Educational Toys | A Design Summative Project

Guang Tseng | Design 10 | Semester 2 | Last Updated: March 22nd, 2018
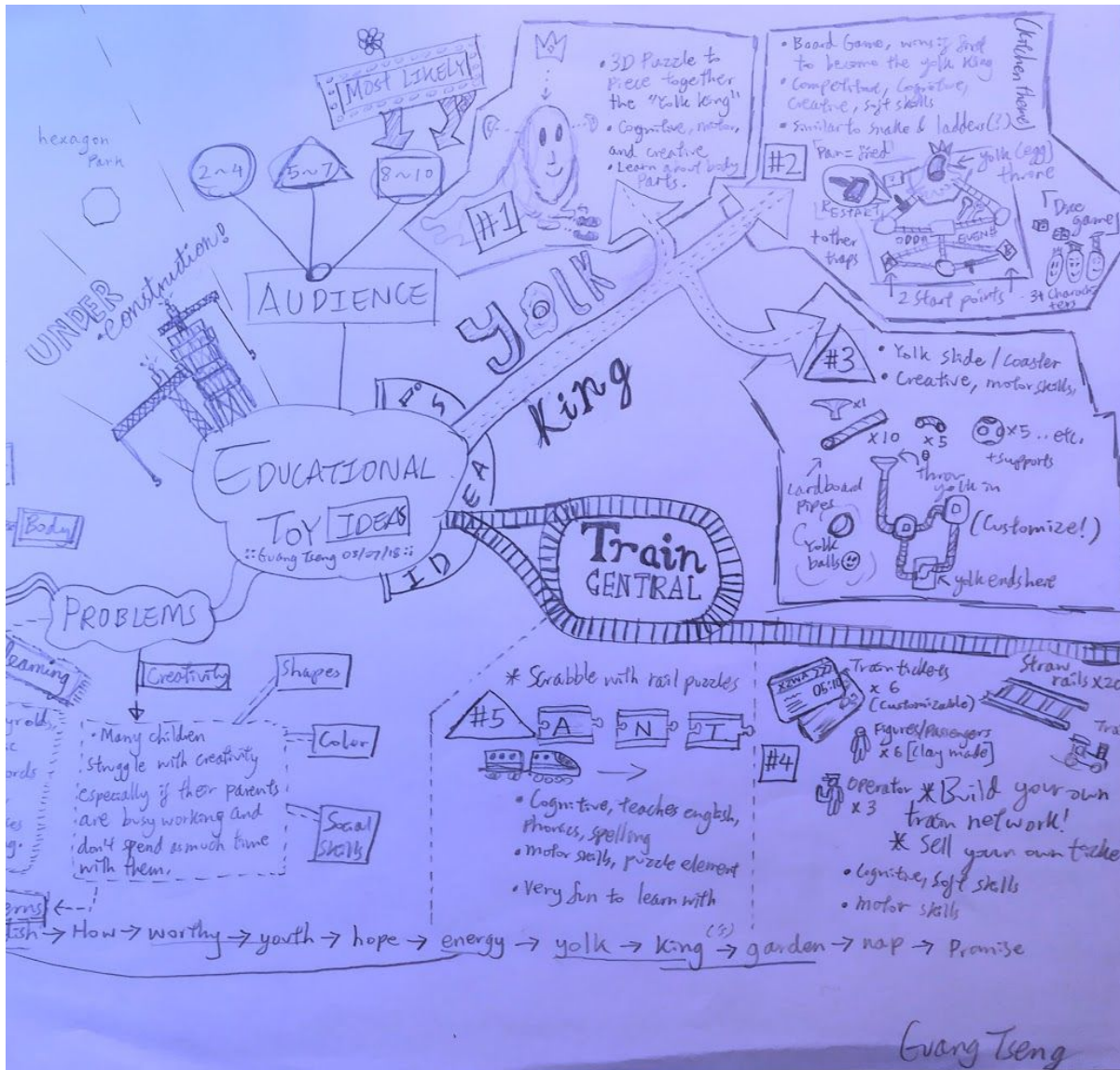
Table of Contents

The Design Situation

The 21st century has created some strikingly fascinating technologies and daily gadgets, it has created the convenience oriented lifestyle of today's society. However, the upsurge in technological advancements has led to the crippling diseases of laziness, ignorance, and carelessness in new generations. To combat this negative trend, Toys R Us has been seeking to expand their educational toys to include ones that can promote extensive cognitive thinking, motor skills, and creativity. It is believed that children attain their core skills and core values up to the age of 6~10 years of age, therefore it is crucial for 6~10 year olds to have educational toys which can build up their character and skills in a positive way.

The creation of toys has been present since humans first existed. Toys are not—as popular thinking suggests—just an expensive magical tool to keep children from bothering their parents. Toys are, in fact, very important to the upbringing and development of any child. The consumer mindset of this century has allowed for the creation of toys that do not teach children positively, therefore, it is important now to create educational toys that can improve children's learning skills and inspire their curiosity.

The solution will have to be feasible, innovative, and appropriate for the target audience. As the solution will require the creation of a child's toy, it is crucial for careful thought to be put into the creation process with a mind for safety as well as enjoyability. Now that the situation and problem is clearly defined, a solution to the growing social negligence can be seen as very much needed. A solution that is genuine in its purpose to educate children and a solution that ultimately benefits society.

Target Audience: Children Aged 6~10
Client: Toys R Us (madeup)

The Research Plan

Priority & Topic	Reason	Sources (P/S*)
1 Children (6~10) needs/behaviour	To understand the audience and their needs in which a solution will be needed; helps facilitate ideas based on reality of behaviour/age.	Internet (S), Interview (P), Younger Sister (P)
2 Types of Toys	To explore and learn about different toys, their purposes, their popularity, and educational values.	Internet (S), Observation at Home/Stores (P)
7 Toys R Us	To know the client, it's mission, and to know what the client expects.	Internet (S), Store (P)
6 Colors	Knowing colors, especially relative to the children, will help in creating a suitable toy with good color schemes.	Internet (S), Ms. Kao (P), **Survey** (P)
4 Safety	The safety is of great concern for kid toys. Safety will help in facilitating ideas that are suitable and safe.	Internet (S), **Survey** (P), Books (P+S)
3 Parenting Opinions	Though the audience is mainly children (6~10 yo), the main consumer of the toys will be their parents. It is essential to understand their opinions, beliefs, and parenting methods before a suitable toy can be created. Research into what parents desire for their kids is needed.	Internet (S), **Survey** (P), Mom (P)
8 Construction Based Toys	The designer has an idea of a train based educational toy which would be customizable, constructable, and requires creativity. Understanding the requirements of these types of toys will help in finding the solution.	Internet (S), Observation (P), **Survey** (P)
5 Materials + Equipment	Materials are limited at KSS, therefore it is important to understand what materials are available, what needs to be used, and what materials are safe/suitable.	Internet (S), Ms. Kao (P), Observation (P)

The research plan gives a clear outline on the topics required for research. This research plan can/will be added onto throughout the project as ideas develop.

Primary/Secondary Research Priority

Priority & Source Type		Reason or Notes
1	Survey (Primary)	A survey requires time to make and time to allow the surveyees respond. Primary sources are of utmost importance and would strongly influence the solutions.
2	Books (Primary)	If books on the topics could be found and are readily accessible, they should be quickly looked over as they usually provide professional and unique perspectives.
3	Internet (Primary + Secondary)	Internet research will likely be the bulk of the researched content as the internet offers millions if not billions of information on the topics listed in the research plan. It would be nice to prioritize primary internet research before secondary, however, in a realistic situation, it would be hard to separate the primary and secondary sources on the internet and both would be viewed in order of being found.
4	Ms. Kao or Teachers (Primary)	Information that requires experience or skills usually require asking a teacher or advisor. Topics such as color are great examples as art teachers (like Ms. Kao) have experience with colors and may be able to suggest fitting colors for the solution.
5	Other (Primary + Secondary)	Other source types include family members, home supply stores, etc. that are not a necessity, but would be a boost to the credibility and plausibility of research.

The Research Contents

*Below are notes that I took from research.
**URL sources that were used (not just skimmed over) are later cited in the Works Cited

1 | Children (6~10) Needs/Behaviours

According to the Healthwise Staff, children between ages 6-10:

". . . develops a more mature and logical way of thinking. He or she gradually becomes able to consider several parts to a problem or situation." (Healthwise Staff)

6 to 10 year olds still can not grasp all ideas or concepts, in contrast, they like to learn in real terms (things they can touch or feel). They are also going to elementary for the first time and experimenting with social feelings. The Healthwise Staff also warn parents to be careful around them as they are still emotionally fragile at times. The child's sense of self-esteem is very important to keep them confident and happy. Children of this age also:

". . . need firm and consistent rules that are explained clearly and compassionately. Effective parents are able to give their children enough independence to learn from their successes and failures and at the same time provide consistent direction and unconditional support." (Healthwise)

Sources:
https://myhealth.alberta.ca/Health/pages/conditions.aspx?hwid=te6244
https://www.webmd.com/children/tc/growth-and-development-ages-6-to-10-years-topic-overview#1
http://raisingchildren.net.au/articles/habits.html/context/727
http://raisingchildren.net.au/articles/encouraging_good_behaviour.html/context/732
http://raisingchildren.net.au/articles/choosing_toys.html
https://wehavekids.com/parenting/How-Toys-Impact-Childrens-Development
https://www.quora.com/What-are-the-basic-needs-of-a-child-at-the-age-of-6-10-years

2 | Types of Toys

According to toy association, the types (categories) of toys are:
1. Action Figures
2. Arts & Crafts
3. Battling Toys
4. Building and Construction
5. Collectible Trading Cards & Toys
6. Costume and Dress Up
7. Dolls
8. Educational
9. Games & Puzzles

10. Infant Toys
11. Miscellaneous
12. Models
13. Musical Instruments & Toys
14. Outdoor Seasonal Toys
15. Preschool Toy
16. Ride Ons
17. Sports Toys
18. Vehicles
19. Youth Electronics

Building Sets and Accessories
Includes items that have interlocking pieces that can be taken apart and allow for building in multiple ways. Also includes any accessories that go along with the building set (wheels, mini figures, etc). This category includes building toys for all ages but does not include traditional blocks, which would be included in the infant and preschool categories for which they are age-appropriate. (Toys Association)

Results from Survey:

What kind of toys did you like to play most as a 6~8 year old kid?
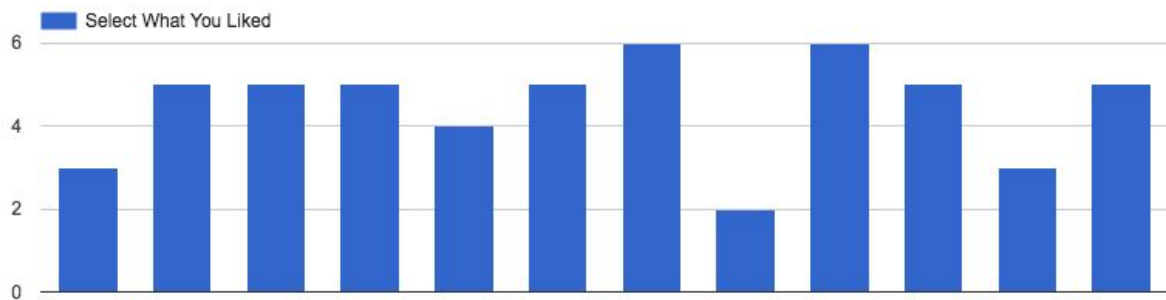
Sources:
http://www.toyassociation.org/App_Themes/tia/pdfs/membership/definitions.pdf

3 | Parenting Opinions

Results from Survey:
"Made with safe materials; design that doesn't fall apart or have small parts; doesn't promote violence."

"Explore the world of nature along with good cultural activities, but should be fun along the way. Studying should be lots of reading and songs/music along with languages, arts, and fun math/science activities. Make studying/learning "fun" so they start to enjoy

studying/learning for themselves. Minimize on pressured studying/learning and tests. Group and social activities along with individual, contemplative activities."

"I think children should be learning a wide range of knowledge and skills but mainly through exploring and discovery rather than intensive studying. Guidance from teachers and parents will be very critical. Also learning how to interact or socialize with peers."

"Kids are often in big cities, not a lot of outdoor/nature experiences.. be more in touch with nature. Explore the world around (safely), develop the senses."

What types of toys would you allow/encourage your kids to play (if they were 6-8 year olds)
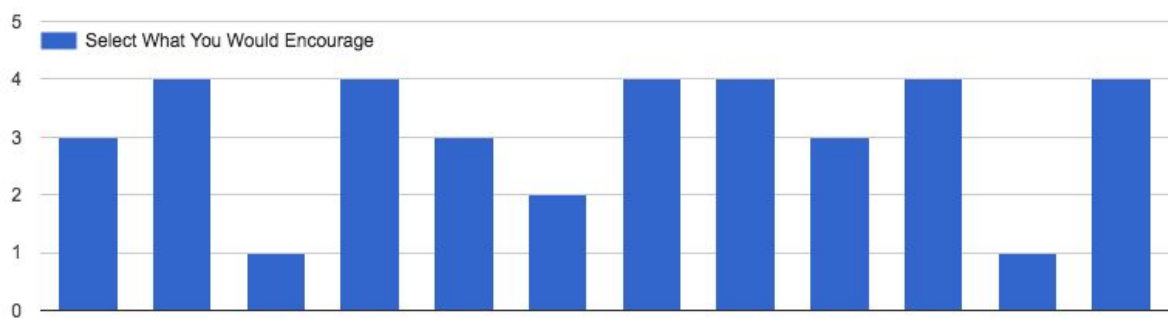
4 | Safety

1) Always pay close attention to the age recommendations on toys and choose one according to a child's age, interest and skill level. Also, be aware of other safety labels such as "Flame retardant/flame resistant" or "Washable/Hygienic materials" on dolls and stuffed toys.

2) Discard the plastic wrappings from toys immediately; they become deadly playthings to small children.

3) For children one and under, choose toys that are colorful, lightweight, have various textures and are made of non-toxic materials. Children this age learn through sight, touch, sound and taste and often put things into their mouths to explore them.

4) Don't give young children any toys with small parts such as removable eyes, noses, etc., they are choking hazards.

5) Inspect all toys for sharp points or edges made from such materials as metal or glass—these toys should not be given to children under eight years of age. This includes stuffed animals with wires that could stab, cut or shock if exposed.

6) Toys with strings, cords or ribbons of any kind should not be hung in cribs or playpens. Young children can become entangled which can cause injury or death.

7) Teach older children to keep their toys that may have removable small parts, sharp points or toys ran on electricity out of reach of younger siblings. Young children are very curious and may investigate toys that aren't appropriate for them.

8) Keep toys and play equipment in good condition, discard any toys that are broken to prevent injuries.

9) Supervision is essential; provide safe hazard free play environments both indoors and outdoors. Toys get used and abused by children; regularly conduct a toy maintenance check for safety and durability.

10) Teach children early to put toys away when they are finished playing with them. This will prevent accidental falls over them.
(Fisher-Price)

Sources:
www.fisher-price.com/en_US/parenting-articles/health-and-safety/10-toy-safety-tips
http://ec.europa.eu/growth/sectors/toys/safety/
https://www.naeyc.org/resources/topics/play/toys

5 | Materials + Equipment

Cardboard, 3D Printer, Balsa Wood, Acrylic Paint, etc.

Packaging:
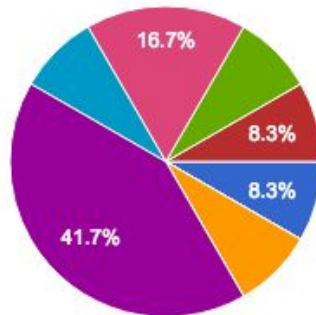http://www.instructables.com/id/Fancy-Rigid-Gift-Boxes/
  - 2mm thick, hard cardboard
  - poster paper
  - spray adhesive(?)

6 | Colors

Results from Survey:

What is your favourite toy color?

12 responses

- Red
- Orange
- Yellow
- Green
- Blue
- Purple
- Pink
- Coral pink!!!
- black

The Analysis of Existing Products

Analysing (i) Material, (ii) Shape & Color, (iii) Educational Value, (iv) Safety & Inspiration.


Multi-Skill Development Toy | By I'm Toy   Age: 3+

The **Material** of this multi-skill development/educational toy is primarily wood. The colors/symbols are printed/painted on and give it a high quality finish. The material of wood is solid and suitable for a small child's toy.

The **Shape & Color** of this toy is well considered as the colors are distinct, contrasting, and helpful in learning the numbers or alphabetical letters. The shape of a triangle is fitting as it helps children understand shape/space, it also allows any side of the triangle to be the base, giving the children space for creativity and motor skills.

The **Educational Value** of the toy is very high for the target audience (perhaps a 7/10 in rating). The triangular prism teaches english, time, numerics, drawing, and motor/cognitive skills. It is very simple but very enjoyable and educational.

The **Safety** of the toy would rate about 8/10 as there are no sharp edges, no way for it to topple over, and no individual (breakable) pieces. Children would be able to enjoy this toy without concern and parents can relax. The toy gives the designer many **Inspirations**. The shape of the toy is especially of interest as it is the same whatever way you rotate it, this gives the toy an advantage in that it can be placed stably on any side. The colors and educational values are also of assistance to the designer as it allows the designer to understand the importance of choosing the right colors but at the same time keeping simplicity so that the child can easily understand the toy. Though this toy is mainly for 3 year olds, a lot can be learned from it and applied to 6~10 year old children toys.
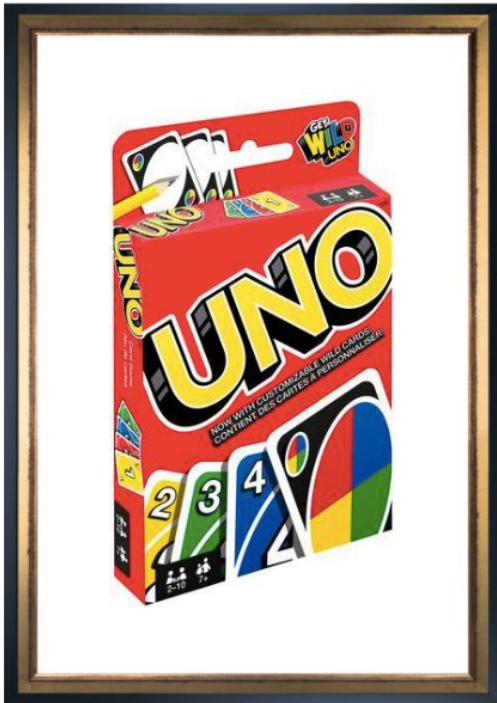
UNO Card Game | By Mattel

Age: 5+

The **Material** of UNO consists only of card paper which is stiffer than normal printing paper. The colors are printed on and the surface is smooth.

The **Shape** of UNO is a rectangular and comfortably held in one's palm. The curved edges of each card makes them relatively easier to hold. The card considers human ergonomics. The **Color** of the card includes red, blue, green, yellow which are all primary colors that humans come in contact with often. The cards are very easy to be distinguished.

The **Educational Value** of UNO cards is quite unique as it is cognitive, competitive, and also improves basic human skills in distinguishing differences. The colors, numbers, and special cards add multiple layers of learning to the game which makes it fun as well as educational. Personally I have played UNO with my 7 year old sister and she has definitely shown improvement in awareness, competition, and critical thinking while playing the game.

The **Safety** of UNO would be rated an 9/10 as there are no real potential harms except for paper cuts (rare with card paper). The rounded corners make it more convenient to be held but also improves the safety dramatically as it takes away the sharp edges. The colors make it bright and easily noticeable which means it will be easy to identify if found in the wrong places (e.g. spread out throughout the house). UNO is very **Inspirational** as it looks straightforward but actually has a lot of depth and game strategies which people develop or learn as they play more. A card game is very much feasible for Design in KSS and could be considered as a design solution.

Road and Rail Train Set | By Imaginarium

Age: 3 - 5

The **Material** of the Road and Rail Train set consists of wooden rail, plastic rail/roads, plastic signs, board paper base, and plastic vehicles. The materials are all highly polished and smooth to the touch.

The **Shape** of the toy is realistic and representative of actual roads/rails. The base is a rectangle while the roads/rails are mostly curvy. The whole toy put together has a harmonic feel to it and looks comfortably messy.

The **Educational Value** of the road/rail toy set is mediocre as it teaches the child a lot about movement, construction, and motor skills, but the game is quite limited in terms of true creativity (map, rail shapes restrict space). The educational value would rank a 6/10 as it could have included more cognitive/creative features.

The **Colors** used in the toy set are mostly of a colder tone (except for bridge and signs) which is what you would expect on real roads. The color appeals to kids because it feels professional and is easy to understand.

The **Safety** of this train set would be rated a 7/10 as there are no sharp corners, no risks in the toy mechanisms, but it does have the potential to be 1) stepped on, which hurts; 2) sucked on by smaller toddlers; 3) pieces are easy to end up lost or broken (sharp edges). The toy is **Inspirational** in that it shows a guided form of creativity and allows the child to grow their creative thinking skills to build the rails, however, since the map and rail shapes make it limited, the child will get bored of the toy after playing with it for a while. The simplicity and complexity of a train set is always surprising and children love the challenge of building their very own train track.

The Design Brief

After having spent time researching the topics from the research plan, the needs and requirements of the design solution has been better defined. Research has determined that the 21st century digital world has negatively impacted young children. This calls for the creation of educational toys to train children in various skills which will give them an advantage as they mature. In order for the design solution to reach a higher potential, the educational toy should promote a variation of skills as well as high levels of engagement.

The final product should promote cognitive skills, motor skills, and soft skills for it to be successfully educational on a balanced level. Developing these skills are very important as it all needs of 6-8 year olds and refines their learning behaviours.

The final product should be under the categories of Board Games or Puzzles, Outdoor/Sports Toys, or Building and Construction Toys as these three categories were found to be popular through the student survey and are good at educating children.

The final product should, according to the ideals of parents surveyed, be fun, safe, somewhat challenging, though also mindful of the child's pre-existing skills so that they could build up on them. Parents believe that toys play an important role in educating children and can be highly valuable in the development of their skills.

The final product should be suitable for children of ages 6-8 with no sharp edges or harmful materials, and with an appropriate ergonomic design for their hands. Safety is a big concern of many parents and thus, it should be addressed carefully.

The final product should be made so that it can easily be stowed away into small storage units as children often leave their toy lying around and parents desire for their kids to learn to clean up after themselves. Perhaps a nicely designed box or bag would help the clean up.

The final product should use materials of cardboard, plastics (from 3D printer), balsa wood, paper or plastic sheets, acrylic paint, etc. These materials are easy to gather, safe for children when properly used, and can be effectively manipulated for the desired effects.

The final product should include colors such as Blue and Pink because the survey shows that students (when they were 6-8 years old), liked these colors on their toys most. Color helps kids to identify differences in objects and functions; teaches cognitive/creative skills
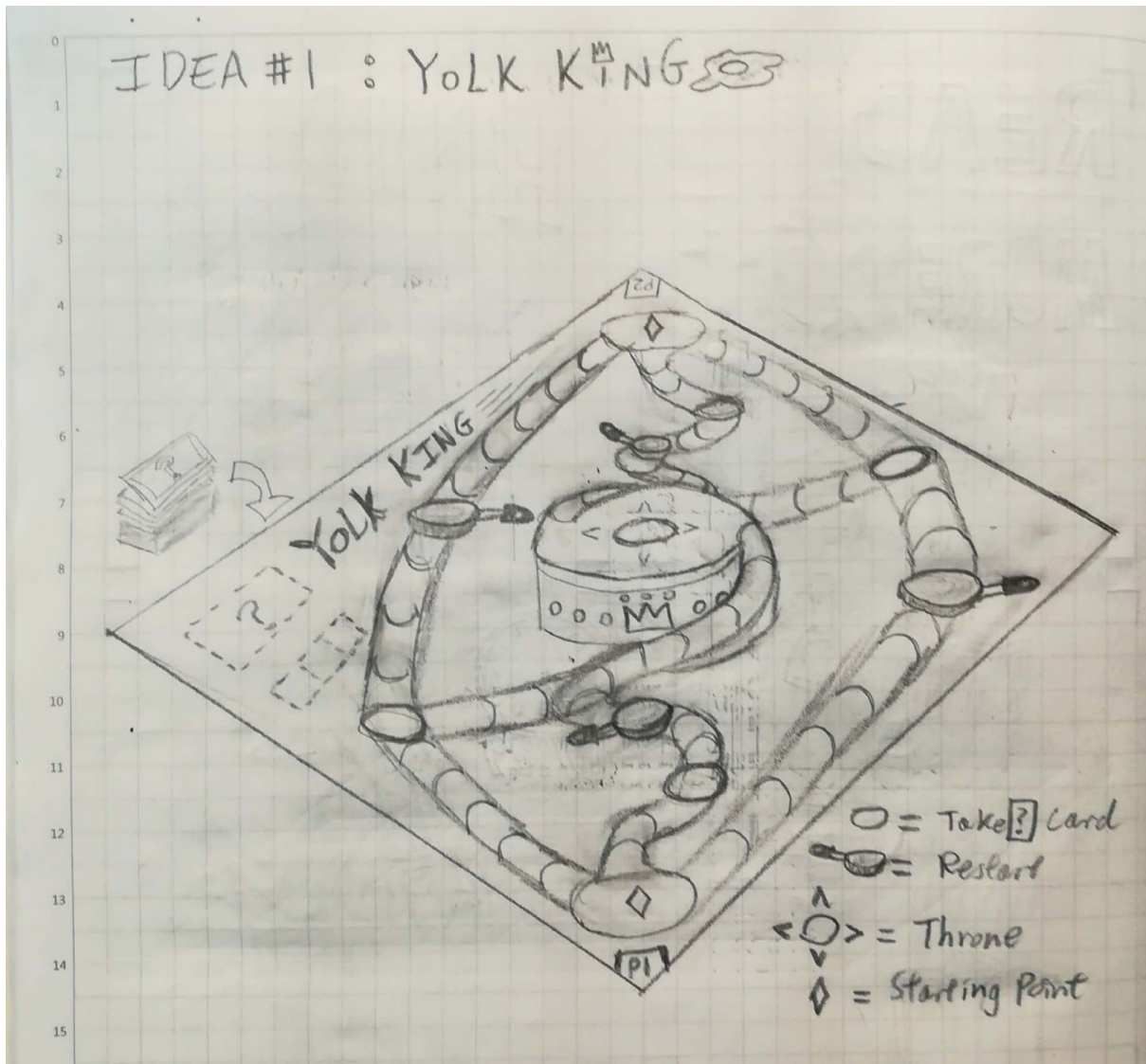
The final product should include some patterns or stylistic design to expose more creativity to the children and allow them to be familiar with patterns, of which they will be

gradually learning about at school. If possible, different textures can also aid in their hands–on skills and can improve cognitive or creative thinking.
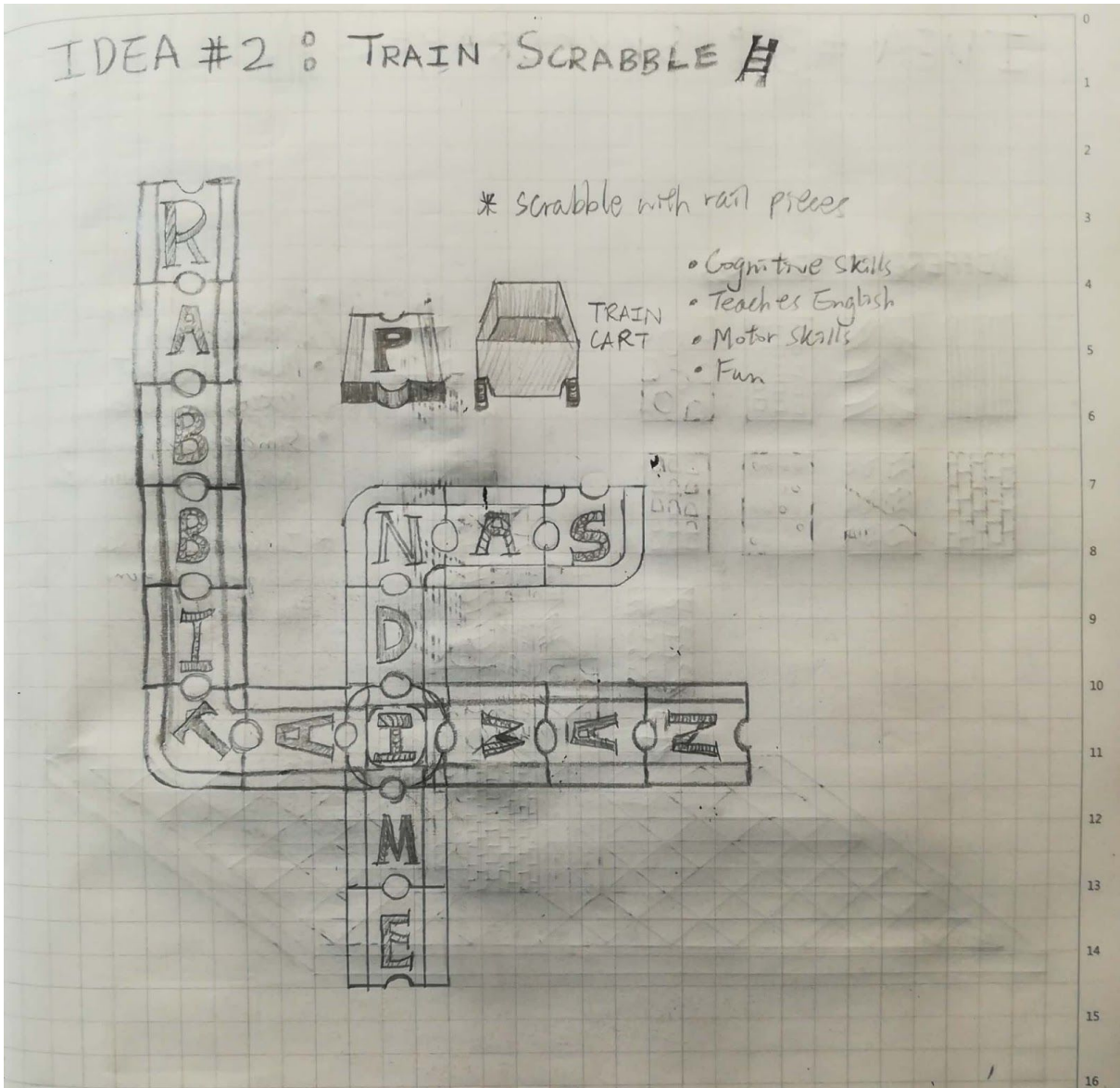
The Design Specifications

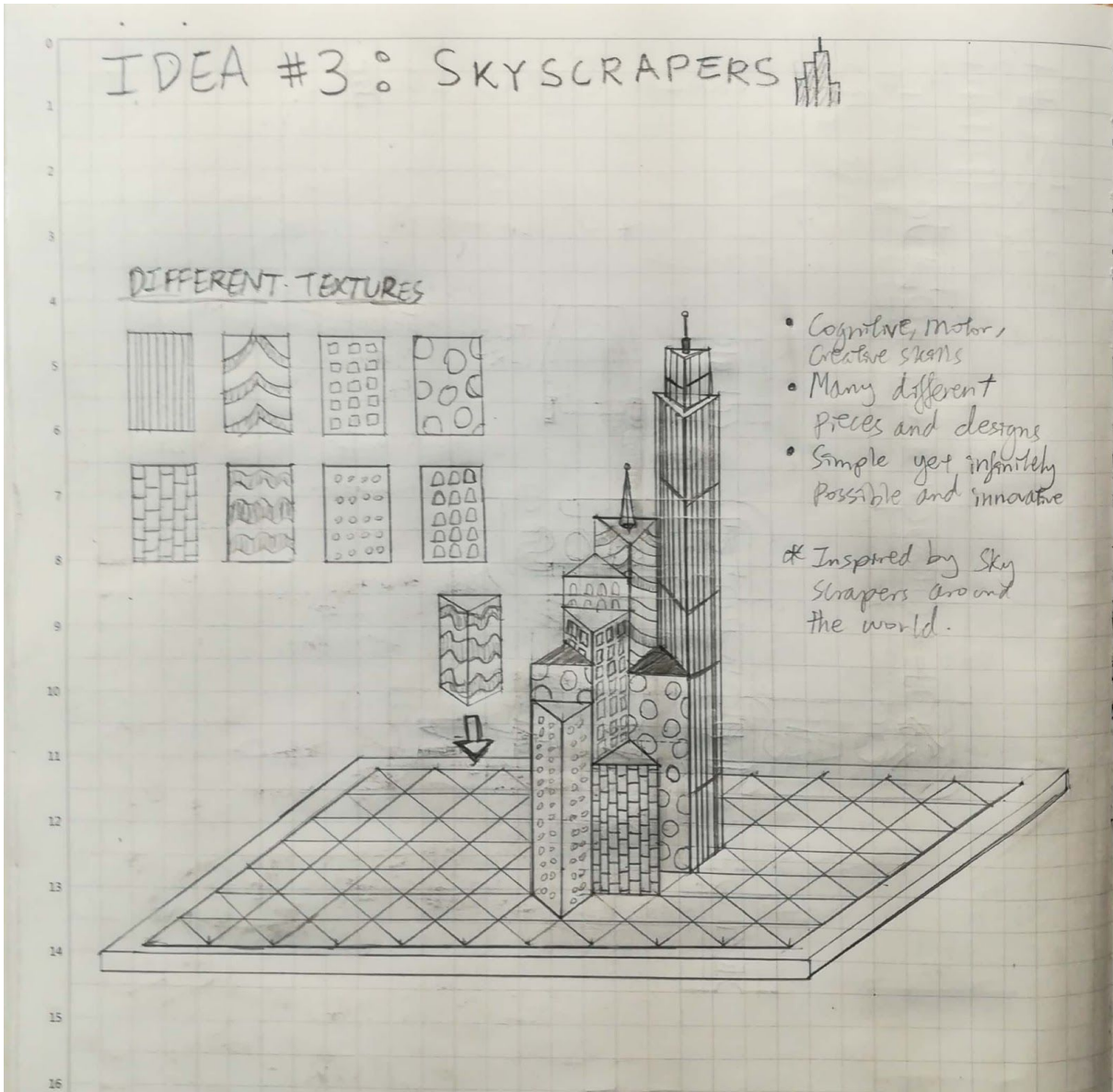| #	Specification	Justification
1	The final product must promote cognitive and creative thinking, develop advanced motor skills, and improve basic soft skills.	Developing and learning these skills are vital to a child's growth. As 6-8 year olds, the children would have learnt these skills, but still require refinement or practice for most of them.
2	The final product must fit under the category of Board Games & Puzzles, Outdoor/Sports Toys, and Building and Construction Toys.	These are the toy categories that are most popular for children of 6-8 years. The toys under all these categories are educational/beneficial.
3	The final product needs to reach the expectations of parents and include educational elements that are appropriately challenging to 6-8 year olds and is fun.	The expectations of parent is an important factor to consider as most toys are bought by the parents and require their approval. Challenging elements increase children's skills and fun develops their social personality.
4	The final product needs to be very safe for children of 6-8 years old to play and must not have sharp edges or harmful materials; it should also be ergonomically suitable.	Toys need to be without sharp edges or harmful materials to keep the children safe. 6-8 years old know not to eat the toys, but still can not protect themselves well. Ergonomics could help with safety as well as convenience as ergonomic designs tend be easier for the children to control.
5	The final product must be able to be easily stowed away in smaller spaces (30x20cm).	Modern city housing usually does not offer a lot of space, therefore, for the toy to be practical for city kids, the toy will need to be easily stored.
6	The educational toy must be made with materials of cardboard, plastics, balsa wood, and/or paper. The materials need to be safe.	The materials listed are available and safe for toys if designed correctly. These materials have a low cost, but are easy to design and craft.
7	The educational toy must have the colors of blue and pink, and should help the children recognize a variety of different colors.	Pink and Blue were the top 2 colors people surveyed liked when they were 6-8 years old. Colors can help inspire creativity, teach differentiation, and organization.
8	The educational toy needs to include patterns, stylistic designs, or different textures to develop their creative skills.	Similar to specification #7, patterns and textures can help develop creativity and basic mathematic ideas. Patterns also reflect the real world.

The Design Ideas

IDEA #1 : YOLK KING

YOLK KING

O = Take ? Card
= Restart
<O> = Throne
◇ = Starting Point

Spec.	Rating	Annotation	Pros	Cons
1	4/5	The idea's name and subsequent game was founded through shiritori. The Yolk King board game is similar to the outdoor game (as well as video gamemode) King of the Hill in which players compete for dominance on the hilltop (center). This board game would be fun, creative, and challenging. However, the game may be too difficult for 6-8 year olds.	The toy has a moderately-high educational value and is challenging to the mind. It provides sustainable fun, is safe to play with and feasible to make.	The toy will likely be slightly too difficult for 6-8 year olds and is not easily understandable. The workings of the game is not properly defined and incomplete.
2	5/5			
3	2/5			
4	4/5			
5	5/5			
6	5/5			
7	3/5			
8	3/5			
—	——			
T	**31/40**			

IDEA #2: TRAIN SCRABBLE

* scrabble with rail pieces

TRAIN CART

- Cognitive Skills
- Teaches English
- Motor Skills
- Fun

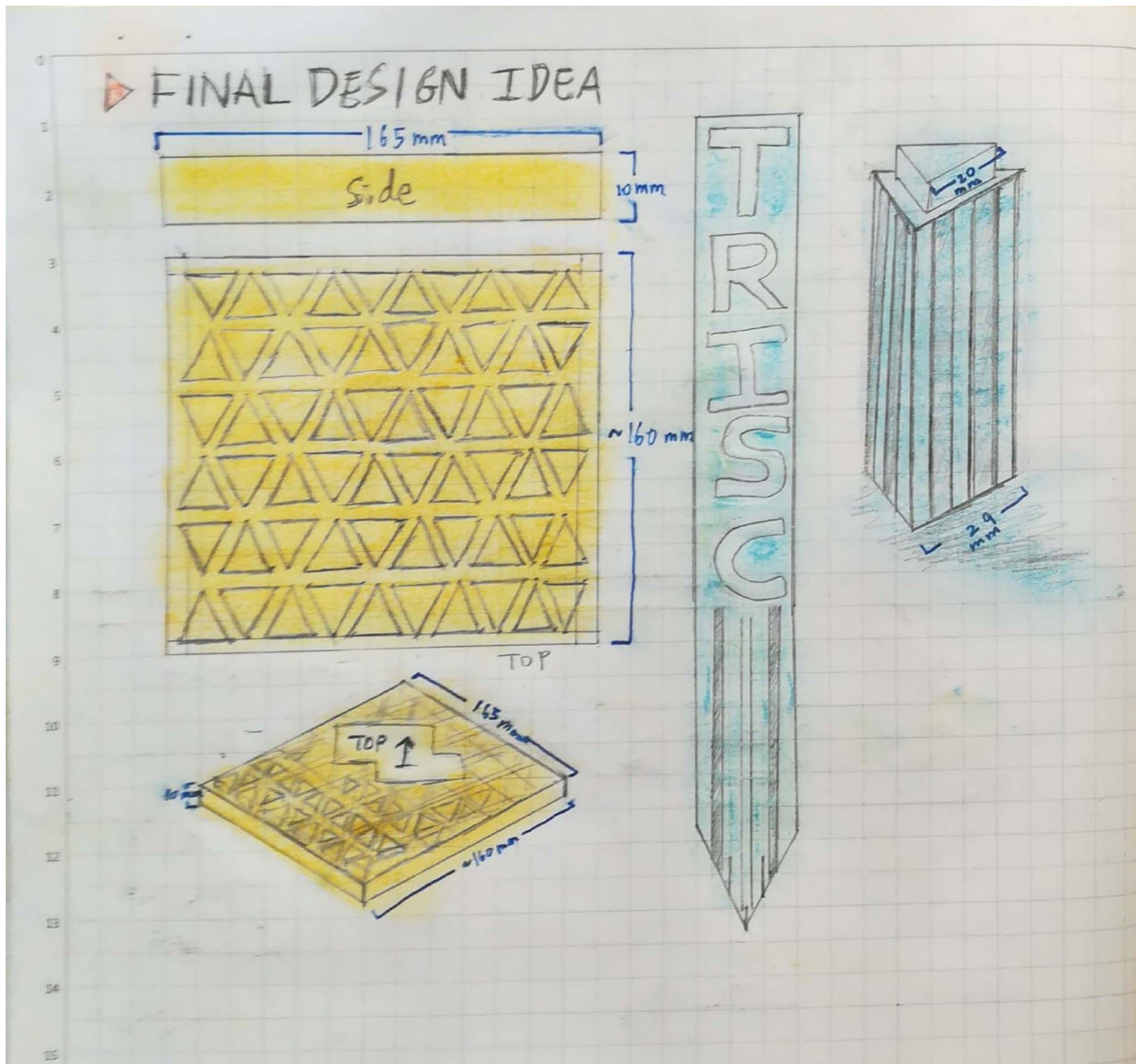| Spec.	Rating	Annotation	Pros	Cons
1	4/5	The idea was inspired by my personal love of trains when I was little. I always found train sets interesting and fun. This prompted me to add an element of scrabble to a typical train set and help 6-8 year olds learn the alphabet and practice spelling. The tracks would be made of wood or hard cardboard and would all be identical, except for the alphabet on top. The design will be made so that the tracks can connect from both sides.	The toy would be relatively easy to understand, sustainably fun, and with a decent educational value. The train scrabble is a fun way to help kids develop their english words.	The toy will not satisfy all kids aged 6-8. The tracks may be hard to create identically and the toy may not be hard enough. The alphabets will be limited, words limited.
2	3/5			
3	3/5			
4	5/5			
5	5/5			
6	4/5			
7	3/5			
8	3/5			
—	——			
T	30/40			

IDEA #3: SKYSCRAPERS

DIFFERENT TEXTURES

- Cognitive, motor, creative skills
- Many different pieces and designs
- Simple yet infinitely possible and innovative

* Inspired by Sky Scrapers around the world.

Spec.	Rating	Annotation	Pros	Cons
1	5/5	This idea was formed when trying to come up with innovative DIY toys. I was inspired by the skyscrapers of big cities and the ingenuity of lego related toys (though I did not think of legos at first). The base of the toy would be 3D printed to get exact triangle bases (embossed from the base). The towers would be built with hard cardboard, wood, or a mix of materials along with 3D printed plastic.	The toy is easy to understand for 6-8 year olds yet it offers a great range of variety and sustainable fun. It is grows cognitive, creative, and motor skills.	The toy may not seem challenging enough for some and does not teach much knowledge, though it does teach skill. Requires more effort to create.
2	5/5			
3	4/5			
4	4/5			
5	4/5			
6	5/5			
7	5/5			
8	5/5			
—	——			
T	37/40			

The Final/Chosen Idea

Spec.	Rating	Annotation	Pros	Cons
1	5/5	This idea was formed when trying to come up with innovative DIY toys. I was inspired by the skyscrapers of big cities and the ingenuity of lego related toys (though I did not think of legos at first). The base of the toy would be 3D printed to get exact triangle bases (embossed from the base). The towers would be built with hard cardboard, wood, or a mix of materials along with 3D printed plastic.	The toy is easy to understand for 6-8 year olds yet it offers a great range of variety and sustainable fun. It is grows cognitive, creative, and motor skills.	The toy may not seem challenging enough for some and does not teach much knowledge, though it does teach skill. Requires more effort to create.
2	5/5			
3	4/5			
4	4/5			
5	4/5			
6	5/5			
7	5/5			
8	5/5			
—	——			
T	37/40			

Justification of Chosen Idea

After doing a fair amount of both primary and secondary research on the different topics related to educational toy design, and after coming up with three designs which were pre-assessed with the specifications list, a final idea has been chosen. The final chosen idea is design idea #3 which embodies the designer's visions for a good solution in whole.

It is, I believe, in the interest of the parents and children to have a fun, easy to understand, safe, and creative hands-on toy. Therefore, design idea #3 was chosen as it had reached the highest total specifications scores, is very suitable for the target audience, and is sustainably fun. The toy has very basic mechanics and does not require much critical thinking to play, but it smartly uses its simplicity to create an infinite amount of modifications and a way to train some of life's most important skills. The toy improves the child's cognitive and creative thinking skills as well as motor and soft skills.

As seen in the final sketch of the chosen idea, the toy will include a variety of different textures, patterns, and possibilities. The toy will challenge children in their imagination and will inspire them to always look for patterns or diversity in life around them. The toy is fun, engaging, and educational for the kid and it is very easy to store/clean for the parent. All in all, the toy is a fantastic design that will effectively aid in a 6-8 year old child's growth.

Materials & Equipment
  - ➢ 3D Printer
  - ➢ 3D Printer Plastic Ink (string)
  - ➢ Acrylic Paint
  - ➢ Hard Cardboard
  - ➢ Textured Paper
  - ➢ Color Markers
  - ➢ Box Cutter
  - ➢ Scissors
  - ➢ Hot Glue
  - ➢ White Glue
  - ➢ Computer (to conduct 3D printing)
  - ➢ Wood Board/Sticks
  - ➢ Carving Tools

General Plan for Production

1. Gather all materials (or at least make sure they are accessible)
2. Using the "TinkerCad" online design software for 3D printing, design the triangle filled base and other necessary 3D printed items
3. Using wood and cardboard, create varying designs and styles of triangular structures that fit with the measurement of the base
4. The triangular structures will need to have indents (like legos) in order to successfully stack on top of each other
5. Wrap the triangular structures in textured paper as well as self designed paper that will create a diverse choice of patterns for the kids
6. Finetune the triangular structures and test if it can fit well on the base
7. Create 3~5 roof designs for the triangular structures (3D print or cardboard)
8. Assemble everything together, make sure to glue all connections securely
9. Your toy should be completed and ready to test

The Production Plan

Seq.	Manufacturing Process	Reference	Tools	Time
Starting Phase				
1	Gather and check all materials/equipment	See "Materials & Equipment"		N/A
2	Design logo ideas, choose 1 out of 4 (draw final logo on computer)		Paper, Youidraw	1.5 hr
3	Plan Ahead: Choose the dimensions for the triangles, this will be set		Notebook, Sketchup	10 min
4	Check & Refine measurements of the toy base from The Final Idea	The Final Idea	Ruler (check real size)	5 min
Digital Design Phase				
5	Create the basic shape of the base (length x width x height)		Sketchup: Shape, Push	5 min
6	Using the Tape Measure tool, mark out all the correct spacing for triangles, create an guide lines		Sketchup: Tape Measure	50 min
7	Draw out the triangles and pull up 10 mm, check for consistency		Sketchup: Line, Push	5 min
8	Make additional changes for better ergonomics (handle areas, round corners), and add the logo	For logo, look at logo design from step 2	Sketchup: Tape Measure, Line, Shape, Push/Pull	20 min
9	Print the 3D toy base in black/grey	Mr. Rosevere, export to .STL	Craftbot 3D Printer	1 hr
10	Create a generic triangular prism with the chosen dimensions	Step 3, chosen dimensions	Sketchup: Tape Measure, Line, Push	5 min
11	Create a hole on the bottom and indent on the top (for connection)		Sketchup: Tape Measure, Line, Push/Pull	3 min
12	Using the generic triangular prism, create 4 new textures	Consider textures on chosen design	Sketchup: Tape Measure, Line, Push/Pull	40 min each (2.5 hr)

13	Print each texture of triangular prisms 4 times (total 16)	Mr. Rosevere, export to .STL	Craftbot 3D Printer	5~7 hr
Physical Assembly Phase				
14	Check the quality of the toy base, sand minor errors (reprint for major errors)		Eyes, Sandpaper	10 min
15	Check the quality of the triangular skyscraper pieces, sand minor errors (reprint for major errors)	(Note: Make sure they fit on the toy base)	Eyes, Sandpaper	15 min
16	Gather acrylic paints: blue, white, orange		Acrylic Paints, Paint Brush	2 min
17	Paint skyscraper pieces, no fixed color (16 total)		Acrylic Paints, Paint Brush	1.5 hr
18	Wash brushes when done using, make sure to uphold quality		Paint Brush, Sink	5 min
19	Check the quality of the painted triangular prisms		Eyes	5 min
Packaging Phase				
20	Make a written list of all the text that will go on the game guide and packaging box	(The list will be made in the next section)	Google Drive	20 min
21	Create the game guide design, paste the text and include icons		Youidraw	1 hr
22	Choose box for packaging, draw rough design		Cereal Box	20 min
23	Using colored paper, make the box according to the design		Print/Colored Paper	40 min
24	Put the completed toy in the box, if it all fits, you're done!		All completed materials	5 min
				975 minutes **16.25** hours

The Process Journal

Starting Phase

Summary
The starting phase went smoothly and was the easiest of the four different phases to complete. For the logo design, our teacher designed an activity for us in which we had to sketch out 50 different logo designs in 60 minutes. The activity was successful in allowing me to come up with a unique and original logo design. I chose the current logo as it had all the attributes I had wanted and it was fitting with the theme of the toy: triangular construction. After I had decided on my logo, I drew it on Youidraw and got fantastic results. The main challenge I had at the beginning of this phase was the worry that I would not be able to come up with a good logo, however, that was resolved with the activity.

Changes
1. Instead of 4 logo designs, I ended up having 50 designs to choose from
2. The dimensions from the final design were changed slightly to be bigger
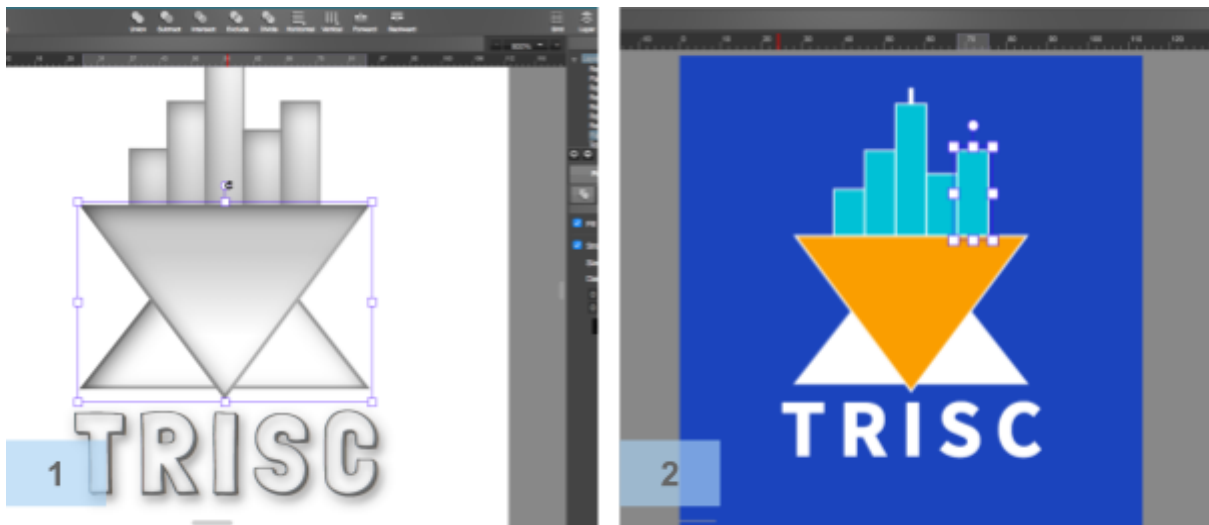
Fig. 1 | TRISC logo in black and white, digital drafting
Fig. 2 | TRISC logo in color, colors were carefully considered

Digital Design Phase

Summary
The digital design phase saw the creation of the TRISC toy base + pieces on sketchup and the physical structures that were printed using a 3D printer. The first thing on the agenda was to finalize the dimensions of the triangular pieces to ensure and to figure out how much cushion space would be needed in order to have the pieces fit on the toy base. I made a rough estimate and started the design process on sketchup. I first made a generic toy piece which was a triangular prism with no textures just to visualize the dimensions. Next, I proceeded to make the toy base. After finishing the toy base, I printed it out with the 3D

printer and while waiting for the print, I started doing my texture designs for the triangular prism pieces. At first, everything seemed to go without issues, however, problems soon started. The hole of the 1st toy piece design was too small, then the modified piece was too big, and finally, the 3rd edition of the piece seemed to fit just right. Throughout this phase I had to face many challenges with finding the right dimensions and I discovered many minor differences through the trial & error of printing and fixing. This phase was long and at times frustrating to have to keep making more revisions, but it all paid off in the end.

Changes
1. The dimensions of the baseboard had to be changed from the sketched plan for the chosen design as it did not account for the fact that the edges of the triangular prism was thicker than the regular sides
2. The hole of the triangular prisms had to be adjusts 2~3 times to make a good fit as the printed required around ~0.5 mm difference to have the piece be able to fit on the baseboard, plus, it was later discovered that there was a significant difference in the print when compared between different printers and print settings
3. The exact order of the digital design phase was not followed.. instead of a strictly step by step order, the reality of the production was messier and had many steps overlapping each other; carried out at the same time
4. The final amount of the TRISC pieces was 10~12 instead of 16 as there was not enough time for all the pieces to be printed out
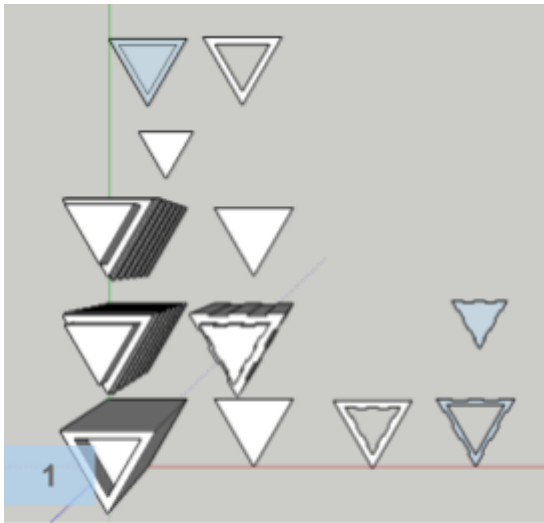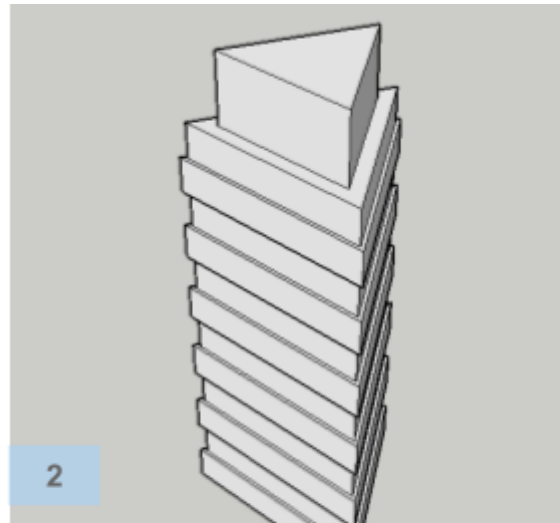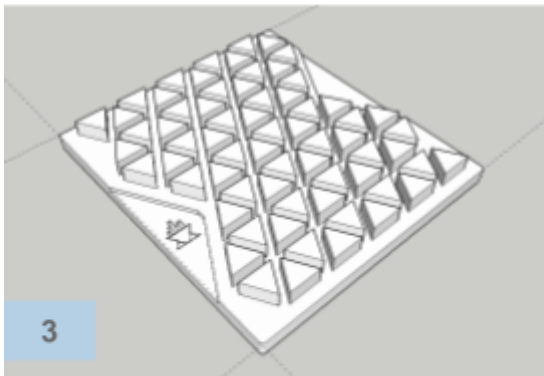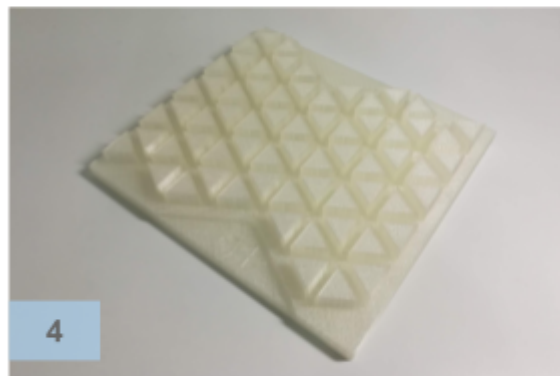
Fig. 1 | Sketchup pieces draft
Fig. 3 | Sketchup baseboard design

Fig. 2 | Sketchup, N1 piece design
Fig. 4 | 3D printed transparent baseboard

Physical Assembly Phase

Summary
The physical assembly phase was a combination of two major tasks: (1) quality control/check, and (2) product refinement. The first part of this phase overlapped the latter parts of the previous phase (digital design phase) as the quality control and check was carried out immediately after the pieces were printed out. For multiple (total of about 5 times), the pieces/base did not pass quality control and was sent back to the digital design phase for adjustments and re-printing. This step of quality control is of paramount importance as it makes the final products look better and work more efficiently. The second task/part was also important but not too much of a necessity. The painting of the TRISC pieces (triangular prisms) was only conducted on two pieces due to time and the fact that the original white color looked fine and would allow kids to paint them on their own if they so desired—adding a new creative element to the toy.

Changes
1. The steps were not done strictly one after another and were often done simultaneously with steps in the previous phase

2. The original plan was to paint all 16 pieces, but only 2 pieces were painted as it was deemed unnecessary to have them all be painted (plus, the white looked good)
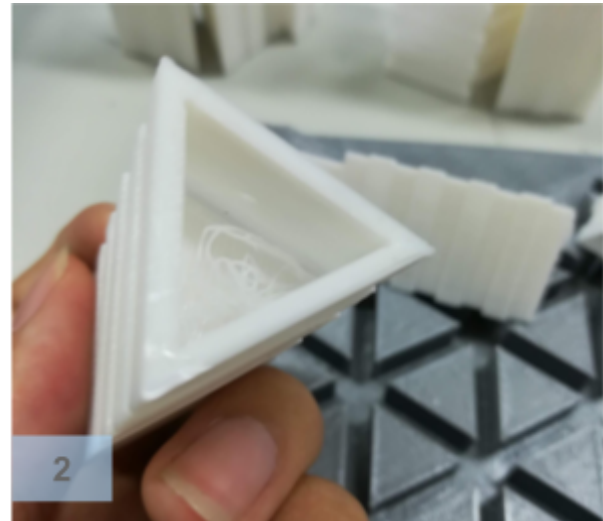

Fig. 1 | TRISC piece being colored in acrylic blue
Fig. 2 | Quality checking a piece, some displaceplastic fibers are visible

Packaging Phase

Summary
The packaging phase took the 2nd longest amount of time as it required detailed planning and careful execution over a period of time. The first thing that was created for this phase was the game guide (AKA brochure). The game guide to TRISC is fairly simple and outlined all the necessary items such as "How To Play" and "The Concept". The game guide was created on Youidraw and took a while to finalize. The second thing that was created was the actual packaging (AKA box). The box took a long time to make as I envisioned a professional looking box that was handmade and especially customized for this toy. I had originally considered the option of finding a box printing place but later decided that it would be to messy and it would take too long. In the end, I made the box entirely from scratch (as you will be able to see from the pictures below). I used the steps on this webpage http://www.instructables.com/id/Fancy-Rigid-Gift-Boxes/ as reference. Step 1: I brought 2 big pieces of 2mm condensed cardboard and many pieces of poster paper. Step 2: I figured out my dimensions and created measured out the cutting/folding lines on the cardboard as well as on the poster paper. Step 3: I taped the corners of the cardboard and measure + cut out white paper to fit inside (to look professional). Step 4: I cut out and glued the outer colored poster paper. After I did all this, I repeated the steps to make the top box. For the top box I also printed out my logo and cut + glued it. Later on, I added styrofoam parts inside the box as support for the board and to make the box a snug fit for the toy pieces.

Changes
1. The box was much more complicated and customized than planned

2. The creation of the box required many more steps and took much longer time, around 5.5 hours in total and delayed my time for other homework, but it was worth it because the box came out really nice
3. Used styrofoam pieces that made the box more shock resistant (the pieces were better locked in place) and made the box feel more customized for the toy
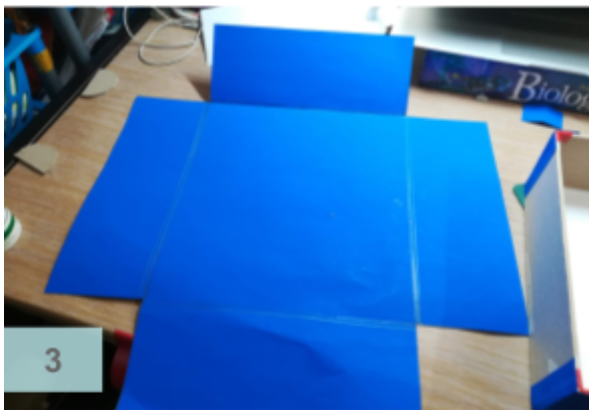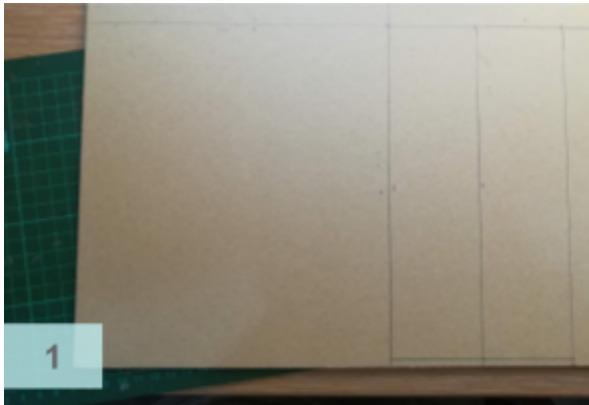

Fig. 1 | Original Cardboard Piece
Fig. 3 | Blue poster paper, shape of box

Fig. 2 | Shaping the box (top + bottom box)
Fig. 4 | Finished box (top view)

The Final Product

GAME GUIDE CONTENTS

The Concept
TRISC® is a newly designed educational toy concept that is most suitable for children ages 6-8. Although the toy itself is relatively easy to play with, additional elements of the game adds difficulty and slight challenge for the children. The game difficulty can be altered depending on the age of the players. TRISC® in its simplest form is a game of skyscraper buildings where the child freely innovates and creates their desired cityscape.

Easy Set Up
All you need to set up TRISC® is the baseboard and the provided tri-scrapers. Try to place the baseboard on a flat table surface or on the ground.

Parts & Pieces
Baseboard (x1)
N1 Tri-scraper (x4)
N2 Tri-scraper (x4)
N3 Tri-scraper (x4)
N4 Tri-scraper (x4)
Dice (x2)
Game Manual (x1)

How To Play
Gamemode 1 : Innovative
1. Set up on flat surface
2. Start building skyscrapers of your own design
3. Connect tri-scraper to base and tri-scraper to tri-scraper
4. Build high or build wide, you decide!

Gamemode 2 : Competitive
1. Have 2 to 4 players
2. Set up on flat surface
3. Take out the dice (x2) and Competitive Gamemode Card
4. Rock-Paper-Scissors, winner starts
5. Roll the two die
6. Look for the corresponding number on Gamemode Card
7. Follow the instructions on card
8. Whoever builds a tower that is 5 blocks high first wins

Educational Value
TRISC® allows children aged 6~8 to practice and develop their cognitive, creative, and competitive skills. The construction based game also trains the essential motor skills that will be useful to them for an entire lifetime.

TOY PRODUCT PACKAGE & CONTENTS
Below are photos of the finished final product and the customized packaging.

Game Guide

The Concept
TRISC® is a newly designed educational toy concept that is most suitable for children ages 6-8. Although the toy itself is relatively easy to play with, additional elements of the game adds difficulty and slight challenge for the children. The game difficulty can be altered depending on the age of the players. TRISC® in its simplest form is a game of skyscraper buildings where the child freely innovates and creates their desired cityscape.

How To Play
Gamemode 1 : Innovative
1) Set up on flat surface
2) Start building skyscrapers of your own design
3) Connect tri-scraper to base and to tri-scraper
4) Build high or build wide, you decide!

Gamemode 2 : Competitive
1) Have 2 to 4 players
2) Set up on flat surface
3) Take out the dice (x2) and Competitive Gamemode Card
4) Rock-Paper-Scissors, winner starts
5) Roll the two die
6) Look for the corresponding number on the Competitive Gamemode Card
7) Follow the instructions on card
8) Whoever builds a tower that is 5 blocks high first wins! Congratulations!

## Educational Value
TRISC® allows 6~8 year olds to practice and develop their cognitive, creative, and competitive skills while training essential motor skills in a construction based game.

Easy Set Up
All you need to set up TRISC® is the baseboard and the provided tri-scrapers. Try to place the baseboard on a flat table surface or on the ground.
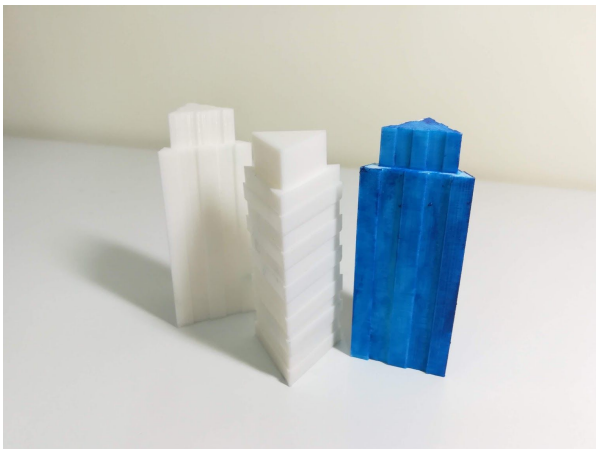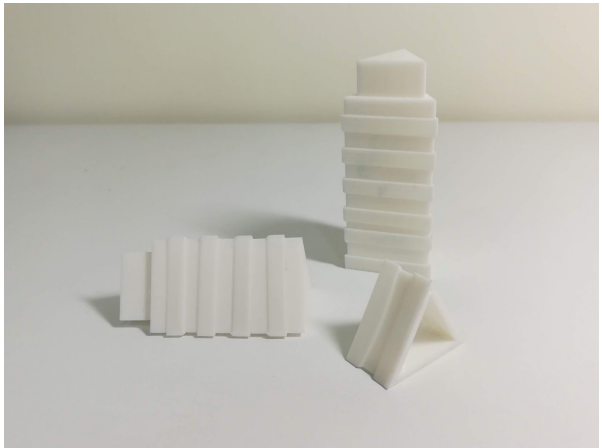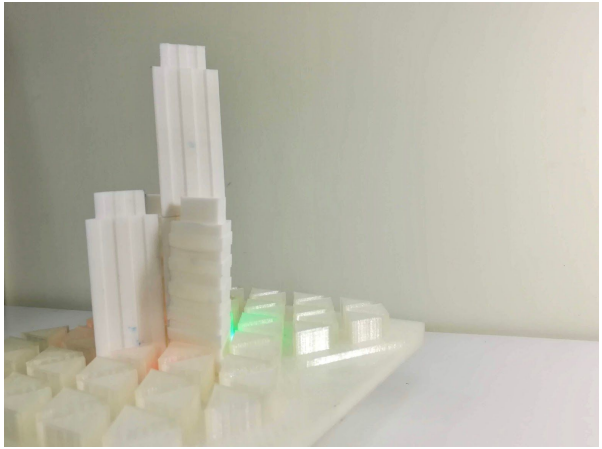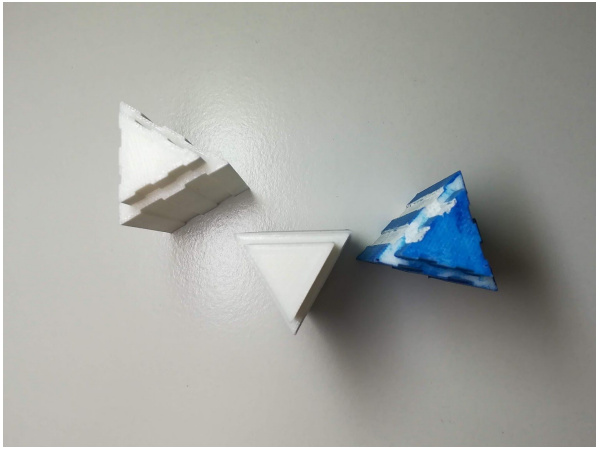
TRISC

Parts & Pieces
Baseboard (x1)
N1 Tri-scraper (x4)
N2 Tri-scraper (x4)
N3 Tri-scraper (x4)
N4 Tri-scraper (x4)
Dice (x2)
Game Manual (x1)
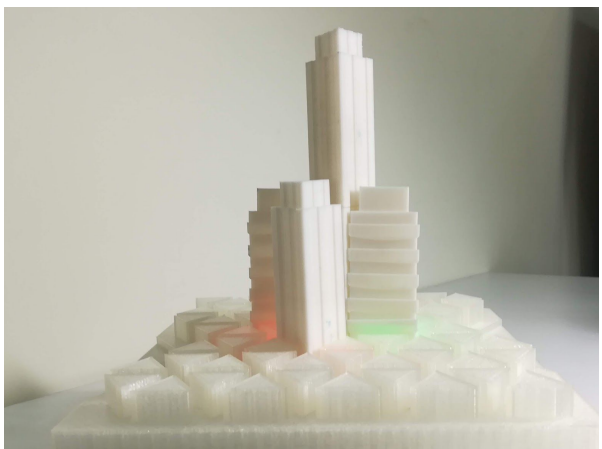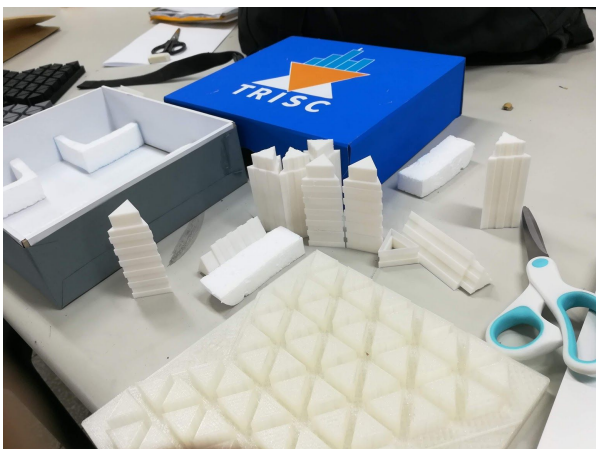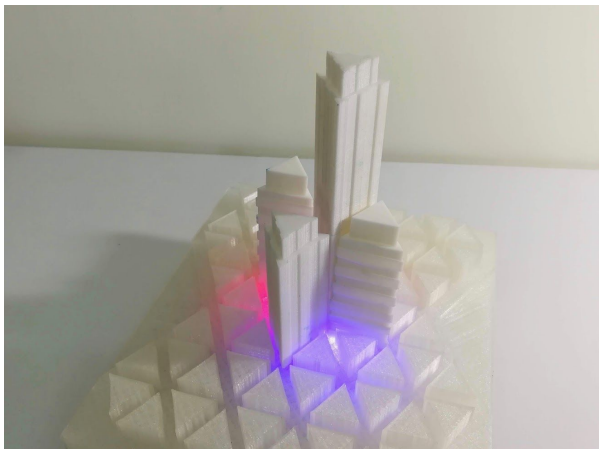
Evaluation : Testing the Product

Strand i & ii | Rating is according to the specifications

#	Specification	Product Testing Method	Evidence/Results from Tests	Rating
1	The final product must promote cognitive and creative thinking, develop advanced motor skills, and improve basic soft skills.	Record the reactions and reflections of 2nd graders during the Toy Lab. Assess whether these skills appear to be taught with the toy.	The final product promotes creative thinking and medium level motor and soft skills, but does not promote much cognitive thinking.	3/5
2	The final product must fit under the category of Board Games & Puzzles, Outdoor/Sports Toys, and Building and Construction Toys.	A visual observation will be carried out to determine if the product fits under these categories.	The product would fit under the category of puzzles and building/construction toys.	5/5
3	The final product needs to reach the expectations of parents and include educational elements that are appropriately challenging to 6-8 year olds and is fun.	The toy will be compared to the parental expectations survey for their child's toys.	When compared to the parental expectations survey, it appears that most, if not all, expectations were met. The toy is "made with safe materials", "interesting", promotes "exploring and discovery rather than intensive studying".	4/5
4	The final product needs to be very safe for children of 6-8 years old to play and must not have sharp edges or harmful materials; it should also be ergonomically suitable.	The safety of the toy will be determined through the surveying of kids during the Toy Lab and the opinions of parents or peers. A visual and experimental (touch) observation will also be carried out.	From the results of the experimental observations show that the toy is safe as there are no harmful sharp edges (triangles are slightly rounded). The children at the Toy Lab all gave the safety a 5 out of 5.	5/5
5	The final product must be able to be easily stowed away in smaller spaces (30x20cm).	The packaging of the toy will be measured and should be close to the set dimensions.	The box was measured to be around 21 x 18 cm which was smaller than the set dimension. Will be easily stowable.	5/5
6	The educational toy must be made with materials of cardboard, plastics, balsa wood, and/or paper. The materials need to be safe.	The materials will be checked visually and with the process journals for criterion C. The materials will be checked for safety.	The visually observations and check with the process journal showed that the toy was made with plastics (3D printer) and that the packaging was made with 2mm cardboard and poster paper. All materials are safe.	5/5
7	The educational toy must have the colors of blue and pink, and should help the children	The colors of the toy will be visually checked and surveyed with the children of the Toy Lab	The product displayed colors of Blue, Orange, and White, though the toy itself was transparent + white. Children @ Toy Lab found	4/5

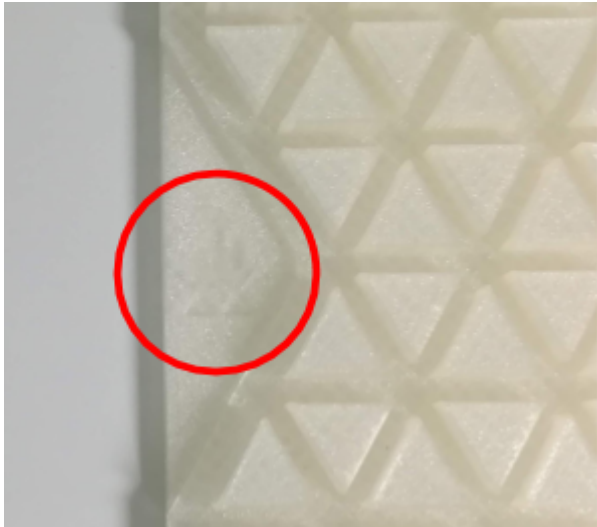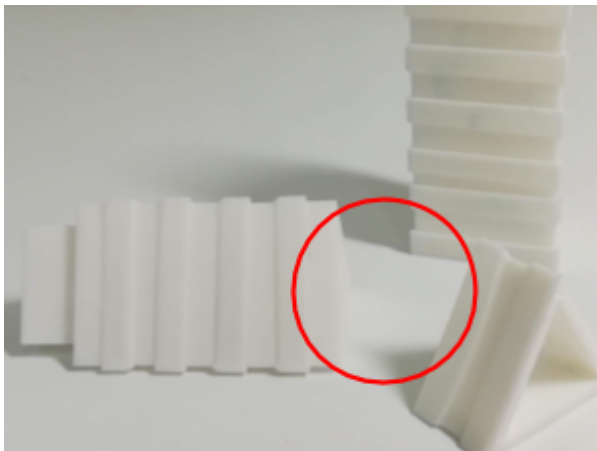|			the package to be 3/5 to 5/5 in terms of the color scheme.	
	recognize a variety of different colors.			
8	The educational toy needs to include patterns, stylistic designs, or different textures to develop their creative skills.	The patterns and textures of the toy will be visually checked to determine if sufficiently creativity inciting patterns are included.	The patterns and textures of the toy are determined to be sufficiently creative after having been visually checked. However, more patterns or toy pieces could have been created.	4/5

Questions asked for Evaluation during the Toy Lab

1. Do you like the color of the toy and box? (1 to 5)
2. Do you think the game is fun? (1 to 5)
3. What is your favourite thing about it?
4. What do you think needs to be improved?
5. How likely would you play this game? (1 to 5)
6. How safe is the toy? (1 to 5)

Evaluation : Problem & Solutions

To fix this = Improvements/Solutions (crit. D strand iii)

#	Identified Problem & Solutions	Image Evidence
1	There are a few patches on the box cover that becomes visible on closer inspection. The patches were originally put there due to glue stains that were very visible and distracting on the box. **To fix this** minor error or inconsistency in the box texture, the box cover could be remade (with sufficient time) or the patch could be made of different materials or colors to make it look more like a pattern on the box. Glossed paper would have worked nicely as it would add a fashionable detail to the box cover.	

2	The final toy board was printed with a transparent or translucent plastic. This allowed colored lights to be used under the toy board as the light would go through, however, the logo on the left side of the board is not visible due to the transparent material. **To fix this** problem, the toy could use a different board color such as grey or orange. Alternatively, the logo section could have been colored with acrylic paint to be easily visible (perhaps painted in the logo colors of the box).	
3	The box was made with care, however, after painting some of the TRISC pieces + the box styrofoam stabilizers with blue acrylic paint, a bit of the paint got smeared onto the insides of the box. **To fix this** issue, the side that was smeared could be re-done by replacing the white paper, however, that would take a lot of time and might affect other parts of the box that were untouched by the paint. Additionally, the color could be removed with some form of paint remover (but it might cause stain of oil like substance).	
4	The N1 TRISC piece was designed to be different from the other pieces as it went in and out vertically. Creating this pattern was always a risk as the 3D printer would have to print over 0.5 mm of empty space every 5 mm up. This in and out pattern caused the N1 pieces to be very fragile and many of them broke easily when tested. They can be roughly pieced back together segment by segment, but **to fix this** in a more complete manner, the piece should be redesigned to have supports between the in and out patterns.	

Evaluation : Impact of Final Product

Towards the Target Audience (6~8 year olds)

The final product had a positive impact on the target audience of 6~8 year olds as shown through the Toy Lab test session. The toy was created with the target audience in mind and was able to provide children with an educational toy that trained them to use their creative, soft, and motor skills. The toy itself was a success, however, the realistic target age might need to be lowered as it is considerably too simple for 2nd graders even though it may be fun. The toy in its current form would be more fitting for 5~7 year olds. Alternatively, the toy could be made to be more difficult with a board-game like factor such as adding a dice + card element into the game. The more challenging version could require a dice roll to pick a card with the matching number and the card could show a structure that the child would have to build. To be more competitive and to include everyone, the game could be played in a way where it would be a reverse janga. Each player would add a piece to the structure until someone builds a piece that causes the whole skyscraper to fall down (more pieces and shapes would need to be devised). All in all, the toy was fitting for the target audience, but lacked the challenge that comes with the most immersive games or toys.

Towards the Toy Market & Future Innovations

In my personal opinion, the TRISC toy would not be able to outcompete other toys in the same categories of construction and buildable board games. However, it would impact the toy market positively as other toy designers would (hopefully) be inspired to create better educational toys as opposed to toys that are made just for profit. The toy could be innovated to become more challenging in the future (as mentioned in the paragraph above). It is possible that this TRISC toy concept could end up being quite popular if sufficient time, effort, and resources were put into its future development.

Works Cited

European Commission. "Toy Safety in the EU." *Growth*, 25 June 2018,

ec.europa.eu/growth/sectors/toys/safety/. Accessed 25 June 2018.

Fisher-Price. "10 Baby Toy Safety Tips Fisher Price." *Fisher-Price*, 19 Feb. 2018,

www.fisher-price.com/en_US/parenting-articles/health-and-safety/10-toy-safety-tips.

Accessed 25 June 2018.

Litchfield, Irina. "What Are the Basic Needs of a Child at the Age of 6-10 Years?" *Quora*, 15

Jan. 2016,

www.quora.com/What-are-the-basic-needs-of-a-child-at-the-age-of-6-10-years.

Accessed 25 June 2018.

Michaela. "How Toys Impact Children's Development." *WeHaveKids*, 22 Dec. 2013,

wehavekids.com/parenting/How-Toys-Impact-Childrens-Development. Accessed 25

June 2018.

MyHealth.Alberta.Ca. "Growth and Development, Ages 6 to 10 Years."

MyHealth.Alberta.ca, 4 May 2017,

myhealth.alberta.ca/Health/pages/conditions.aspx?hwid=te6244. Accessed 25 June

2018.

NAEYC. "Good Toys for Young Children by Age and Stage." *NAEYC*, 2018,

www.naeyc.org/resources/topics/play/toys. Accessed 25 June 2018.

Raising Children Network. "Encouraging Good Behaviour in Kids: Tips." *Raising Children

Network*, 30 May 2018,

raisingchildren.net.au/articles/encouraging_good_behaviour.html/context/732.

Accessed 25 June 2018.

---. "Toys and Choosing Good Toys for Kids." *Raising Children Network*, 10 May 2016,

    raisingchildren.net.au/articles/choosing_toys.html. Accessed 25 June 2018.

Rakuten. "木のおもち." *Rakuten*, I'm Toy, 2018,

    item.rakuten.co.jp/moc-kinoomocha/im-22045/?s-id=xb_shop_001. Accessed 25 June

    2017.

The Toy Association, Inc. "Toy Industry Product Categories." *The Toy Association, Inc*,

    2013, www.toyassociation.org/App_Themes/tia/pdfs/membership/definitions.pdf.

    Accessed 25 June 2018.