed to fade out with successive sheets and the students should improve their writing skills over time, eventually not needing the specialized paper at all.

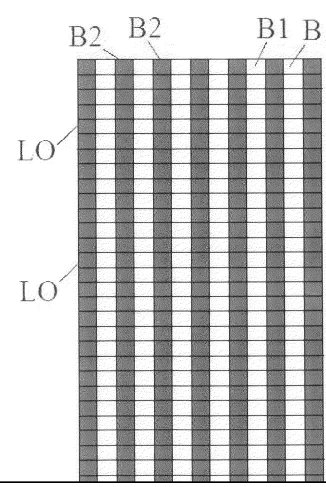


Figure 7: Patent #20120034960

This design focuses on an interesting technique, but is primarily for writing words not numbers or graphical representations. It is also designed as a learning and remediation tool. In our project, the students are old enough that they have already learned and become set in their handwriting. In addition, our goal is to design a solution for communicating mathematics, not improving their handwriting through specialized practice. However, this design does use features that our group is interested in. The differing lines and contrast between colors and line weight seem to provide effective visual barriers. We are interested in how this design would fare in a more mathematically oriented configuration.[7]

The second patent that is of interest to this project actually builds on the one listed above. This iteration uses grid lines to mark the page and then vertical stripes of gray or other pale color. It provides a box format with easily distinguished boundaries for each number. This invention is designed specifically for dysgraphic individuals.

While it does apply directly to our project, this still is only another form of specialized paper for students to use. As our client has stated that graph paper does not suffice to assist the students in any way, we are skeptically optimistic at the results specialized paper will produce.[8]

Dragon Dictation [9]

Dragon Dictation is a voice recognition application that allows users to speak and instantly see text for everything from email messages to blog posts on iPad, iPhone or iPod touch. The application transcribes speech to text, which is seemingly ideal for the current problem. However, it's focus is not specifically in math writing, but rather in general speech functions. Although the app enables users to use a variety of applications, like word processors or math tools such as WolframAlpha, its functionality for math depends on the interpretation of speech, which can lack the capability to interpret mathematical jargon needed to convey the nuances of math problems. For instance, speaking "x to the second power" might not translate into "x^2" as needed to correctly write an equation. Despite it's broad range, Dragon has been a powerful tool for educators.

Individual with muscular disorders, like ligament or tendon damage in the hand, or impairments caused by neurological disorders, can greatly benefit from *Dragon*. An individual with cerebral palsy, who cannot hold a pen, can dictate entire essays and books[10] using the application. Dragon, according to a cerebral palsy user, allows him to "focus on the content of his writing instead of constantly having to look at the keyboard to see how to spell the words" [11]. For students who can write, but struggle to write neatly, Dragon will accurately and neatly dictate speech into legible text.

ModMath[12]

ModMath is an iPad application for writing and solving math problems that was created specifically for people with dysgraphia and dyslexia.[13] ModMath gives users an on-screen keyboard to enter numbers, equations, and formulas into its graph paper interface. The graph

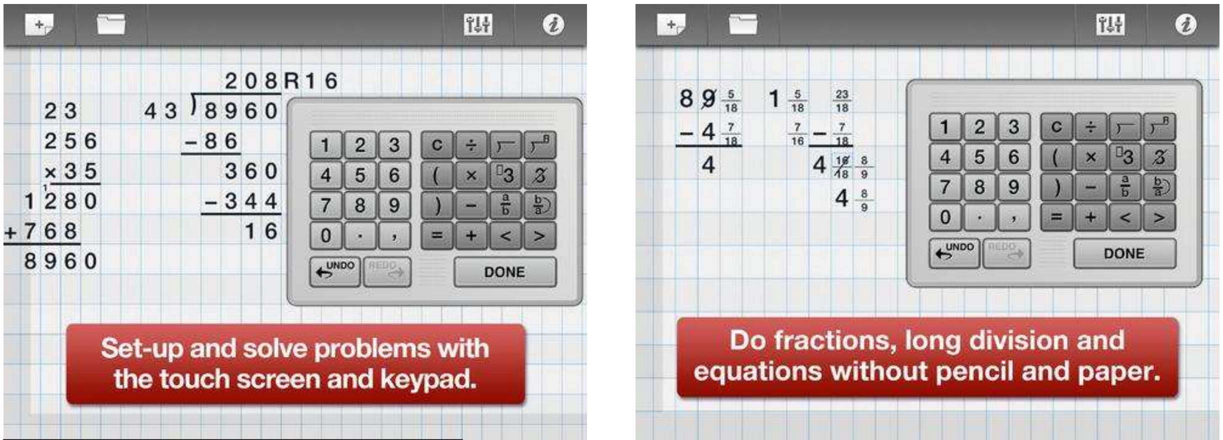


Figure 8: *ModMath* Screenshots

paper interface restricts text to one-character per box, which maintains a neat and easily understandable interface to work out problems. The computations can get complex, involving long equations, and variables in addition to the four basic functions.

ModMath is extremely neat and simple to use. However, it does not fully satisfy our client's needs. It does not support graphing functionality, which is a significant part of the student's mathematical education. At the very best, *ModMath* is a supplement to the student's learning, allowing them to execute intermediate computations through the application. Although it is useful, it does not satisfy the range of functions needed by the client.

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[6] - see [2]

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[13] - see [12]

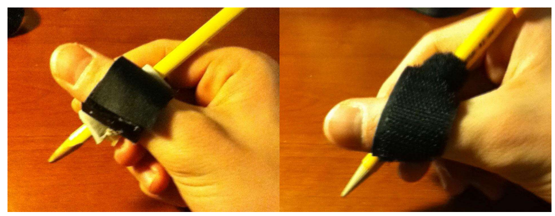
[14] - see [12]

Appendix C: Mockups

The purpose of this appendix is to describe all of the iterations of mockups we developed, and concisely summarize our observation findings from user testing. From their reactions, we focused on improving the effective mockups they preferred and moved away from the designs that were ineffective and disliked.

Figure 9

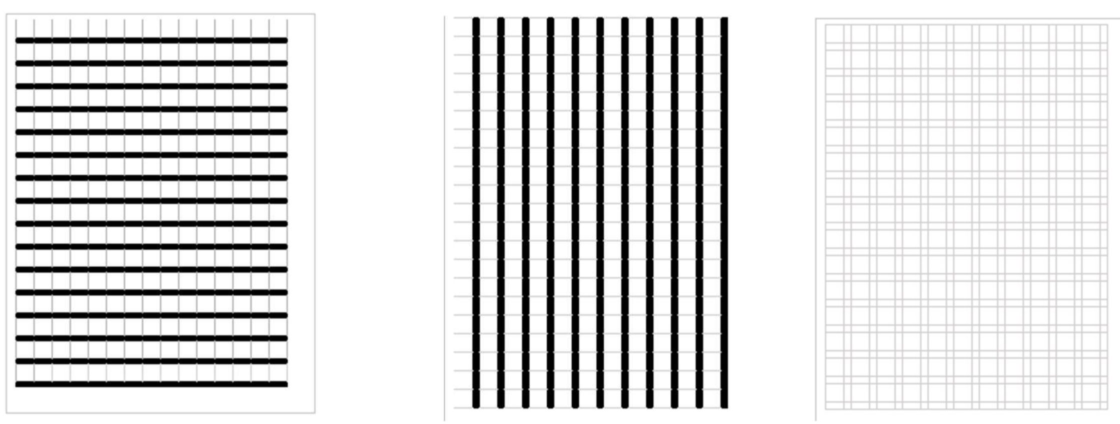
Pencil Grip



This design is a soft rubber grip that is bound to the pencil with a velcro thumb attachment. One part of the pencil grip fits around the thumb as shown, while the other is wrapped at an angle, so the index finger can fit. After showing the user how the pencil grip works, we asked them to test it. The pencil grips showed no significant improvement in the user's handwriting. Thus, we decided to move away from this design.

Figure 10

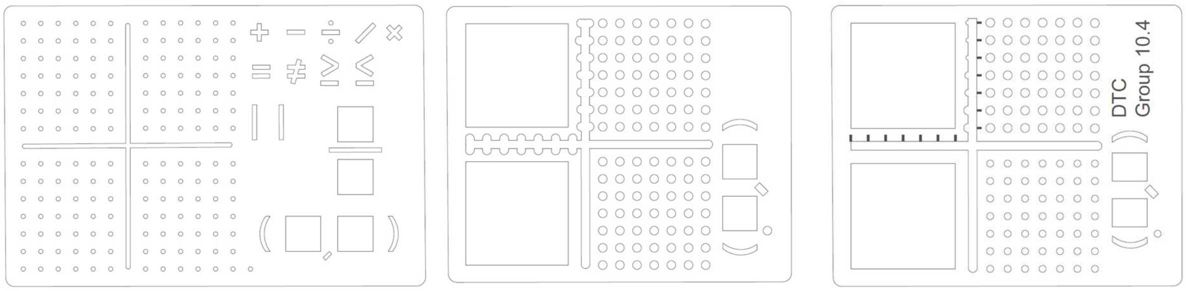
*Specialized Graph Pape*r



This mock-up is graph paper with bold black lines in a vertical or horizontal alignment; paper with empty lines meant to be filled in. For the first two designs the users were given the paper with no instructions. Users naturally flipped the paper with the vertical black lines to a horizontal orientation, rendering the change in orientation ineffective. When testing, users also ignored the thicker boundaries and wrote over the large black dividing lines. When testing the paper with empty lines, the users ignored the boundaries entirely and wrote as if they were writing on printer paper. Overall, none of the graph paper iterations had an impact on the legibility of the writing.

Figure 11

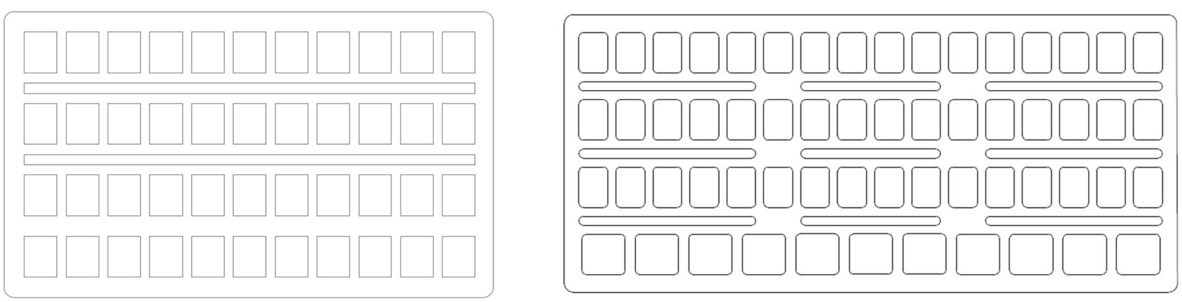
Graphing Stencil



The graphing stencil has a coordinate axes and an array points for graphing functions. The notches, found along the coordinate axes, are included to help the students evenly space the values on each axis. The stencil also includes a coordinate point labeler, in the form of (x,y). This design intended to be significantly better than them having human error affect their work. We determined that students disliked using such a complicated design, and that this design did not improve the students' algebraic expression writing- a major issue for them.

Figure 12

Box Stencil



The stencil has several boxes for writing numbers; the boxes are equally spaced at a uniform height and width. The numbers and math symbols will be aligned equally, keeping the student's work organized. The width of the boxes also accommodates two character numbers, so double digits or decimals do not become cramped. In between each row of fraction bars. These lines are for bars that can represent fractions, and the boxes above and below the line are aligned keeping the fraction organized. The supports increase the structural integrity of the stencil so it does not break when stress is applied to the fraction lines, since they are a structural weakness.

Appendix D: User Observation and Testing

On Thursday, January 22, 2015, Jeremy Midvidy and Jack Christensen, two students on this team, traveled to Edgewood Middle School in Highland Park, IL, to observe students with dysgraphia working out math problems. The purpose of this visit was to gain a better understanding of the nature of the student's impairment, so as to create a tailored solution for our users.

Methodology

The students observed are pulled from class one period for small group math which gives them extra time to account for their various conditions that affect their handwriting. The team gathered information with students in two ways: observing them as they worked through their math problems or speaking to them directly. From watching them, we were able to observe their handwriting, mechanical movements, pencil grips, and writing techniques. From speaking with them, we developed a better understanding of how they view math, and what kinds of specific troubles each student may have.

Observation

We observed Adam, a 7th grader attending Edgewood Middle School in Highland Park, directly as he worked through his math midterm.

Observations from Adam's work:

- most multiple choice problems are done mentally without showing work
- writes large, sloppy characters
- equals sign consistently overlaps with numbers to the left and right sides
- each horizontal line is level
- vertical spacing between horizontal lines is typically large
- Adam usually runs out of room before he can finish a problem

- when he runs out of room, he finds any why space he has left in the question area to compute steps
- commonly scatters steps
- trips up on work
- no problem with cognition or understanding problem (he was able to explain it verbally)
- number lines are easy and neat (horizontal drawing)
- graphs with two axes are well constructed, however, plotting of points is typically messy and inconsistent
- number lines are drawn by hand and tend to not be straight making it difficult to determine where the point is plotted sometimes
- when an inequality is plotted on a number line the shading is easy to recognize overall
- drawing lines in 2-Dimensions is difficult, lines are curved, slanted, or entirely incorrect
- handwriting is also messy

Two students, Toby and Luca, were spoken with and provided details on how they work out math problems and currently view math in general.

Notes from Speaking with Toby:

- likes math and problem solving
- easy to understand and work through steps
- draws a V-shape on his paper as he works through problems, helps him maintain neatness
- uses a lot of space to solve problems
- graphing is the most difficult part, drawing curves or lines in space is tricky
- says he prefers to use graph paper when solving problems

Notes from Speaking with Luca

- overall he enjoys solving his math problems by hand on paper

- dislikes doing math problems in a predefined box, mentioned Pizzazz as an example of having small boxes to solve problems in
- does a lot of long division as part of the curriculum
- seemed to prefer graph paper because it wasn't as restrictive on how he could organize his work
- the homework he does in class wants the students to draw the graph, not generate it using a computer or some other device

Second Round of User Observation

For our second visit on February 12th, we brought four different mockups to be tested. These mockups included a box stencil, a graphing stencil, a pencil grip, and various graphing papers. We again observed Adam, the same user from the first observation. The observations pertaining to him using each mockup are listed below.

Box stencil

- Occasionally moved the stencil down a row instead of going to next line
- Used the fraction bar
- Good sized stencil
- Leaves behind a lot of empty space
- Occasionally slides the stencil left/right when adding variables or second digits

Graphing Stencil

- At first did not use the tick marks provided
- First time drawing the axes, Adam struggled at the center point
- Does not use the dots on the stencil to plot points
    - would rather have open space with no stencil
- Uses the stencil as a ruler
- Adam says that it slows him down which could be a good thing
- Does not line up the dotplot with the corresponding dots
    - Writing could intersect a line unless it were rotated
- Having a thin stencil makes it bend

Pencil grips

- Grips were designed for righties; adam is a lefty
    - We improvised a quick orientation switch to work for lefties
- They are tight enough
- Foam design is not comfortable, does not work well with small hands because of the added separation
- Adam’s fingers are much smaller and grips need to be tightened
- Handwriting shows no significant improvement
    - Adam says it could help
- Both grips make erasing difficult
- The foam design was lighter and less encumbering

Different Graph Papers

- Respect the vertical faded lines at first but then starts to cross over
- Horizontal lines are too spaced out
    - Adam is used to using graph paper with big boxes for homework
- Using paper in portrait is better than landscape
- Writes on the black lines when doing things like balancing the equation
    - Wasting a whole line to write +3 does not make sense and Adam would rather have it compact
- Empty graph boxes are weird and not very comfortable to write on

Appendix E: Instructions for Use

The following are the instructions for how to use the Box Stencil.

Setup

1. Have paper in portrait position
2. Place the stencil (with big boxes on the bottom) on the paper so that the ends line up with the right and left ends of the paper.

Use

1. Write one to two digits or symbols per box while writing out work
    a. Use fraction bars where needed
    b. The expanded character boxes on the last row of the stencil can accommodate three characters per box
2. For clarity of work, start writing on a new row for each new step in the problem
3. If the problem requires more than 4 lines:
    a. move the stencil down and align the top row of boxes with the previous last row of writing
    b. continue writing in the next blank row of boxes

Storage

- We recommend the stencil be stored flat, in a location such as a binder or folder.

Appendix F: Instructions for Construction

This appendix provides the information needed to construct the Box Stencil.

Bill of Materials				
Description of Purchase	Quantity	Vendor	Part Number	Cost
12”x24” 3/32” Polycarbonate	1	McMaster- Carr	8574K39	13.84
			Total Cost:	13.84

Tools

- A water jet (water cutter) is needed to cut the polycarbonate sheet
- NOTE: A laser cutter can not be used to cut polycarbonate for safety reasons.

Preparing the Material

- Because of the vibrations and intense forces the water jet creates, we recommend that the plastic sheet on the cutting side (side facing up) of the polycarbonate be removed to prevent it from snagging on the nozzle of the water jet.
- The polycarbonate should also have two to three inches of excess material around the planned cut outline, so that it can be safely secured with weights to the cutting table.

Cutting the Material

- Using the provided AutoCAD drawing, input the file into the software for the water jet. Make sure to have a professional trained in the use of this machine present for this entire step.
- Secure the material on the water jet table, and stand a safe distance away from the machine while it is cutting the material.

Finishing Steps

- Dry off the polycarbonate sheet and stencil. Both will be wet and most likely have wet sand on them (the abrasive used in the water jet).

- Remove the plastic from the back side of the stencil
- Remove the small polycarbonate filaments attached on the back side of all of the cuts. These are from the cutting process- they pose no harm and do not interfere with the use of the stencil.