Connecting the lines: A practitioner's report on using ToucheTech's Tactile Geometry Construction Kit for the students with Visual Impairment

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Abstract

Learning geometry concepts has been a persistent challenge for students with visual impairments. The lack of appropriate accessible tools for geometry construction and drawings have resulted in students' disinterest towards the subject. The common pedagogical resources around Geometry construction and drawings for the students are limiting and rely on negative impressions. In this practitioners' report, we spotlight the research and development of a Tactile Geometry Kit – a patented range of accessible tools that are deployed in special schools through Vision Empower's pan-India network. The report chronicles the evolution of the Touchetech's tactile geometry kit and its implementation. Through observations and interviews, we report teachers' perception towards the geometry kit and its potential scope as they integrate it into their lesson plans. The report offers insights about successful adoption of assistive technology innovation in the domain of education. Vision Empower's rigorous field immersion brings to the fore the value of employing universal design for learning (UDL) principles for deploying grassroots AT innovation.

Introduction

"Tell me and I forget, teach me and I may remember, involve me and I learn." - Benjamin Franklin

Blindness is a physiological condition with no bearing on intellectual capabilities and it has long been established that students with visual impairment (and no other constraining additional disabilities) can fully engage in and learn about the world through all subjects, including Social Studies, Science, Maths, Engineering etc., without requiring a "special" curriculum, that is most often a reduced theoretical version of the original one for the sighted students. Many notable Indian and international persons have disproved the myth that students with Visual Impairment (VI students henceforth) cannot learn and understand STEM subjects. However, for the VI students to be able to learn these subjects effectively, the mainstream curricula that are designed for the sighted needs to be necessarily adapted using various assistive methods and technologies.

For the majority of the curriculum components that rely primarily on reading, writing, and comprehension, many accessibility solutions to assist the VI students have been in practice. For example, reading and writing are facilitated by audio solutions (e.g., screen readers, audiobooks in different formats) [6,7] and tactile solutions (e.g., Braille and Nemeth Braille, available on paper or refreshable displays) [8]. For concept understanding, tactile diagrams, models, and experiential learning activities have proven effective [9].

However, certain components of the curriculum, like art and craft, sports, lab work, and geometry construction, pose unique challenges, raising fundamental questions about accessibility and inclusion.

Visually impaired students in India face significant challenges in learning visual concepts in STEM subjects [5]. Concepts around Geometry, for instance, are inaccessible to students as the existing curricular and pedagogical resources do not afford accessible ways for VI students to learn and practice this visual subject [1].

Specifically in STEM education, geometry construction has been a contentious area, eliciting doubts:

- Do blind students even need geometry?
- Can students with blindness draw?
- Can they measure accurately?
- Can they construct geometric figures with accuracy?
- Can they handle multiple instruments, including sharp ones, safely and effectively?
- Are the geometry tools available in India being used effectively, or is selective learning happening with omissions and substitutions of concepts and questions in the syllabus?

Traditionally, the substitution or omission of activities or questions such as constructions or measurements in geometry (as well as lab work etc.) has been an accepted norm. In the present age of technological advancements, numerous tactile solutions can be made available to construct an angle, bisect a line etc. If so, the omission for VI students can be removed so that their understanding of geometry is not hampered by the lack of hands-on activities.

Focusing specifically on geometry construction, this practitioner's report highlights the practical application of Touchétech's Tactile Geometry Construction Kit [2,3] by Vision Empower in their engagements with special schools for the blind [10]. It examines how this innovative tool enables students with visual impairments to perform geometry tasks independently and competently, fostering inclusion and advancing accessibility in STEM education.

Background

Pursuing highly visual subjects such as Science and Maths has been a huge challenge for the VI students, especially in India, where many schools and state governments themselves limiting the subjects only up to Class 7 due to the various constraints. But scientific thinking and mathematical reasoning is essential as much to the VI students as to the sighted children. Some of them who really have a passion for these subjects are forced to take up other arts subjects because of challenges related to resources and teaching. Many institutions working in the area of special education for the VI students so that they pursue the STEM subjects in high school and further have addressed these challenges by using national and international tools. Especially, in the area of teaching geometry, the various components of the kit were made available by various vendors which were curated and used. In doing so, they faced challenges in deciding which tool to use, how to use them effectively for constructions or measurements, and which method or system worked best. Each tool had unique advantages and limitations in its design and method, often depending on the specific construction task. For instance, a tactile ruler by one manufacturer might suffice for drawing a line segment but fail to be effective when joining two points to create the line or angle bisector. Additionally, the design of many tactile geometry tools was rooted in older systems of tactile drawing. These tools were developed during a time when reverse drawing (negative impressions) on Braille paper was the only option —i.e. drawing on one side and feeling the raised lines on the other side of the paper, and hence the tool was designed accordingly. As a result, the design and method of the tool didn't align effectively with the newer approach of same-side impressions on plastic textured sheets or other methods.

Over the years, tactile drawing tools have evolved significantly. Early methods relied heavily on spur wheels used with Braille paper, which created raised lines on the reverse side. This process required mirror-image drawings to ensure accuracy on the tactile side. With advancements in tactile drawing, newer approaches emerged, such as creating same-side raised impressions on plastic sheets (though these sheets were expensive and challenging to procure). Educators have shared notable experiences that highlight the limitations of older methods. The chore of using the spur wheel on Braille paper to carefully draw mirror images to ensure the raised lines appeared correctly can remove the interest of even an ardent learner, especially a child.

In 2017, the Xavier's Resource Centre for the Visually Challenged (XRCVC) launched a systematic study to evaluate all the tactile geometry tools available in the market then. This research involved testing national and international geometry construction sets that were most widely used with a diverse user base to identify the most effective elements for creating a comprehensive accessible geometry kit. The findings culminated in the publication of the 2019 report, **"Degrees of Accessibility" [1]**, which served as a guide to aid anyone interested in working with or designing a universally accessible geometry kits. In the Degree of Accessibility research [1], six core skills related to the geometry concepts that a student must learn were identified. These skills include:

1. Constructing a line segment
2. Measuring a line segment
3. Constructing an angle
4. Measuring an angle
5. Drawing/Constructing a Circle
6. Constructing/Cutting Arcs

Research conducted by XRCVC [1] assessed different tools available along these six core geometrical construction skills. Notably, a few critical limitations of existing geometry tools emerged:

1. The process of drawing a tactile line (the most frequent step to be performed while learning geometry) necessitated using expensive parchment /textured papers that were not affordable for the students in the Indian context.
2. The process of aligning the ruler/protractor with the tactile line involved extreme complexities as they had to figure out the accurate positioning of the points. The lack of tactile markings made it difficult to accurately situate the points, leaving the students perplexed and exacerbating disinterest in learning geometry topics.
3. While drawing different shapes, students first had to imagine a negative impression, i.e., the mirror image, to draw the shape on the paper. There was a severe need for a tool that enabled a positive impression on the paper, easing the cognitive load of the student learning geometry.
4. Students had to use different tools designed by different manufacturers with varied conventions and design standards. As a result, the process of drawing and geometry construction entailed navigating different materials and design conventions. Unlike their sighted peers, students with visual impairment lacked a compact geometry box or a kit.

Vision Empower, an NGO that was founded in 2017 designed its interventions using a systematic research-based approach. The primary research on Needs Assessment adopted ethnographic methods and focused on stakeholders in the education system for the visually impaired, particularly in Karnataka [5]. The key stakeholders in the research study included students, teachers, enabling agencies involved in providing resources to the students with visual impairment and technology designers in labs and corporate organizations engaged in supporting their education [11]. Data from public reports regarding persons with visual impairment, their education and the pedagogic processes and technologies being used by them in India were gathered. Using a mixed ethnographic approach of data gathering through participation and observation (including field immersion exercises such as observing classroom lectures, conducting institutional workshops, and participating in teacher trainings as active participants in a peripheral membership role, interviews with structured questionnaire to understand the prevailing scenario of STEM education of VI students in India, in terms of availability of resources for education, employment opportunities, technology use, design of various technologies, support systems available such as resource providers and families/mentors etc.), the needs and gaps were identified. The research led to findings which were classified in terms of three major challenges being faced by the stakeholders and their views on the possible ways to address them:

- Lack of Accessible Science and Math content.
- Lack of trained instructors for the VI students.
- Lack of Infrastructure and technology aids for the visually impaired, and the process of their creation and use.

Vision Empower also identified the issues with teaching and learning Geometry by the students during their primary research as well as further implementations. The issues identified were discussed by Vision Empower with XRCVC and the inventors at Touchétech to find a solution where tactile accessibility was built-in from the beginning of the design and build of the product and not as an afterthought. The need was to make a kit that addresses the challenges highlighted in the report and also one that can be cost-effective and sustainable to be taken to all the VI students in India. The geometry kit consequently created was added to the STEM Kit of Vision Empower and distributed to all the schools they engage with since 2020. After the use of the kit in the field, we report the findings about the usage of the kit and what it means for math education for the visually impaired. The design of the Geometry kit is presented in the next section.

Touchétech Geo Kit Design

Based on the detailed research report from XRCVC and the inputs from the usage of various Geometry Kits by Vision Empower. Touchétech, set out to create a geometry construction kit which was not just a minor adaptation of the sighted kit for the VI students but a tactile by design kit.

“The principal object of this invention is to provide a Tactile Geometry Kit comprising a set of Tactile Geometry drawing measuring tools to facilitate a use of the tools by the sighted and visually impaired alike, having a common feature of groove-based location and measurement guide for use with a stylus or drawing tool or marking or locating pin.” [2,3]

This tactile-by-design approach paved way for the guiding principles of same side drawing, self-centring V or semi-circular profiled grooves that accurately locate and guide objects placed in them towards the vertex or lowest point of the groove, smooth measurement to marking ability – without additional simultaneous finger to tool and finger to marker alignment , intuitive interval markings that can be located rapidly, easy movement across the tool for larger units, pinning feature to keep the tool immobile during the course of work, linear and radial measurement according to need and not pre-determined by the designer, accurate positioning and measurement that eliminates errors, natural functions of the tool to achieve the purpose (e.g. angle bisectors etc)

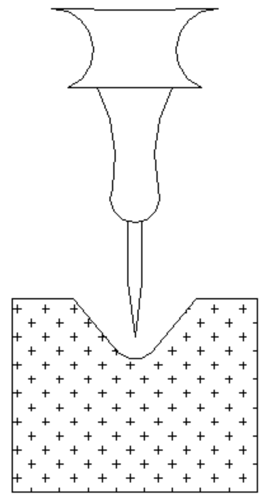

Figure: The V Groove Principle

The Touchétech design principles were also guided by the detailed design recommendations provided by the XRCVC report [1] regarding the size and texture, stopper mechanism, marking system, groove design, clip design, immobilization mechanism, method for keeping the orientation correctly, method for centralizing, method of drawing and measuring, accuracy needs, and user preferred features for each of the elements in the kit. Guided by the design principles discussed above and research inputs about the kits in the market, the newly invented Touchétech Geometry Construction Kit consisted of the following items:

Item	**Description**
Drawing Board	Any firm and elastic substrate like a rubber mat
Pins	Regularly available board pins / thumb tacks
Drawing Sheet	Any routinely used printing paper sheet (A4, parchment, Braille etc.)
Roulette	Roulette is an affordable spur-wheel drawing tool that is capable of drawing tactile lines with positive tactile images/impressions on any paper of choice. The working principle of Roulette requires it to be rolled over the sheet in the direction of choice (instead of dragging it across the sheet)
Ruler	V-grove principle to situate a stylus/pin on the paper. Unlike other contemporary tools, the V-grove principle ensures that the stylus remains fixed in position while aligning the side. It accurately locates the stylus without any risks of slipping out of the grove. The two sides of the ruler have coarse and fine groves. The stylus jumps from one grove to another - placed at a distance of 10mm (larger grove). It also has a teardrop design at the surface to help easily locate the side of the stylus. The coarse side has smaller groves placed at a distance of 5 mm. The principle of groove is such that one could align the stylus from the zeroth place to the desired distance by sliding the stylus. One could also use the pins directly in lieu of the stylus to locate / measure and then directly slide them off the ruler on to the paper. One could also use pins to compare the distance. The ruler

	could also be fastened on the paper using pins using the holes that are marked on the surface at regular intervals. One can also locate the grove by placing the pins at the tactile markings placed at a distance of 10 mm.
Protractor	Designed with the V-grove principle, ensuring accurate pin markings. The centre of the protractor has a V-grove to accurately position pins towards the point or vertex from which the angles are to be measured. The two ends of the protractor could be fastened using the push pins on the board to ensure stability while measuring. There are tactile markings for 30, 45, 60 and 90 degrees. This is in addition to the rapid locator grove, which has 15-degree groves for rapid location in 15 degree intervals. The two ends referred to as land areas allow the protractor to be aligned with the base line by directly by butting against a pin placed on the base line. The design is sturdy to prevent errors in measurements due to movement. The protractor allows one to precisely mark the vertex and the baseline. Extensive focus was on the usability of the protractor to make it efficient for reading markings, making measurements, and accurate alignments.
Bisector Arcs	An unique item in the kit, the bisector arcs fundamentally revolutionized the process of locating points of intersections. With an auto-locate feature to align with endpoints and points of intersections of arcs used to bisect lines or angles, the bisectors are used as matched pairs. The functioning of bisector arcs is in stark contrast with the functioning of a traditional compass. The compass would entail drawing sets of arcs along the line and putting pins at the point of intersection in order to draw the bisector line. The bisector arcs have a curved surface with groves on the other ends, thereby forming a "T". The groves serve to locate a pin at the centre of the arc produced by the bisector. The arcs are rotated until a point where the two arcs surface comes in contact with each other. Based on the alignment of the centre, a pin is attached to identify the point of intersection. Next, the bisectors are swivelled in another direction to follow the same process on the other side of the line. Thus, by pushing pins at the two ends, the bisector arcs help accurately position the points of intersection along the line. With a similar process, bisector arcs can also be used to bisect angles. Thus, bisector arcs could replace the compass
Compass	Designed as a bar with a spur wheel tip (similar to the Roulette device) that can be held with both hands. It has tactile markings from both sides of the main bar. There is a tactile marking every 10 mm for sliding the pivot. The pivot is fixed in the position with a knob. To move the pivot, one could loosen the knob and move in desired direction. The pivot has tactile markings that can be aligned with the frame. The pivot also has a protective nut to ensure that the sharp pivot does not accidentally hurt the students.
Working Tray	A normal pad with a clip on facility to hold the mat and the paper
Carrying Case	A compact pouch/ box with the items in the kit that can be carried daily in the school bag

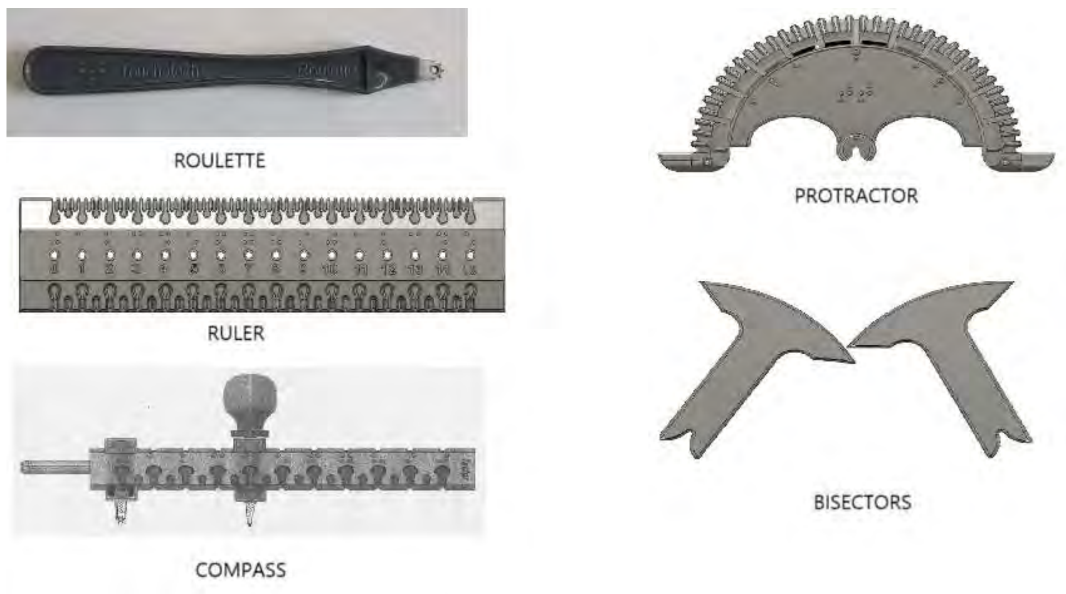

Figure: ToucheTech Geometry Construction Kit with the various items

These tools were disseminated across India through Vision Empower's network of special schools. User feedback about the material helped in refining the design further. For the Roulette, there were about 50 trials for the gear wheel and teeth design. About 500 Geometry kits were distributed through the local network of school coordinators and an extensive set of video tutorials to familiarize the tool. The school coordinators acted as last-mile peers to acquaint the teachers with the geometry kit and effectively integrate it within their existing pedagogical practices without disrupting the classroom structure. Integration of geometry kits in the lesson plans ensured that the students could imbibe essential geometry skills. The teachers appreciated that the tools empowered them to inculcate learning outcomes that were at par with the sighted students.

The **Touchétech Lab's geometry construction kit**, particularly its **Roulette**, revolutionized tactile drawing by enabling same-side raised positive impressions on simple printer paper. This innovation eliminated the need for costly materials like Braille paper and complex setups, making tactile drawing affordable, accessible, and efficient. It is a tool that can be used not only for Geometric constructions but for instantly drawing tactile or raised lines, whether when studying, or when teaching students with blindness. This advancement marked a significant step forward in making tactile drawing accessible to all. The roulette eliminates complexities, providing a simple and intuitive solution for tactile drawing and geometry construction.

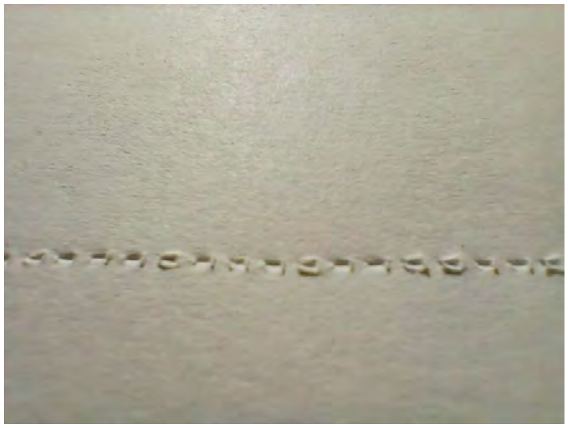

Figure: An image of a positive tactile line produced by Roulette

Implementation and usage in the field

Upon using the newly developed kit, the XRCVC research team tried the same and gave their valuable feedback:

“The roulette simplifies tactile drawing by not only providing same-sided raised images but also making the process more affordable and accessible. There is no need for costly Braille paper; simple printer paper works perfectly. It also eliminates the need for bulky tools or complicated setups required in other methods to achieve same-side impressions. The ingenuity of the roulette lies in its simplicity. While its mechanism resembles that of a spur wheel, it produces entirely different results, making tactile drawing—and, by extension, geometric constructions— simplified and accessible to all.”

The introduction of tools like the roulette has redefined accessibility in geometry, enabling students with visual impairments to engage with STEM subjects on equal footing with their sighted peers.

The Geometry Kit was made a part of the STEM Kit of Vision Empower which comprises of a set of curated accessible resources that help in the better learning of the Science and Math subjects by the VI students. The Vision Empower field personnel were first trained on the usage of the geometry kit. Videos were published about the usage of each of the materials on Youtube. Teachers and special educators in the schools which VE worked with were then introduced to the Geometry kit and trained on the usage of the items of the kit. The feedback received from the usage by the students have been very positive and encouraging. The following section provides user feedback about the various aspects of the kit.

a) Teachers’ and Students Learnability

“While many Geo kits have supported the same side drawing recently, the sheets used for the same have been difficult to procure by everyone. The roulette of the Geometry kit simplifies tactile drawing by not only providing same-sided raised images but also making the process more affordable and accessible to all” (XRCVC Team)

Figure : Drawing with a Roulette

Figure : Usage during teacher's training

The removal of the necessity to create a mirror image and reverse the paper to feel the drawing has taken away the frustration from teaching and learning the subject itself leading to teachers eager to teach and students eager to learn the subject and not fear it anymore, adding it as one more thing that they cannot do at par with their sighted peers.

"Actually our students really like that geo kit as this geo kit small n compact easy to handle so looking forward to work on this and with help of that students first time made circle with rounder." (A Special Educator)

"Early we used to only teach them orally and sometimes do the construction with the normal kit on paper and make them feel the lines drawn or use ice cream sticks to show them the shape of triangle, square etc. But with this kit, now they can create all these shapes themselves. The joy in their faces after they get it is really wonderful and makes us also feel very happy. Even the completely blind is able to do this very well. " (A Special Educator)

b) Efficiency and Effectiveness

Addressing the practical issues which impact the usage of the tools is very important, especially in the case of a geometry kit where precision is of utmost importance. The key errors come from slipping, sliding, inability to maintain straight lines, measuring minute measures, being child-friendly, being compact to use and carry to school and home. The following inputs from the students and the teachers indicate the various aspects of the effectiveness of the kit.

“This kit is practically usable by our class 7 and 8 students to do all the sums in their text book. In class 6 we introduce the various items in the kits, naming and making them touch and feel them. In class 7, we start the portions with one or two classes (based on the ability of the child) of step-by-step introduction of each item and its usage. But once introduced, with practice, they are able to do the sums confidently on their own. They are attempting the 5 mark geometry chapter question in their exam with this kit. “ (A Special Educator)

“The essence of the Touchétech Lab's geometry construction kit, for me, is the roulette - a tool that can be used not only for Geometric constructions but for instantly drawing tactile or raised lines, whether when studying , or when teaching students with blindness.” (A Special Educator)

“The roulette revolutionized this process by enabling raised-line drawings directly on regular printer paper, producing positive impressions or tactile lines on the same side—a game-changer. The roulette changes everything. To me, it is revolutionary in this regard.” (A Special Educator)

“The tools are easy to use. I really love the ease-of-use, and the self-centering grooves. They make drawing and measuring much easier.” (A Special Educator)

c) Satisfaction

Teachers have reported increased interest among the students about math and geometry in particular after the arrival of this kit.

“The students have become very interested in Maths due to the play-based methods of Vision Empower. They are eager to do geometry with the kit. Earlier they used to be scared, but now they are ready for even two periods of math. Even the average student is ready to do math now. Their enthusiasm and confidence have surely increased.” (A Special Educator)

“One student came back and told us how he could participate in a discussion about geo sums when he went home for vacation with his sighted friends. He was happy and proud to tell them that he also did geometry with a special kit.” (A Special Educator)

The satisfaction of the teachers and students is not just evident in how they like this tool but also in how they suggest what more they want to make it usable by them. Some inputs have come in such as these that indicate the engagement of the users with the kit.

“I’d like to see a few more ruler sizes. Maybe a 30 cm and a 10 cm as well? A 30 cm ruler would especially be useful.” (A Special Educator)

“The protractor is one thing I had a lot of fun with. I really like the concept, and the execution is no slouch either. It works as it should work, and it has not let me down yet. I do think that the smaller protractor has grooves that are a bit too small, but it’s no dealbreaker.”

“Finally, I loved the bisector arcs. I would like to see more sizes in that as well, but it’s just soo cool.” (A Special Educator)

“Overall, this hasn’t just been exceedingly fun, but also useful. It’s solved a lot of problems that used to make me hate Geometry. I’d like to see how this can be evolved, and the new tools that can be made using the same principal.” (A VI student)

“Arc markers, the minimum line segment students learn to bisect in school is 3.5cm, and the maximum is 15cm. Hence possibly, there can be three arc markers of the length of 3cm (for 3.5cm to 5.9cm), 5.5cm (for 6cm to 11cm), and 8cm (for 8.1 cm to 15cm). Students can use the 3 cm arc marker for bisecting angles and dividing lines in various ratios as sighted students." (A Special Educator)

The following pictures highlight the usage of the kit by the students.

Discussion

Appropriate, functional tools have been a key factor in the evolution of man on this planet. Every object that we use today has undergone numerous iterations and the principle of survival of the fittest applies to technologies as well. Those that have addressed the needs of the users and enabled them to realize their goals accurately have mostly emerged as the favoured designs. In the world of assistive technologies however, some solutions attempt a marginal improvement in the existing tools to make them accessible for users with disabilities. More often than not, this leads to sub-optimal designs that do not serve the disabled community well. However, when the design is done with the core principle in mind from the beginning, it results not just in a more usable product but also innovative ways to address the problems in the first place (bisecting with arc bisectors without using the compass).

This geometry kit has attempted to address the challenges faced by its predecessors by adapting a tactile-first design approach and hence is usable not just by the Visually Impaired students but also by sighted students who are tactile learners. Such approaches are needed in the design of every tool so that accessibility features are not added as an after-thought but built in. These lessons are useful for designing and developing any assistive technology for the disabled people. The consequent design and products where the perspectives of the users are included from inception will fulfil the voices of “nothing for us without us” and “technologies not to fix but to support” from the disabled community. With the byline that “Feeling Matters”, the founder of Touchétech clarified how the tactile philosophy was built into the kit.

“In the geometry kit, if we see – feeling the point is the most important part. Earlier versions of the protractor used pivot point and that was not feasible. With all the tools in the kit, I used the “V” groove principle. That is the foundation behind all the design. Be it measuring or drawing the line.”

Best practices and recommendations

a) Introduction of teachers to the kit

Detailed lesson plan and Teacher Instruction Kit to be prepared for the Geometry kit that includes the introduction and usage for each of the items with hands-on exercises. Short videos about the usage of the tools to be published with the problems from the text book. Special cases where the teachers themselves are visually impaired to be considered when making the lesson plans.

b) Introduction of VI students to the kit

Items orientation, best practices of using each of the items to be conveyed to the students. Series of exercises with the items that strengthen their familiarity and confidence in using the tools to be crafted and included. Sample videos of how the tool is to be used to solve all the curricular questions to be published for reference and practice.

c) Class work and home work using the kit

Students should be encouraged to complete the class work and home work using the kit regularly so that their familiarity and confidence can be increased by repeated use.

d) Assessments using the kit

Questions from the geometry chapters to be included for the VI students as well and students asked to solve the problems using the kit during the examination time and assessed as is done for the sighted students.

Further, Vision Empower also plans to conduct detailed qualitative research to get the teachers' and students' feedback about the kit as detailed for the other tools in the Degree of Accessibility report. Future research and development may accommodate special needs for students with low vision too.

Conclusion

Assistive Technology for disabled people, digital or non-digital should be built in from the design stage of the product with representation from the user community. Technology transfer from Global North to Global South for the community may not always work as they may be mismatched with the socio-economic contexts of the destination causing low acceptance. Also, given that disability itself is not always permanent and may be applicable to all individuals at some point or other in their lives, an integrated and context sensitive accessibility driven design to support the required functions is needed for all the assistive technologies. The experiences and feedback from the implementation of the Geometry Kit gives an example of how a tool can alter the narrative about whether VI can learn math and opens the possibilities for them, not just to study but also pursue fulfilling careers in maths, construction or architecture if they want. Through these efforts of working with various inventors and institutions, Vision Empower wants to remove any myth that the VI students cannot learn STEM subjects successfully.

About Vision Empower

Vision Empower (VE) is a non-profit established in 2017, dedicated to empowering children with visual impairment in the Global South through inclusive education. VE engages in research and program development to ensure that subjects like Science, Technology, Engineering, Mathematics (STEM), Computational Thinking (CT), Digital Literacy (DL), Language & Literacy, and Early Childhood Care & Education (ECCE) are accessible to them. Our commitment extends beyond creating content for students; we also focus on re-skilling educators and teachers. This enables them to effectively deliver these programs in classrooms, promoting an inclusive educational environment. To enhance the effectiveness of the programs, VE leverages affordable assistive technologies. These technologies not only foster digital literacy among teachers but also support visually impaired students in both special and inclusive schools. VE has been supported by various corporate entities as well as numerous individual donors. This support has enabled VE to design and implement initiatives that cater to the varied linguistic and educational needs of our beneficiaries: the children with visual impairments and their educators.

About Touchétech

Touchétech Labs Pvt Ltd (TTPL) is a social entrepreneurship firm which focusses on solving concerns primarily related to the disabled or challenged. TTPL is committed to improve quality of life for the visually challenged. Touchétech Labs Pvt Ltd is an entity created by Paul Dsouza, an inventor who is dedicating his life to solving problems that need attention. His wide range of inventions and designs have provided solutions to various problems and aspects of life ranging from clocks, gherkins sorting, software and now, the blind.

The Geometry Kit is covered under the following patents – Patent 510160 "Tactile Geometry Tools" granted on August 6, 2021 and the Roulette under Patent 409199 **“**Tactile Drawing Tools” granted on 18 Oct 2022.

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