BOXLAB: A COMPARISON OF BRAND EXPERIENCES FOR STEM TOYS AND THEIR INFLUENCE ON GENDER

by

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DEDICATION

This thesis is dedicated to my children—my son and two daughters. Thank you for inspiring me with your creative spirits and analytical minds. Always remember to choose passion wherever you go in life, and don't let society tell you what you can and cannot do. Thank you to my husband, Max, for your patience, encouragement, and support throughout this entire journey. Thank you to my dad for buying me LEGOs as a child, teaching me how to build, and igniting my interest in STEM topics.

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ABSTRACT

Strides have been made to make STEM inclusive, however the gender gap is still significant. The added attention given to STEM-related fields has not only increased consumer awareness, but also assisted in the growth of a multi-billion-dollar STEM toy industry. But are these products effective in curbing the STEM gender gap or are retailers utilizing tactics that perpetuate the status quo? This research will explore design trends among STEM toys through observational studies to better understand what attracts female participation, and as a result proposes an open-ended learning opportunity while removing outdated traditional gender stereotypes.

I. INTRODUCTION

Objective

The toys that children play with serve an important part of childhood learning (Lange, 2018). Developmental scientists and educators stress play as an important part of child development which builds cognitive abilities, gross motor skills, along with creativity, communication, and social skills (Reich et al., 2018). Historically, toys have been used to prepare children for adulthood and have also reinforced traditional gender roles. Gender stereotypes, also referred to as sex stereotypes or gender roles, are defined as structured beliefs about personal characteristics (i.e. personality, behavior, appearance) which categorize men and women within a society (Kollmayer et al., 2018). Anthropologists suggest that dolls and toy weapons once served a purpose of imitating the adult world while protecting children from dangers and burdens; thereby giving children a feeling of significance, responsibility, and practice of actual adulthood (Cross, 2009). In the late 1800s, toys reflected adult ideals more than the desires and imaginations of children. For example, erector sets were designed to influence boys into becoming an engineer or scientist while dollhouses and baby dolls prepared girls to be modern homemakers and mothers (ibid). More than a hundred years later, today's toys still perpetuate many of the same outdated gender roles, including teaching girls to tidy the home and boys to build. Over the past several years however, educational toys that teach science, technology, engineering, and math (STEM) topics to children have proliferated. These toys seem to reflect adult's desires to advance their children into future STEM careers (STEM/STEAM FORMULA FOR SUCCESS). However, the toy industry may be perpetuating gender roles by marketing educational STEM toys to specific genders. Toy companies use product labels and colors to influence which toys children choose and which toys are deemed 'acceptable' for boys and girls; they

turn products pink to appeal to girls and separate girl toys into a pink aisle (for which retailers like Target have received criticism) (Grinberg, 2015). The STEM aisle has robots and regular volcanoes on one side and unicorn slime kits and pink volcanoes on the other. One of the most rudimentary science experiments—the baking soda volcano—shoots pink glitter and confetti (Figure 1). By contrast, a realistic volcano kit looks like it's the boy equivalent.

The objective of this thesis is to analyze current STEM toys for children ages five to eight, and understand how might toy companies market STEM toys to children ages five to eight without perpetuating existing gender stereotypes? The final outcome will be an open-ended learning design solution which encourages children to explore STEM topics.

Figure 1. STEM Toy Volcanoes Side-by-side: Project Mc² Glitter Volcano and Discover Glowing Volcano. Photo taken by author in Austin, Texas on April 24, 2019.

What is STEM?

STEM, an acronym for science, technology, engineering, and math, has become a widely known phrase over the past decade, and the number of jobs in these fields has grown significantly (National Science & Technology Council, 2018). The *America Competes*

Reauthorization Act of 2010 addressed a growing need for STEM jobs and an urgency to prepare a future workforce with the education and training necessary to fill them. A concern about America's ability to compete in the global economy led to a number of calls to action in order to strengthen the pipeline into STEM fields (National Academy of Sciences, Committee on Science, Engineering & Public Policy, 2007). In the U.S. only 19% of students received STEM degrees, while over 50% completed them in China (Committee on STEM Education National Science and Technology Council, 2013). As technology advances, STEM jobs are expected to grow further. These jobs require a higher education and yield higher salaries; the starting salary for a recent graduate with a degree in STEM is more than 30% higher than one without a STEM degree (Jacobs, 2014). However, nearly 60% of students entering college did not meet the minimum math requirements needed to pursue a STEM degree; colleges report spending nearly two billion dollars a year on remedial education for unprepared students (President's Council of Advisors on Science and Technology, 2016). To prepare K–12 students for STEM college degrees, the Obama administration increased federal spending to support STEM, including an initiative to prepare 100,000 STEM teachers by 2021 (Handelsman & Smith, 2016).

STEM's popularity has flourished for more than a decade, especially within primary and secondary education (Modi, 2012); it's become ingrained into the daily lives of children. According to the *Progress Report on the Federal Implementation of the STEM Education Strategic Plan*, there are more than 125 federally funded STEM programs which account for more than $3.2 billion of the national budget (2019). In addition to in-classroom learning, some elementary schools feature schoolwide STEM labs, high-tech learning spaces, and maker spaces in order to provide students with the skills to thrive in future STEM careers (Wong, 2018). However, STEM-based learning is more than school curriculum. Additionally, STEM

afterschool camps, summer camps, and privately-owned and publicly funded STEM learning centers have popped up around the nation (Krishnamurthi, n.d.). Children have numerous choices when it comes to STEM-based TV shows, games, and toys (ibid). The media that children consume and the toys they play with can have a significant impact on their interests, career aspirations, skills, and future careers (Ilieva et al., 2002). Parents are purchasing toys specifically to help their children with future careers and are spending significant amounts of money on learning experiences (Dreier, 2019). The global STEM toy market is a multi-billion-dollar industry, and market reports show this trend is projected to grow by $473.78 million during 2020-2024 (*Global Science, Technology, Engineering and Mathematics (STEM) Toys Market 2020-2024*, 2020). The Toy Association—a leading industry group in the U.S.—polled 2,000 parents on their opinion of STEM toys; 70% of parents believe they play an important role in skill development, while 82% agree that playing with STEM toys helps develop an interest in STEM subjects (*STEM/STEAM FORMULA FOR SUCCESS*, 2019). Additionally, 55% of parents acknowledge that they're more likely to choose a toy that's marketed as STEM learning (*STEM/STEAM FORMULA FOR SUCCESS*, 2019). This raises the question of whether toy companies are using STEM labels as a marketing tactic.

When it comes to the toy aisle, STEM is often referred to as STEAM. STEAM is an acronym which includes the arts & humanities, and is attributed to John Maeda, from the Rhode Island School of Design (Burry, 2018). Proponents for STEAM, over STEM, argue that art reduces the intimidation factor; while advocates for STEM argue that art is in everything and already plays a prominent role (Burry, 2018). To clarify, the term STEM will be used throughout this paper; however, arts & humanities will be implied in that meaning.

The Problem: STEM Gender Gap

Parents, grandparents, and other adults are disproportionately less likely to purchase STEM toys for girls than they are for boys (Inman, Jacob & Cardella, Dr. Monica E., 2015). This supports a larger underlying problem within STEM, specifically a gender gap—starting from childhood well into adulthood—which has a wide reach and long-term effects which will be explained throughout this section.

Gender bias is defined as prejudice against people of a particular gender, usually women, which may result in discrimination or unequal opportunity (Cornell Law School, n.d.). There are many different types of gender bias when it comes to STEM. For example, men currently outnumber women working in STEM nearly four to one, despite that women make up half of the college-educated workforce in the U.S. and a majority of undergraduates and master's graduates (DiPrete and Buchmann, 2013). Women have made significant progress in recent decades, specifically within medical and legal fields; however, the gender gap persists in certain areas including computer science, engineering, physics, and chemistry (Riegle-Crumb & Morton, 2017). According to the *American Association of University Women* (AAUW), women make up 26% of computing professions and only 12% of engineers. The disparity affects everyone, not just women. When women aren't represented, their opinions and voices aren't being heard; this void can lead to results which impact everyday life (Criado, 2019b).

"Made for male design" or "one size fits man," is another type of gender bias, which refers to research performed in science, medicine, engineering, and other fields using "reference man" or "standard male" design standards (Stanford University, n.d.). Reference man is a 20- to 30-year-old white male who is approximately five foot nine inches and weighs between 150–160 pounds. He's the standard unit of measure when it comes to

designing everyday objects like air bags, computer desks, bus seats, etc. (ibid). Designing products around a male average (reference man) can be frustrating for women, for example having phones too large to fit in female pockets or not being able to reach the top shelf of a grocery store, but more importantly the effects of these design choices can have serious consequences (Boyle, 2019). In her book, *Invisible Women: Data Bias in a World Designed for Men*, Caroline Criado-Perez, provides dozens of examples of the consequences of living in a made for male world, some of which include improper-fitting personal protective equipment (PPE) for female law enforcement, military, and medical workers; dangerous medication dosage recommendations for females; and driver's safety standards that don't account for the female body (Criado-Perez, 2019a). As a result, women are 73% more likely than men to be seriously injured in a car crash, because car safety tests use crash tests dummies based on the male standard. The "female" version is a shrunken down version of the male design (Mohn, 2019). According to the *National Highway Traffic Safety Administration* (NHTSA), the two female crash test dummies currently being used are four foot eleven inches and 108 lbs., while the other is 4 foot 11 inches tall and weighs 97 lbs. (*NHTSA's Crash Test Dummies*, 2020).

Female bodies aren't represented when it comes to designing everyday objects, and they're also not being represented when it comes to science and mainstream media. A study by the Geena Davis Institute on Gender in Media found that women aren't being represented as STEM characters in the media; for every 15 male characters shown in STEM, only one female character was represented (2018). Experts say that the lack of female role models in STEM perpetuates gender stereotypes (Dockterman, 2014a). In addition to the dangerous risks of made-for-male design, there are numerous consequences of gender bias which result in gender gaps in salary, research and grant funding, published work, patents,

and awards (Stanford University, n.d.). One benefit of attracting and retaining more women in the STEM workforce is an increase in innovation, creativity, and competitiveness (Hill et al., 2010).

The effects of gender bias aren't limited to adulthood, they can also affect children. While women have advanced toward parity in the workplace, the toy aisle has moved in the opposite direction (Dockterman, 2014a). Many companies market their toys specifically towards girls, in an attempt to increase their interest in STEM topics; however, many of these products are tied to the beauty industry. For example, many of these toys teach science and chemistry through making your own perfume, bath bombs, or nail polish (see Figure 2). While similar toys have existed for decades, the earlier examples did not claim to have educational benefits (see Figure 3).

Figure 2. Beauty-related STEM Toys (Amazon, n.d)

Figure 3. 1970s Perfume Kit (eBay n.d.)

In U.S. schools, girls are 11% more likely to be in a gifted program, yet parents are two and a half times more likely to Google search "Is my son gifted?" than "Is my daughter gifted?" (Stephens-Davidowitz, 2014). The same study used Google search data to determine that parents were more likely to Google subjects related to their daughters' beauty, weight, and attractiveness despite the fact that girls receive better grades than boys from kindergarten through twelfth grade (Stephens-Davidowitz, 2014). According to experts, the brightest girls are those who are most negatively affected by gender stereotypes and discrimination (Boston & Cimpian, 2018). Beauty standards and negative gender stereotypes start early for children and research shows that children as young as six already hold negative gender stereotypes, such as boys are better than girls in robotics and coding (Cheryan et al., 2015). Additionally, children who are exposed to counter-stereotypic images and content are more likely to develop flexible attitudes toward the toys they choose and who they play with (Spinner et al., 2018 and Coyle & Liben, 2016).

II. BACKGROUND

Gender and Toys

The concept of gender schema is useful when considering gender and toys. According to gender schema theory (GST), gender typing is learned from society and culture, and children process and embed new gender-related information they experience and encounter into their own identities (Bem, 1983 and Kollmayer et al., 2018). This means that children use their surroundings to decipher what makes something "for girls" or "for boys." By the time a child is four or five years old, children have become conditioned by their environment to be interested in what's appropriate for their gender, as well as to prefer friends and peers of the same gender (Bem, 1983).

In a study spanning fifty years, researchers from *Northwestern University* observed how gender-science stereotypes have changed in the U.S. They collected and analyzed over 20,000 children's responses spanning five decades; they concluded that gender stereotypes grow stronger with age (Miller et al., 2018). In other words, gender associations, like girls behave a certain way, or play with specific toys, or are good—or bad—at particular subjects, became more apparent as children grew older; which support GST that children's stereotypes are influenced by the environment around them. According to GST, the way in which children play, and the toys they play with, are influenced by toy type; toy labels and colors play an important role in encouraging and enhancing gender stereotypes (Weisgram et al., 2014).

The belief on what is culturally and socially acceptable based on a child's gender, affects how children participate and act (Coyle & Liben, 2016); ultimately affecting the toys with which they play or even their future career aspirations. Additionally, GST is linked to

the STEM gender gap and can be tied to girls' experiences from media, family, and schools which have conceptualized STEM as for males, instead of females (Bond, 2016).

Gender typing of toys means that toys become associated with a particular gender. While toys play a prominent role in children's lives, they have a history of being separated by gender and this divide has widened in recent decades (Tabuchi, 2015 and Sweet, 2014). Girl toys from the early-to-mid 20th century focused heavily on domestic housework and nurturing which prepared girls for a life of domesticity (Sweet, 2014). However, in the late 20th century toy companies started to rely on implicit gender cues such as color and fantasy-based gender roles/storytelling; the "little homemaker" of the 1950s has transitioned into the "little princess" seen today (ibid). Even today, stores—both online and in-person—still divide toys by gender (Hudak, 2017).

According to Sapna Cheryan, an associate professor of Psychology at the University of Washington, "If there's a way to influence children, it's through a toy. Toys are really important. The first way kids get experience with different fields is through toys, like a toy microscope" (Eckart, 2018). However, this doesn't necessarily support the need for a girl-branded microscope, as research shows that girls actually learn less when playing with toys that are branded specifically for females. In a study by Coyle and Liben, children were presented with a STEM toy, but some were branded for boys or branded for girls; the outcome was that girls learned better when playing with the male-branded toy, instead of the girl-branded toy (2018).

When companies categorize specific toys by gender, it can limit the types of toys parent's purchase, as well as which toys children are drawn to (Weisgram & Bruun, 2018). Additionally, separating toys by gender may support outdated gender stereotypes and influence the toys in which children play with, instead of allowing freedom to explore diverse

toy choices (Weisgram & Bruun, 2018). Girls perform better in verbal skills, while boys outperform girls on tasks using spatial and visual skills. Traditional masculine toys like blocks, puzzles, building sets, and video games build visual and spatial skills, while traditionally feminine toys like tea sets and baby dolls build communication and social skills (Klass, 2018). Research shows girls who grow up in an environment rich in spatial skills training are more likely to develop confidence and future interest in STEM fields (Hill et al., 2010).

Color and Toys

Children's toys are especially likely to use color to differentiate which toys are consistent with a specific gender; additionally parents themselves possess gender schemas which categorize toys "for girls" or "for boys" (Coyle & Liben, 2018). This means that color plays an important role to not only children, but to parents.

Parents are the gatekeepers for toys, especially for young children, and parent attitudes and existing biases can afford or neglect opportunities when it comes to children's growth, education, and exploration. While parents may have particular preferences when it comes to color, research shows that infants—both females and males—don't. In fact, the like/dislike divide for the color pink doesn't appear among infants yet increases with age. Around the age of two to three girls begin to show a small preference for the color pink and by the age of three to four girls' preference for pink remained high while boys' response showed a steep decline (LoBue & DeLoache, 2011).

Children spend a large amount of time playing with toys; however, the time they spend has declined since the 1980s (Weisgram & Dinella, 2018). Today's families often include fewer siblings and two working parents, resulting in toys that serve more of a

recreational purpose than a future training purpose (ibid). Despite the progress women have made in higher education (by number of degrees), working outside the home, and a move away from traditional gender roles, many of today's toys still reflect the gender tropes of an outdated society specifically through the use of color and marketing to specific genders. For comparison, Suzy Homemaker was a popular toy line from the mid 1900s, which specialized in toys related to cooking, cleaning, and raising children (see Figure 4). Suzy Homemaker toys predated the popular Easy Bake Oven, which are still available today. Today's Easy Bake Oven features purple and pink illustrations, gold glitter, and prominently shows a girl on the front packaging (Figure 5). According to the comments on *Amazon*, only three out of 107 indicated they bought the product for a boy while 41 mentioned they purchased the toy for a girl (Amazon.Com: Customer Reviews). Color is used implicitly to show what products are suitable for girls

Figure 4. Suzy Homemaker Advertisement (ClickAmericana.com, n.d)

Figure 5. Easy-Bake Oven Packaging (Amazon, n.d)

When it comes to marketing, color and packaging play a powerful role. For example, gendered STEM packaging specifically affected how mothers interacted with the toy and their children, how children played with the item, and how children learned (E. F. Coyle & Liben, 2018).

In 2015, Target removed their "girl" and "boy" labels from their aisles (Figure 6) after much criticism. A 2015 news article from Target's corporate blog stated,

"Right now, our teams are working across the store to identify areas where we can phase out gender-based signage to help strike a better balance … In the Toys aisles, we'll also remove reference to gender, including the use of pink, blue, yellow or green paper on the back walls of our shelves. You'll see these changes start to happen over the next few months."

Figure 6. Gendered signage at Target (Bechtel, 2015)

The term "pink it and shrink it" is a commonly used marketing tactic of feminizing existing gender-neutral products (Tabuchi, 2015). Many of these products receive criticism because they're designed by men for women; they're pointlessly gendered; and they often cost more than similar male or gender-neutral products—a term coined the "pink tax" (Powers, 2019). This type of marketing is visible in many areas, including sports jerseys, golf balls, tools, and the toy aisle. Gendered marketing can increase sales, especially when it comes to toys, as parents with both genders will purchase double (Powers, 2019). The New York City Department of Consumer Affairs found that girls toys cost 7% more than boys toys (de Blasio & Menin, 2015). A quick search on Target.com supported the NYC study. Two similar VTech KidiBuzz G2 Smart Devices are sold in two different colors—the pink version has a girl on the front and is priced at $99.99 and the blue version features a boy and is priced at $69.99 (see Figure 7). The price difference is more than 45%.

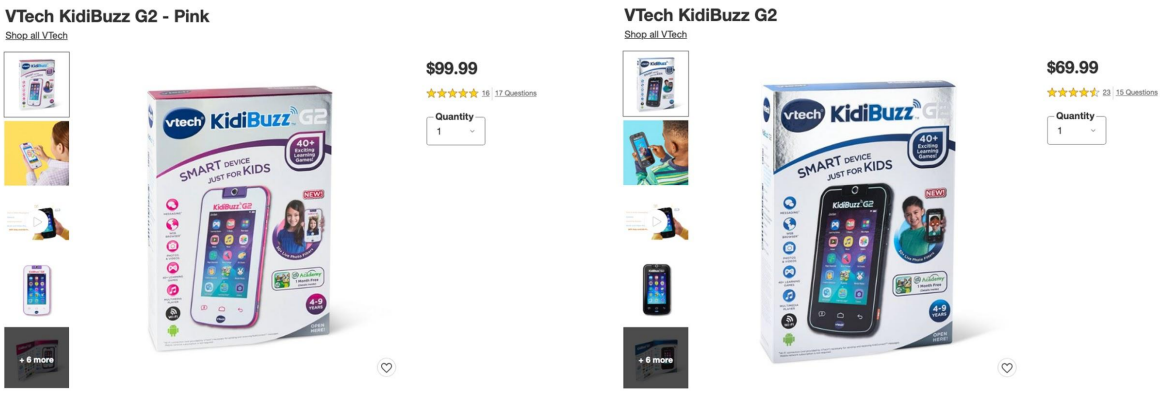


Figure 7. Tech KidiBuzz Comparison (Target, n.d)

It's important for children to experience a diverse range of toys with representation from both genders, as well as for parents to acknowledge their own gender biases when selecting toys; however, companies who use STEM labels as a marketing tactic aren't going to help close the gender gap in STEM.

The Toy Industry

According to industry reports from *MarketLine,* the U.S. is the world's largest consumer of toys, purchasing 26% of the global share, followed by China with 23% (North America 2020 and Asia-Pacific 2020). STEM toys fall under the category of "traditional entertainment and learning games," which includes science kits, vocabulary game cards, math and counting games, geography games, and bilingual games (Fernandez, 2019). This category generates the second largest industry revenue of 37% (see Figure 8), falling behind electronic and video games, and surpassing traditional toys (Fernandez, 2019).

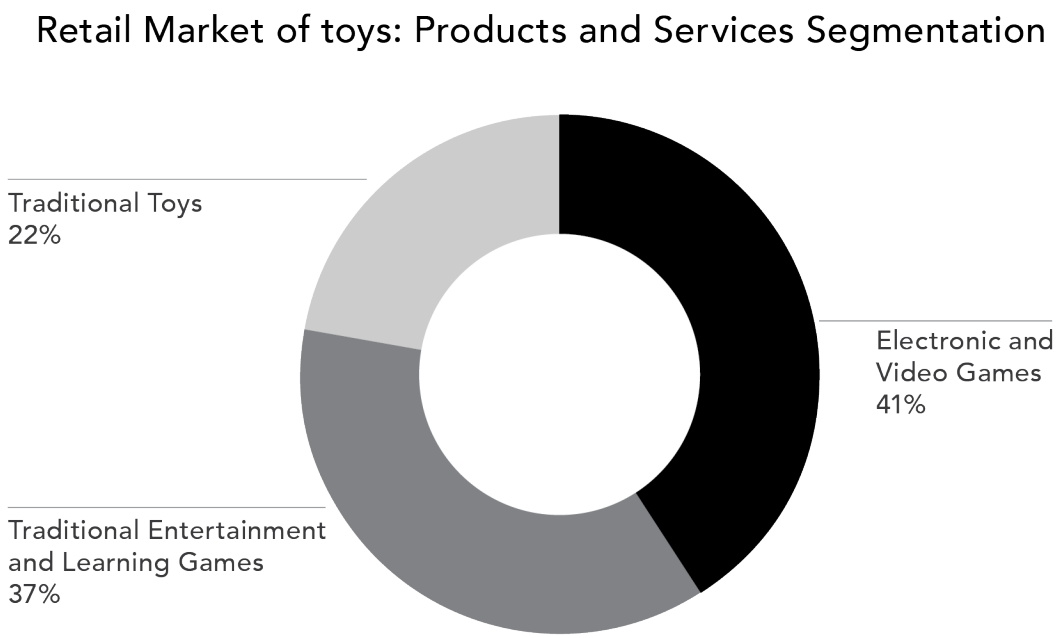


Figure 8. Breakdown of Toys in the U.S. (Data US Specialized Industry Report OD6117, 2019)

The toy industry is controlled by a small number of retailers who account for the majority of sales numbers; they decide how toys are viewed on shelves and have direct customer contact with parents and children through in-store and online purchases (2018 Annual Report, 2018). The largest U.S. toy retailers in terms of revenue include Walmart, Amazon, GameStop, Target, and Costco respectively (Fernandez, 2019). Several of the world's largest toy companies are based in the United States, including MGA Entertainment, Mattel, Hasbro, TY, and VTECH. Globally, the top-selling toy properties included LOL Surprise!, Barbie, Marvel Universe, Hot Wheels, and Nerf (2019 Global Toy Industry Sales, n.d.).

Figure 9. Characteristics of STEM Toys (The Toy Association, 2019)

When it comes to STEM toys, their popularity isn't isolated to the United States. According to a March 2020 report by *Technavio,* the fastest growing regions for STEM toys include North America, Asia-Pacific, and Australia. Additionally, leading companies include: Elenco Electronics Inc., Hasbro Inc., Johnco Productions Pty Ltd., Learning Resources Ltd., LEGO System AS, Mattel Inc., Melissa & Doug LLC, Ravensburger AG, Smartivity Labs Pvt. Ltd., and Spin Master Corp (Science, Technology, Engineering and Mathematics Toys Market by Distribution Channel and Geography - Forecast and Analysis 2020-2024, 2019). While STEM toys aren't regulated or defined by a specific organization, *The Toy Association*

has come up with a set of guidelines of ideal characteristics for STEM toys (see Figure 9). Additionally, *The Toy Association* surveyed 2,000 parents to measure what characteristics they expect from STEM toys. Most importantly, parents expect STEM toys to encourage creativity, followed by foster problem-solving, provide fun, engage children, and finally build a child's confidence.

Marketing Toys and Brand Experience

The U.S. toy industry has changed significantly with the influence of digital devices, video games, artificial intelligence, streaming services, and the Internet of Things. Traditional and cultural values have shifted, and parents are no longer able to predict the future tools children will need as adults (Cross, 2009). However, parents are purchasing STEM toys with the intention of preparing children for STEM careers (Dreier, 2019). According to *Mattel's 2018 Annual Report*, toys today have shorter life cycles than past generations in addition to increased technology components, which fuels competition among toy companies. Today, children outgrow toys at a younger age than previous generations, as a result of children moving toward electronics devices and video games (*2018 Annual Report*, n.d.). Online sales account for more than half of total sales ("MarketLine Industry Profile," 2020a); which means companies have had to change how they market these products.

Brief History of Marketing Toward Children

The 1980s played a pivotal role in shaping marketing toward children. Mattel and Hasbro, two large U.S. toy companies, began creating TV commercials as miniature sales pitches which showed children how to play with their products (Cross, 2009). These commercials became so popular that Mattel and Hasbro turned their commercials into half-hour programming, in the form of G.I. Joe and He-Man (Cross, 2009). President Ronald

Reagan supported the deregulation of children's media and the *Federal Trade Commission Improvement Act of 1980* opened markets to target children as they saw fit (Molotsky & Times, 1988). In the year after deregulation, all ten of the best-selling toys were based on children's programming including Transformers, G.I. Joe, Care Bears, Voltron, Mask, Cabbage Patch Kids, He-Man, Super Goobs, WWF action figures, and My Little Pony (Barbaro & Earp, 2008). This practice is still popular today and large toy manufacturers widely purchase licensing rights to popular brands including those from TV, films, books, Marvel, DC, Star Wars, and Disney ("MarketLine Industry Profile"). While Disney hasn't come out with a STEM kit yet, there have been licensing deals with Barbie, National Geographic, and Discovery.

Children's media viewing patterns have changed significantly since the 1980s and 90s, and the number of brand messages they see a day has increased (Hoppe-Spiers, 2018). Gone are the days of Saturday morning cartoons, in-store release parties, gigantic holiday toy catalogues; and have been replaced by streaming services, YouTube channels, online pre-orders, free two-day shipping, and online wish lists. TV is diluted with messages, and marketers find it challenging to reach kids through traditional media (Hoppe-Spiers, 2018).

Experience Marketing

Brand experience is the way customers interact with a product or company—which can happen in person or online. The term brand experience includes all touchpoints between a customer and a brand, which can be subjective internal consumer responses elicited by brand-related stimuli like packaging, communication, and environment (van de Sand et al., 2020). Equally as important as brand experience (BX) is user experience (UX) and customer experience (CX). UX encompasses all aspects of customers' interactions with the company and its service and considers customers' daily lives and how the company can help to

improve them (Solis, 2015). CX is a customer's perception and how they have engaged with a company, brand, product, or service; it's also how customers consciously and subconsciously see their experience (ibid). How customer's view, perceive, interact, and live with a brand is highly measured and studied by marketing departments. There are more than 50 million children under the age of 12 in the United States and they have become a very influential demographic for marketers (Barbaro & Earp, 2008).

Figure 10. Victoria Gardens in California (ULI- The Urban Land Institute, 2007)

Outdoor malls—also known as lifestyle centers, or mixed-use lifestyle centers—are an example of customer experience; they have grown in popularity as consumers want something to do when making purchases (*Experiential Purchasing and the New Retail*, n.d.). Shopping trips have become retail destinations. In addition to shopping, these centers offer food, drink, and entertainment for families. Examples include Mockingbird Station in Arlington, Texas; Reston Town Center in Reston, Virginia; The Domain in Austin, Texas; Botany Town Centre in Auckland, New Zealand; and Victoria Gardens in Rancho

Cucamonga, California (see Figure 10). Today's consumers expect shopping experiences to be fun, which has led to the term deemed "experiential buying" (*Experiential Purchasing and the New Retail*, n.d.).

Figure 11. Disney interactive area at Target (Corporate Target, n.d.)

The concept of experiential buying is not only apparent in shopping centers; it's also apparent within retail stores, and more specifically the toy aisle. Interactive store displays are another example of experiential buying. In an effort to compete with online retailers, such as Amazon, brick and mortar retailers are increasing brand experiences. Toy companies are getting creative and marketing toys through integrated marketing strategies including licensing agreements, toy influencers, digital ads, and brand experiences (Tu, 2018). In August 2019, Target partnered with The Walt Disney Company to open 25 permanent Disney-branded shops inside Target stores (Figure 11), a marketing strategy to increase customer foot traffic and provide unique shopping experiences ("MarketLine Industry Profile"). Additionally, Target stores redesigned their store layouts featuring interactive areas for kids, pop ups, and exclusive "Made for Target" items, in addition to offering free two-day shipping. Walmart recently created a "Toy Lab" (see Figure 12), where children can

digitally test and review the latest toys; retail activations at the KidHQ virtual store; and recently expanded its toy assortment for the holiday season ("MarketLine Industry Profile," 2020). In a study by Field Agent (2016), six out of 10 parents agree that interactive toy displays—which allow kids to try before they buy—are extremely important or very important.

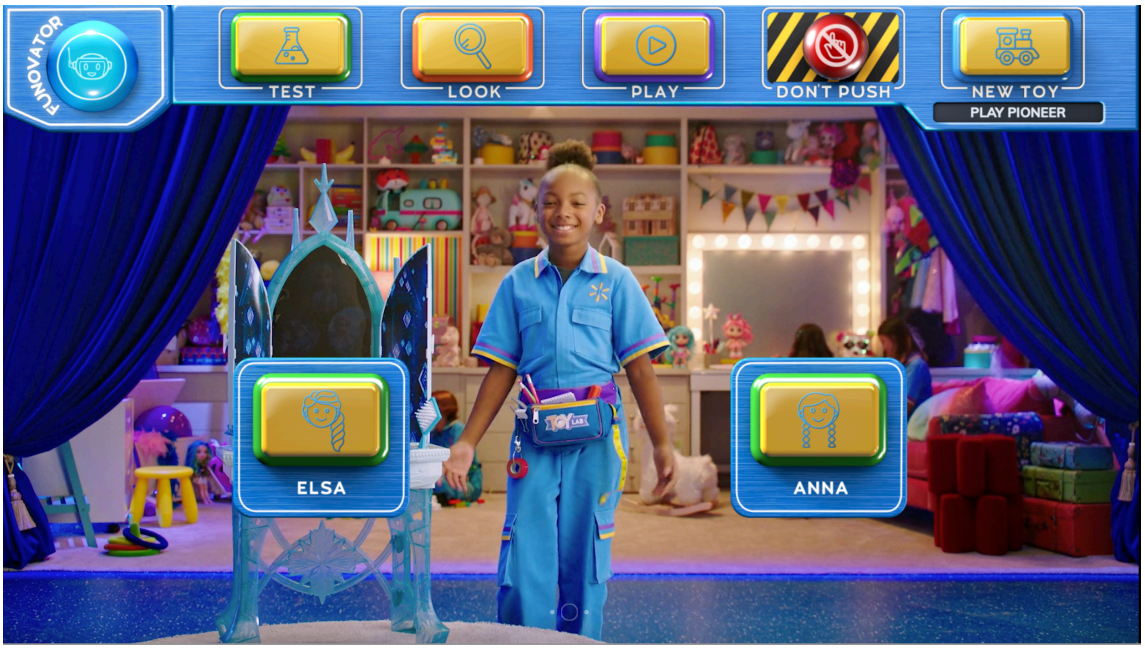


Figure 12. Walmart's Digital Toy Lab (Walmart Toy Lab, n.d.)

Social Media's Influence on Toys

Toy aisle trends appear to mirror popular culture, which means that social media has widely influenced the toy industry. Children watch more YouTube than traditional television, which has led to a phenomenon known as "YouTube-driven product creation" (Kestenbaum, 2020), meaning popular content on YouTube can be licensed and purchased in stores. An example of this includes, Karina Garcia, a self-proclaimed "Slime Queen." Garcia's YouTube channel has more than 300 videos, nine million subscribers, and has collectively accumulated more than 1.5 billion views (Garcia, 2019). Her slime empire is valued at $1.6 million and she receives income from ad revenue, sponsors,

events/appearances, and promotional deals (Hansen, 2018). Garcia's popular YouTube videos led to the creation of Craft City, a line of products which sells slime kits, bath bombs, and lip gloss (Hansen, 2018). Many of Garcia's products are marketed as STEM and can be found at Target and other big box retailers. While Garcia is only one of many successful "slime influencers" on social media, store shelves mirror the popularity of this type of content by featuring toy sections dedicated to slime.

Unboxing videos appeared in the early 2000s and initially featured adults opening and reviewing the latest electronics; creating the term "geek porn" (Lieber, 2019). However, since the launch of YouTube in 2005, the unboxing phenomenon has evolved into commercial and cultural influences and grown at a rate of 871% since 2010 (Kelly, 2014). This trend includes unboxing videos of children's toys which feature adults and children opening, assembling, and demonstrating toys and products. Influencers who make unboxing videos are content creators who create content which is categorized as social media entertainment (SME) (Craig & Cunningham, 2017). The highest paid YouTuber is a seven-year-old boy from the channel *Ryan Reviews Toys.* He unboxes videos for a living and earns a reported $22 million per year (Kestenbaum, 2020). Toy companies are taking note of unboxing phenomena, made apparent by walking through any toy aisle— whether it's a big box retailer or even a chain drugstore—the number of "surprise" boxes is astounding. Additionally, Ryan's success as a YouTuber has entered store shelves in the form of "Ryan's World." The range of toys is extensive, according to Walmart's online toy store there are 107 Ryan's World Toys to choose from (2020).

III. EXPLORATION

While the problems surrounding gender stereotypes within toy aisles and solving the gender gap in STEM are vast, the goal of this research is to analyze existing STEM toys. Regular toys are designed for specific genders, but is this the case for STEM toys? Parents and other family members are the gateway to a child's access to toys; so how are toys like the Mc² Glitter volcano—previously mentioned in chapter I—perceived by consumers? How do gender stereotypes affect how STEM toys are purchased? To summarize this research and to focus on an attainable goal, the following design problem has been defined: How might toy companies market STEM toys to children ages five to eight without perpetuating existing gender stereotypes? To address this question, the IDEO Human-Centered Design (HCD) approach was used to develop an empathetic and innovative solution to alleviate this problem. HCD focuses primarily on users (or the people using a product), follows an empathetic approach, and uses available resources to develop an iterative prototype, using the following steps: inspiration, ideation, and implementation (IDEO.org, 2015). IDEO's HCD approach has been a reliable and successful method of design thinking since the 1980s, when Apple used this method to create the first usable computer mouse (IDEO). Today, HCD has been used to create design solutions across various fields such as consumer goods and services, education, experiences, health and wellness, medical products and services, toys and games, etc.

Method 1: Observational Research

To understand product branding and marketing strategy of existing STEM toys, this research focused on observational research methods at three large toy retailers—Amazon, Walmart, and Target—because they're among the largest toy distributors (Fernandez, 2019)

and have multiple locations and delivery to the research area. In addition to observing these retailers–either in-person or online—additional in-person observational research took place at craft, office, and discount stores including Michael's, Hobby Lobby, Barnes & Noble, Office Max, and TJ Maxx. These stores were selected due to close proximity, as well as a wide number of national and regional locations. For the purpose of this study, photos were taken to inventory existing products, packaging, and placement of STEM toys.

Method 2: Four Case Studies

During observational research, there were several STEM toys which appeared to be marketed specifically toward girls. In order to better understand the underlying principles of these items, four of these toys will be analyzed as case studies. Case studies allow researchers to compare qualitative data and to analyze on a singular or multiple case basis; however, there's no clear explanation of what a case study entails despite being a commonly used research method (Heale, 2017). For this research method, four female-branded toys (determined by color, topic, and/or images used) will be compared for an in-depth discovery of who makes these products, why they were made, and/or how they have been perceived, according to secondary research. The four STEM toys for girls include: Barbie STEM Kit, Mc2 Adrienne Perfume Kit, GoldieBlox, and LEGO friends. The outcome of these finding will help guide further research and the questionnaire.

Method 3: Questionnaires

Online questionnaires were used to gather quantitative and qualitative data in order to measure the purchasing behavior and customer attitudes of existing STEM toys. For more than forty years, surveys and questionnaires have been a recognized form of collecting market research data (Ilieva et al., 2002). For this research study, online questionnaires were

a cost-effective research method that provided a large amount of user data in a short amount of time. The questionnaire was distributed online to adults 18 years and older.

In order to gather multiple datasets, respondents were divided into two groups: Group A and Group B (see Figure 13). Group A consists of parents of children between the ages of five to eight, while Group B includes all others. The research primarily focused on children ages five to eight—as well as toys appropriate for this age group; making it possible to narrow down the wide array of available STEM toys.

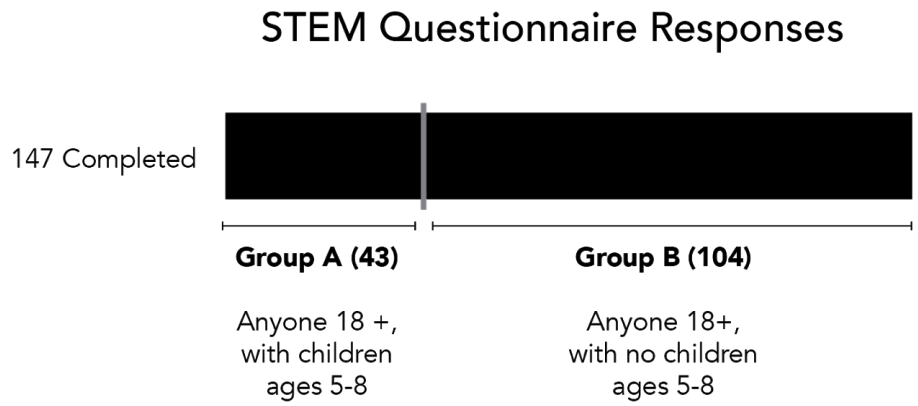


Figure 13. STEM Questionnaire: Group A & Group B, a breakdown of the total number of questionnaire respondents, which were separated into Group A or Group B. Group A has children between the ages of five to eight, while Group B includes anyone other than parents with children five- to eight-years-old.

Questionnaire 1: Group A

The Group A questionnaire specifically targeted parents who have children between the ages of five to eight. This age group is either entering or already enrolled in elementary school and is likely to be familiar with STEM. Prior research—mentioned in chapter II—shows that this age group has strong gender stereotypes yet is still young enough to be reconditioned (Miller et al., 2018 & Spinner et al., 2018). Additionally, five- to eight-year-olds have not grown out of the toy-playing phase and are influenced by peers, curriculum, and media.

The goal of Group A's questionnaire was to answer the following questions (see Appendix A for full questionnaire):

- What STEM toys are parents of five- to eight-year children most likely to buy?
- What motivates parents to purchase STEM toys?
- Will parents purchase toys that are marketed toward the opposite gender?

Questionnaire 2: Group B

The Group B questionnaire was designed to capture a general consensus of users and their opinions of STEM toys. For this reason, anyone 18 years or older (who did not have children in the five to eight demographic) were asked to complete this questionnaire. Many of the questions mimicked the card sorting technique, a commonly used method in design research which asks users to group similar products. In this questionnaire, users were asked to categorize photos of existing STEM toys into feminine, gender neutral, or masculine categories.

The purpose of Group B's questionnaire was to answer the following questions (see Appendix B for full questionnaire):

- Are current toys marketed to boys and girls separately?
- Does gendered packaging affect purchasing behavior?
- Are current STEM toys masculine, female, or gender neutral?

Findings Observational Research

In-person observational research revealed that STEM toys were grouped together by brand and topic, which resulted in a divide of pinks/purples and blacks/blues/greens (see Figure 14). The LEGO aisle was separated by trucks, superheroes, spaceships on one side and princesses, ponies, and Duplo's (the toddler LEGO bricks) on the other. Many of the aisles are labeled as STEM or as educational toys. STEM labels varied in design and location;

sometimes STEM was featured prominently on the front of the box, sometimes it was marked with an emblem, and other times it was placed on the backside of packaging or as text (see Figure 15).

Figure 14. Panoramic View of a STEM Toy Aisle. Toys appeared to be arranged by gender and color. Taken by researcher in Austin, Texas on April 15, 2019.

Figure 15. Various STEM Toy Labels. Taken by user in Austin, Texas between 2019–2020.

Findings Four Case Studies

Dolls are one of the oldest types of toys and have historically been designed for girls as a way to practice for motherhood. In addition to traditional baby dolls, today's toy aisles are filled with different types of toys. However, even traditionally feminine toys such as dolls have begun to cross over into the STEM-learning world.

I'm a Barbie Girl

Every three seconds, a Barbie is purchased somewhere in the world (Escobar & Schubak, 2019 and Crosley, 2013). The iconic, long-legged plastic doll is manufactured by Mattel and has been sold for more than 60 years (Dockterman, 2014b). Mattel reports annual sales of one billion dollars across 150 countries and 92% of American girls ages three to 12 have owned a Barbie (Dockterman, 2014b). Despite her success, Barbie has a long history of reinforcing negative gender stereotypes. One of many examples includes the 1992 Talking Barbie which received national criticism for saying "Math class is tough" (Greene, 1992). Barbie has evolved to include a diverse line of different body types, races, and careers. New careers include astrophysicist, game developer, entomologist, and robotics engineer. However, a new career means changing Barbie's clothes, not encouraging new play experiences. For example, Game Developer Barbie has red hair and comes with a laptop, glasses, and a wardrobe that isn't primarily pink. While Barbie's physical appearance and resume have changed, Mattel's efforts appear to be superficial. For example, Thames and Kanos partnered with Barbie to create a Barbie STEM kit (see Figure 16), where children could create a spinning closet. Despite an attempt to teach children STEM, Mattel again perpetuated unnecessary gender stereotypes by associating STEM with fashion/appearance.

Figure 16. Barbie STEM Kit (Amazon, n.d.)

GoldieBlox Goals

GoldieBlox is a doll which introduces STEM learning with storytelling/role playing. In 2005, Debbie Sterling graduated from Stanford with a degree in Mechanical Engineering; only one out of four graduates that day were women. This was a driving motivator in her decision to create GoldieBlox, a toy that encouraged girls to build and as a result taught spatial awareness (Causer, 2013). Before creating GoldieBlox, Sterling researched the characteristics of girls' favorite toys, finding that girls prefer to play with characters, themes, and stories (Hudak, 2017). In 2012, Sterling created a prototype and attended the New York Toy Fair where she received criticism among a male dominant industry (Causer, 2017). After her first failed attempt, she turned to Kickstarter and raised enough money to manufacture GoldieBlox, a blonde-haired action figure donning overalls, a tool belt, and building activities (see Figure 17). The toy received mixed reviews despite a successful crowdfunding campaign, critics declared Sterling of "pink washing;" however GoldieBlox also received several awards and appeared as a float in the 2014 Macy's Thanksgiving Day Parade (Hudak, 2017).

Figure 17. GoldieBlox (Walmart, n.d.)

Project Mc² for Profit

In 2016, The White House released a fact sheet titled "Breaking Down Gender Stereotypes in Media and Toys so that Our Children Can Explore, Learn, and Dream Without Limits," which anticipated the release of Project Mc², a Netflix-commissioned show to help break stereotypes in media. The show depicts a team of girls who work together to "save the day" and "to further inspire girls to unlock their own STEM potential" (United States, Office of the Press Secretary, 2016). According to Isaac Larian, CEO of MGA (the parent company of Project Mc²), "The Project Mc² brand was developed in order to inspire girls that it's cool to be smart, leverage the growing trend of STEM" (Wilbur, 2015). While leadership claims that the company's products were made to increase the number of girls going into STEM, the product line focuses heavily on beauty, fashion, and gender stereotypes (see Figure 18). MGA is also the manufacturer for many of the girl-branded STEM toys mentioned in chapter I. In addition to reinforcing negative stereotypes, the Netflix show is a platform to promote toys and products.

Figure 18. Project Mc² (Amazon, n.d.)

Rebuilding LEGO

LEGO, a Denmark-based company, is a household name for parents and the company has been building gender neutral construction sets for generations. While LEGO has historically marketed building sets to all children (see Figure 19), they have recently introduced product lines, LEGO City and LEGO Friends, which target boys and girls separately (Reich et al., 2018). In 2008, a marketing study revealed that 90% of the current LEGO sets available were designed for boys. To fix this problem, LEGO embarked on a 10-year research study to understand how girls play; their findings showed that girls are more interested in bite-sized assembly and role-play opportunities (LaFrance, 2016). The result was LEGO Friends (Figure 20), a line of bricks for girls that came out in 2012. Initially, LEGO Friends was met with criticism, as some felt the bricks were a dumbed down version of the traditional bricks. LEGO Friends was petitioned by tens of thousands of people and received a "Toys Oppressive and Destructive to Young Children" (TOADY) Award (LaFrance, 2016). However, according to Business Insider LEGO sales increased by 24% in 2012 and the product line has expanded.

Figure 19. 1981 LEGO Advertisement (Wasserman, 2014)


Figure 20. LEGO Friends Set, "41332 Emma's Art Stand." (LEGO, n.d.)

In 2018, a team of researchers analyzed all 66 LEGO Friends sets, along with 66 LEGO City sets, released between Jan 2012 and Feb 2015. One of the most striking data patterns revealed that male sets focused on professional work activity while female

characters focused on recreational, hobbies, and domestic tasks (Reich et al., 2018). Eighty-nine percent of LEGO City sets focused on a job or profession, while only 47% of LEGO Friends sets focused on jobs. Additional themes included that being male involves danger, saving people, and sense of urgency while being female involves socializing and the importance of beauty (Reich et al., 2018)

A study by Fulcher and Hayes researched whether changing the color of LEGO bricks affected genders; they found that both girls' and boys' speed and accuracy was the same regardless if they used pink or blue bricks (2018). Additionally, the researchers found that girls were more attracted to girl-branded pink LEGO bricks; however, they were restricted in how they played when using the pink LEGO bricks (Fulcher and Hayes, 2018). Opponents of LEGO Friends compared the new product line to the 1981 ad, arguing that the "imagination, infinite possibilities, and unisex LEGO principles of play" had been reduced to simpler building sets which narrowed creativity and imagination (Lange, 2018).

These four case studies exemplify how toy manufacturers are attempting to connect female-branded toys with STEM; however, little research exists on the impact of these efforts. Chapter III will explore this topic further.

Findings Questionnaire 1: Group A

Group A consisted of 43 respondents; 72% were women and 28% men. The most common age group of respondents was 31–40, followed by 41–50, then 21–30 (Figure 21). Ninety-three percent of respondents were familiar with the acronym STEM. Group A accounted for 58 children who were ages five to eight (32 sons and 26 daughters).

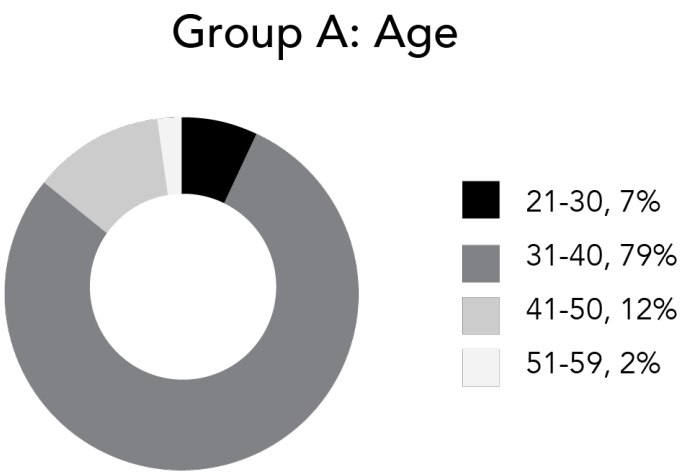


Figure 21. Group A: Age Demographics

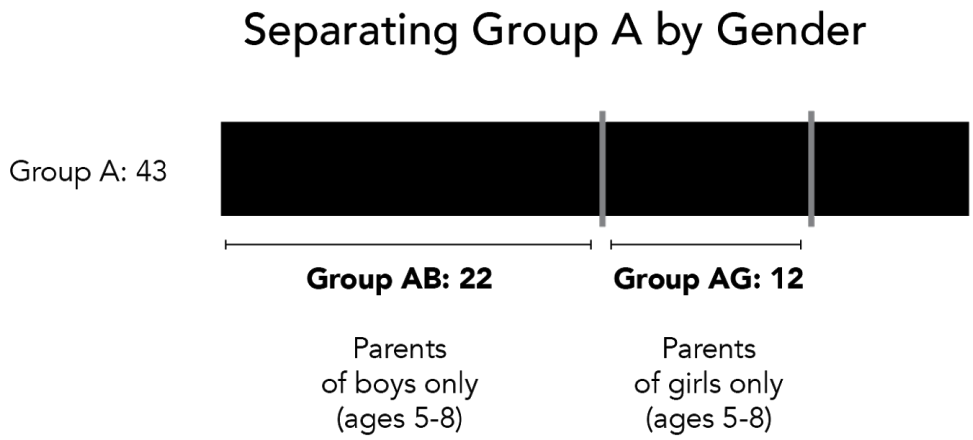


Figure 22. Group A: Gender Demographics

In order to account for a larger number of respondents with sons than daughters, and to avoid having results skew toward more masculine outcomes, data were analyzed further and divided respondents into families with only girls and only boys. Of the 49 respondents in Group A, 22 respondents had only boys and 12 respondents had only girls (Figure 22). Splitting the data into these groups allowed the researcher to observe gender differentiations and revealed several findings.

First, gender determines which types of toys are most popular. For families with all boys, the most common toys included building and construction sets, games/puzzles, youth electronics and arts and crafts (tie), while families with all girls included arts and crafts, games/puzzles, and dolls and action figures (Figure 23). The data support prior research that boys are more likely to play with construction sets and girls with dolls.

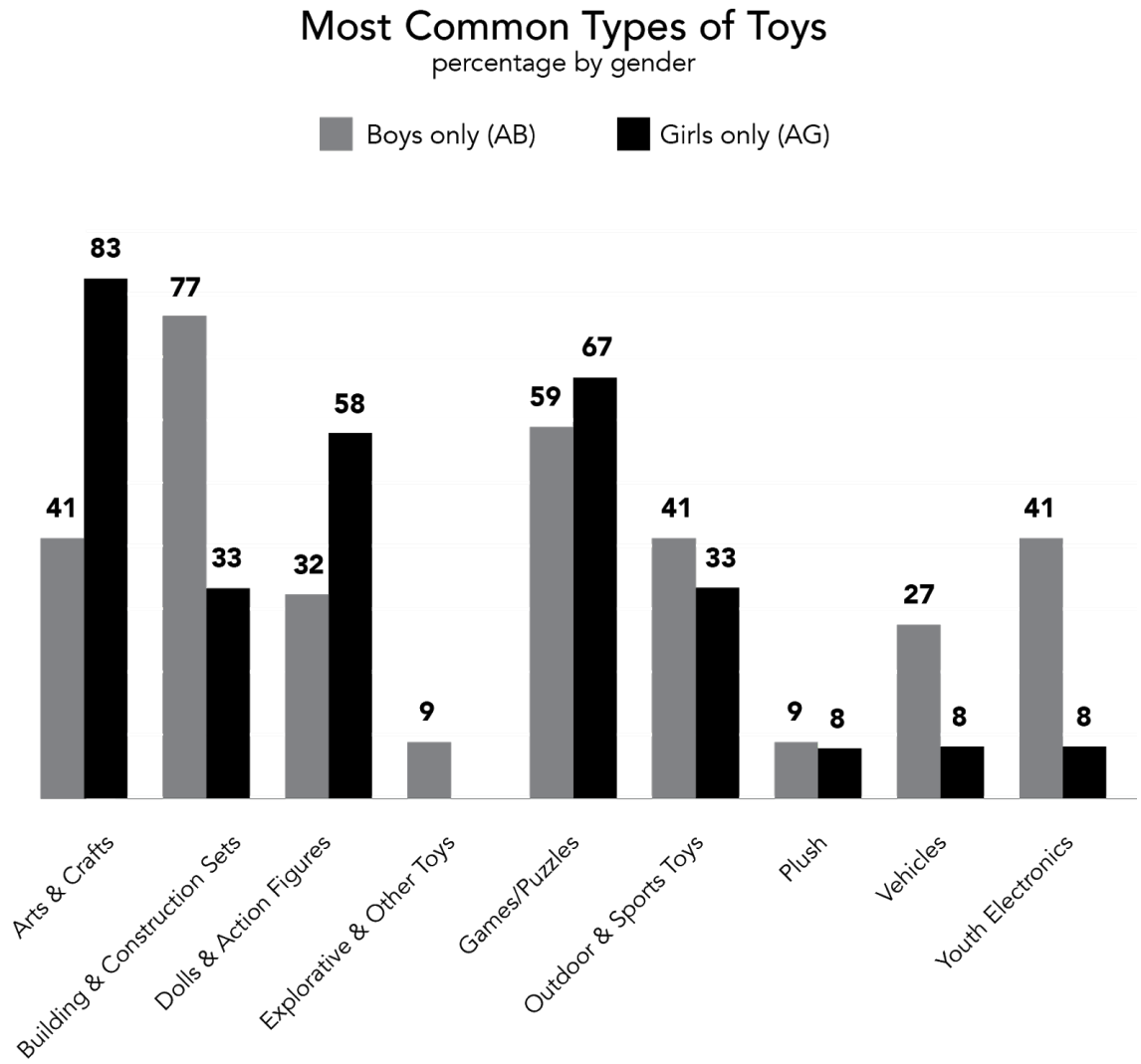


Figure 23. Most Common Types of Toys by Gender.

Second, respondents indicated that their child's gender determined the factors which influence their child's interest in a toy. Parents of all boys indicated the top three most influential factors were packaging design (73%); TV, online, or other media (68%), and in-

store display (59%). Parents of all girls indicated the top three factors included friends and peers (75%); TV, online, or other media (75%); and packaging design (67%) (see Figure 24).

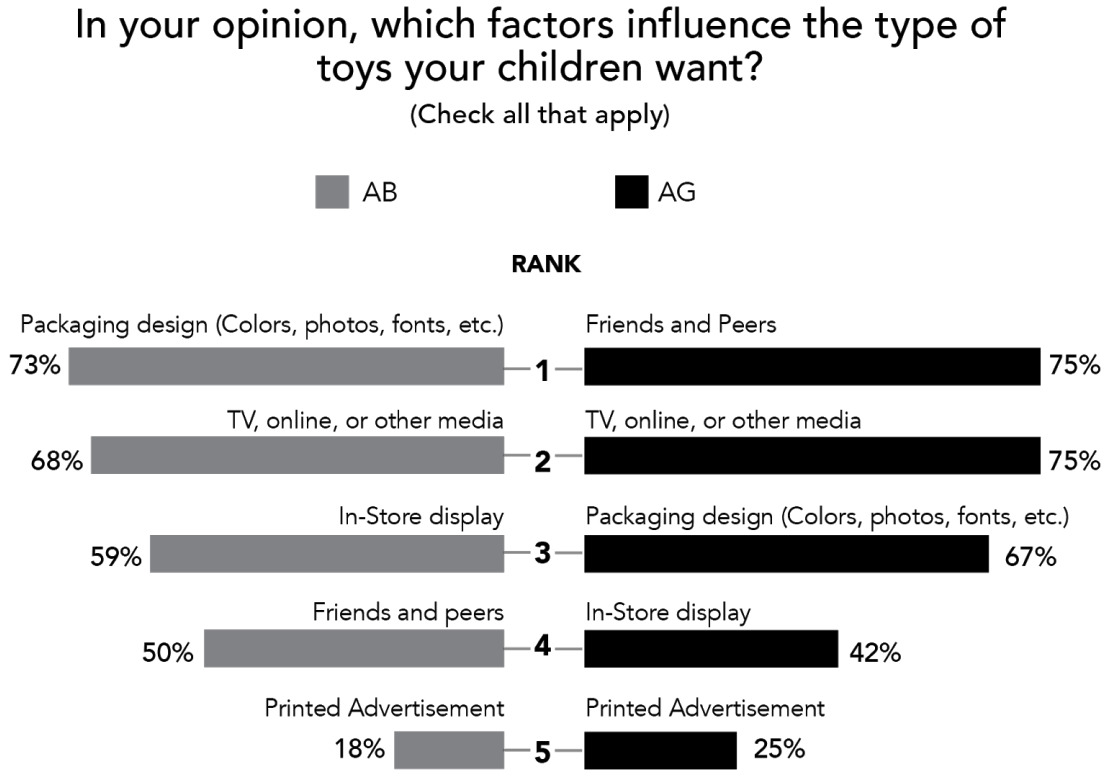


Figure 24. Factors which Influence Children's Toy Preferences.

Third, parents of girls were more likely than parents of boys to indicate that a product was gender neutral. The data suggests that parents of girls are more accepting of both toys considered to be masculine or feminine toys, than parents of boys.

Fourth, there was a strong correlation between gender neutrality, teaching STEM topics, and the likelihood parents would purchase the toy. In other words, STEM toys which were perceived as less gender neutral were more often perceived as less educational. Parents of boys were also less likely to purchase toys that were not gender neutral. Parents of girls indicated that the gender neutrality of STEM toys did not affect whether or not they would purchase a toy.

Findings Questionnaire 2: Group B

The Group B questionnaire included anyone 18 years or older (who did not have children in the five- to eight-year-old demographic). This questionnaire was designed to capture quantitative results from a general population and focused on evaluating whether existing STEM toys are designed as masculine, feminine, or gender neutral.

Questionnaire 2 was completed by 104 respondents; 33% or which were males, 65% females, and 2% preferred not to say. The top three age groups included 31- to 40-year-olds (42%), followed by 60< (20%), and 41- to 50-year-olds (13%) (see Figure 25). While this questionnaire excluded anyone with children between the ages of five to eight; 59% of respondents were parents to children of other ages. Forty-two percent had adult-age children (ages 19 years or older), 24% were parents to nine- to 13-year-olds, 20% were 14- to 18-year-olds, and 15% were four or under. Eighty-six percent of respondents were familiar with STEM, which may correspond with 30% of the group being age 50 or older. Some notable findings included the following.

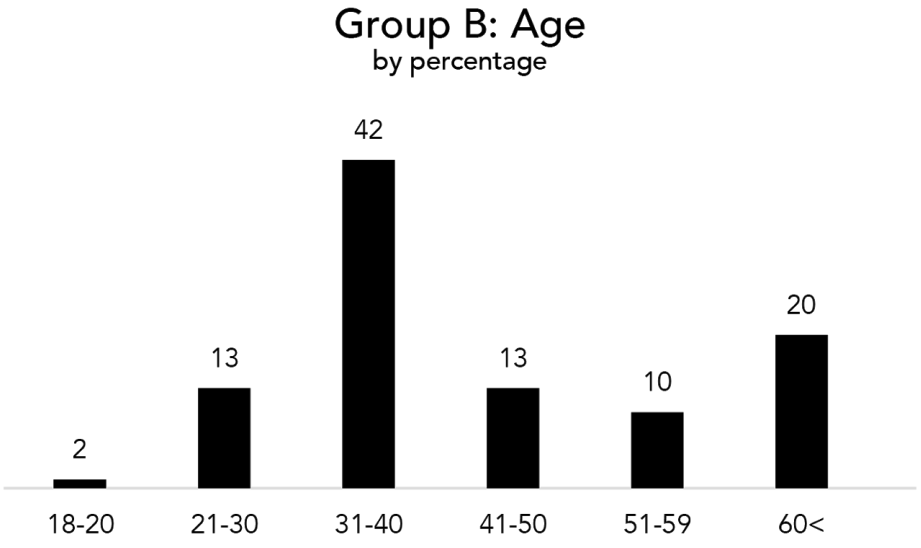


Figure 25. Group B: Age Demographics

Respondents indicated that color and images were the most important factor when purchasing a toy, followed by age/skill level, and education value (see Figure 26). Similar to Questionnaire 1, respondents were more likely to purchase gender neutral toys when shopping for both girls and boys.

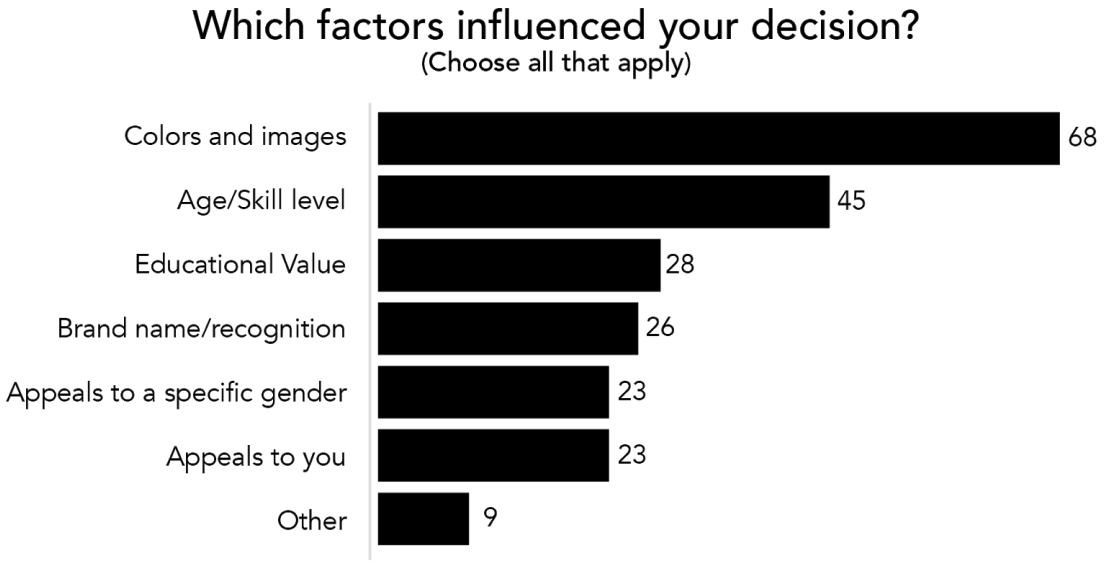


Figure 26. Group B: Influential Factors

Respondents were presented with 29 STEM toys and asked to indicate whether they were masculine, feminine, or gender neutral. The toys represented a range of colors. Many did not feature photography, but of those that did, they featured a boy, a girl, or both genders.

The results showed that Group B respondents labeled most of the STEM as gender neutral, however they were more likely to be labeled as feminine than masculine. Of the 29 toys, four were rated as 100% feminine while none were rated as 100% masculine.

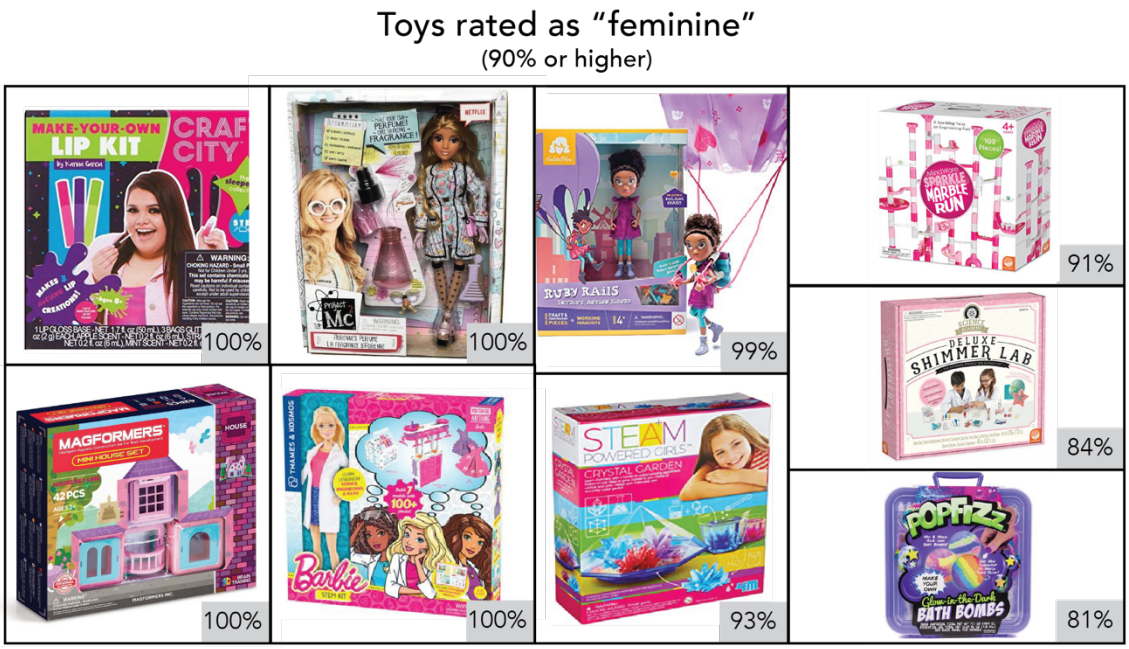


Figure 27. Feminine Toys: Group B labeled the STEM toys above as feminine.

Respondents rated nine toys as 75% or higher in the feminine category (Figure 27). Some of the feminine toys feature illustrations of girls and photos of girls; however, the Deluxe Shimmer Lab features a boy and a girl. Respondents rated all of the dolls and beauty-related toys as feminine; additionally, all toys in this category are predominantly purple and pink. These observations support prior research featured in this thesis, which suggests that girls are conditioned to like beauty products and dolls. Additionally, research shows that pink is used as a marketing tool (Coyle & Liben, 2018).

Figure 28. Gender Neutral Toys: Group B rated the STEM toys shown above as gender neutral.

Eleven toys were rated by Group B as 75% or higher in the gender-neutral category (see Figure 28); none of which prominently featured pink—although they did include graphics ranging from primary, secondary, and pastel color palettes. Of the seven gender-

neutral toys, only one had a photo of children (both a boy and girl). Two toys were rated lower than 75% gender-neutral so they are labeled as inconclusive.

Group B rated six toys as masculine (receiving a 51% rating or higher); however, none of these toys was overwhelmingly rated as masculine (see Figure 29). Of the 29 toys presented, only one—the Magformers Amazing Rescue Set—was rated more than 70% masculine. These masculine STEM toys lacked a specific use of colors or design trends; however, the content of these toys seems more important. Three of the six masculine toys were LEGO sets, which support research by Reich et al. which stated that LEGO gender-specific marketing has led to increased gender stereotypes. According to this research, kids believe "girl LEGOs" are pink, boy LEGOs are not.

Figure 29. Masculine Toys: Group B rated the STEM toys shown above as gender neutral.

Discussion

The number of STEM toys categorized as feminine was not surprising, but the high feminine rating (90% or higher) was unexpected. It was also unexpected that STEM toys weren't equally rated as "masculine." The researchers' expectation was that STEM toys were being marketed to girls and boys separately, mirroring the pattern of how non-STEM toys are marketed, chapter II describes a long history of gender division between boys' and girls' toys (Sweet, 2014). However, this research shows STEM toys are marketed to girls separately, but not to boys. Additionally, there's not a prominent gender divide within the STEM toy aisle like seen in the boys and girls (non-STEM) toy aisles. This data shows that STEM toys are rarely deemed masculine and content influences gender more than design. Even among STEM toys that feature traditionally stereotypical content, such as cars and robots, as well as colors such as blues and greens, are not deemed masculine. Additionally, photos and illustrations of boys do not indicate a toy is masculine.

It was not surprising that questionnaire data revealed that parents of boys showed more apprehension than parents of girls toward feminine-branded STEM toys. Parents of all boys are very likely to purchase toys that are gender neutral or masculine, but very unlikely to purchase toys that are considered feminine. Questionnaire data revealed that parents of boys are actually deterred by STEM toys marketed for girls. The data showed that while five- to eight-year-old boys may be open to crossing gender stereotypes (such as playing with dolls), parents feel reluctant to buy STEM toys for boys when a girl is on the front of the box. This hints toward the importance of branding and design, which will be discussed further in this section.

It was expected that parents of girls would feel apprehensive toward masculine toys, but the lack of masculine STEM toys made this impossible to measure. Questionnaire results

revealed that parents of girls are just as likely to purchase gender-neutral toys as they are feminine toys; these parents don't seek out toys marketed specifically for girls. In some instances, parents preferred the gender-neutral option over the feminine version.

It was surprising that both parents of girls and parents of boys were less likely to purchase feminine branded STEM toys. The majority of STEM toys are considered to be gender neutral; this mirrors parents' attitudes that educational type toys don't need (and shouldn't) reflect gender. This research, in addition to secondary research studies, suggests that parents prefer to purchase gender neutral toys, which promote gender equality better than gender-specific toys. Product branding didn't sway parents with five- to eight-year-old daughters and didn't affect how parents perceived the toys. The main takeaway is that girl-branded STEM toys don't increase sales for parents with daughters; however, it did limit the number of purchases by parents with boys. These results show that branding scientific and educational toys for girls doesn't increase their interest or teach STEM. Additionally, the design of the product didn't influence the educational value or motivate parents to purchase.

Both questionnaires asked, "Should STEM toys be marketed toward specific genders?" and the majority of both groups answered "No" or "not sure"; only 16% of Group A (parents of five- to eight-year-olds) and 24% of Group B agreed that STEM toys should be gendered. However, 60% of Group B indicated that STEM toys marketed specifically toward girls does increase their interest in STEM. This may be a result of grandparents and older generations purchasing toys. Future research is necessary, to determine how age affects this data.

This questionnaire showed that parents are widely influenced by their children's toy preferences when purchasing toys; however, educational value is considered as well. What motivates children's toy preferences differs by gender; parents of all girls reported that

friends and peers were the driving factor while parents of all boys reported packaging design was the main factor. This leads to the question of if boys care so much about packaging and girls don't, why are companies marketing to girls specifically? Data suggest that doing so is unnecessary and doesn't actually increase interest or purchase potential. Modern companies are moving away from gendered labels and by doing so are increasing sales (Tabuchi, 2015). Additionally, putting a STEM label on a toy is a motivating factor for parents to purchase and toy manufacturers are aware that parents are more likely to purchase both the girl and the boy version when given two gender options (NY Transit). While the push for decreasing the gender gap in STEM is an important cause, the questionnaire data shows that toys marketed "for girls" aren't necessary. STEM toys are marketed to single out girls, despite the fact that parents of girls are just as likely to purchase a toy that is gender neutral. Toy companies seem to be unnecessarily designing STEM toys for girls, which as a result could actually split their potential sales in half.

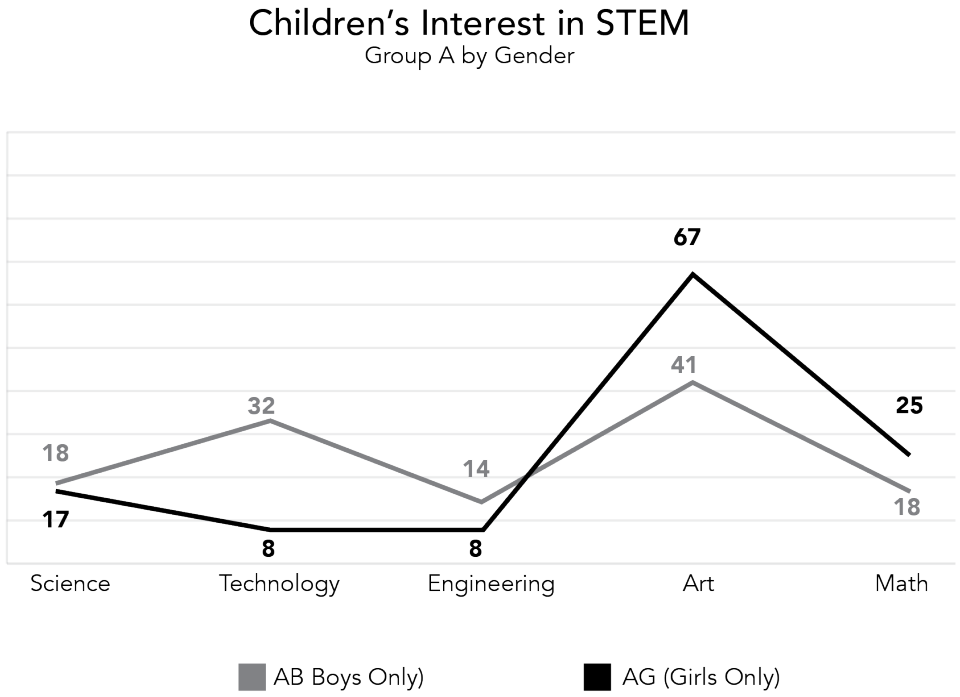


Figure 30. Children's Interest in STEM by Gender.

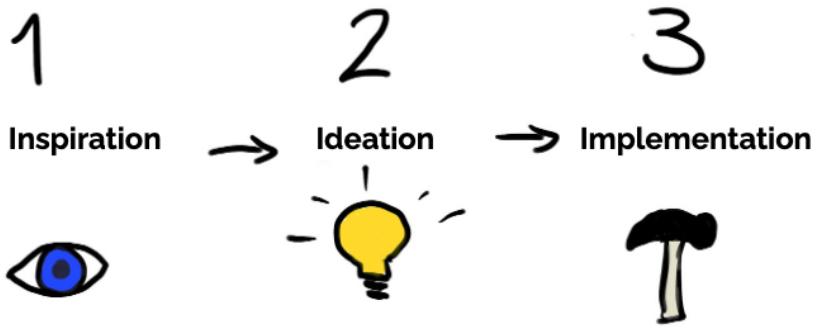
When it comes to which STE(A)M topic was most popular among boys versus girls, the expectation was that boys would prefer science and engineering while girls preferred art. This hypothesis was guided by the researcher's observation of girl-branded STEM toy packaging. For example, the Mc2 glitter volcano focuses heavily on art and creativity. Parents indicated that their daughters were interested primarily in art (67%) followed by math (25%); while boys were also primarily interested in art (42%) followed by technology (32%). Additionally, this data suggests that boys' interests in STEM are broader, whereas girls' interests are more narrowed down to specific subjects (see Figure 30). Surprisingly, art is the favorite subject for both genders which support prior research suggesting that STEAM (versus STEM) may invite a wider range of children to participate (The Toy Association, 2019).

Design Process

As previously mentioned, the design process guiding this study was informed by IDEO's Human Centered Design methodology in order to gather data and find a design solution. The process included the following three steps: inspiration, ideation, and implementation. Table 1 below breaks down each process and the activities contained therein.

Table 1. IDEO Process. The project's creative process, following IDEO's Human Centered Design methodology.

IDEO Process



Define the challenge	Top 5	Prototype
Observations	Mindmap	
Feedback	Comparables	
Empathy Mapping	Create Frameworks	
Messaging	Mood Board	
	Color Inspiration	
	Mockups	

Inspiration

In order to narrow down and to clarify the direction of this research, the first activity was to frame the design challenge. To define this particular challenge, the following statement was developed: "How might we make STEM learning a fun part of independent play for children ages five to eight, while removing outdated traditional gender stereotypes." Additionally, all of the in-store observations and questionnaire data were examined to find themes, mainstreams, and extremes (see Table 2).

Table 2. Themes, Extremes, and Mainstreams. Breakdown of observational trends, including themes, extremes, and mainstreams.

Themes, Extremes, and Mainstreams

Found themes:	● STEM toys are marketed separately for girls, but not separately to boys. ● Parents purchase toys and STEM toys more often for boys than girls. ● Parents of boys are more concerned about time commitment, cost, and being appropriate for gender than girls. ● Less than 20% of parents feel STEM toys should be marketed to specific genders. ● Parents are more likely to buy a toy because: ○ their child shows interest ○ it has a STEM label
Extremes:	● Boys STEM toys = gross and slimy; girl STEM toys = beauty and glittery ● Parents are divided on "learned" vs "innate" gender differences ● Friends and peers influence girls, while packaging influences boys ● Some parents of boys support buying dolls for their sons ● Parents of boys are more concerned about marketing to a specific gender
Mainstreams:	● Girls and boys like the subject "art" best ● STEM is widely known ● Boys who play with toys marketed toward girls increased creativity ● Parents attempt to purchase toys that are gender neutral ● Toy manufacturers market to boys and girls separately to increase sales

Ideation

The second step was the ideation phase, or the process of using existing research to develop ideas. Color has been an important aspect of this research, including how it's used to appeal to specific genders. Using data from the questionnaires, color palettes were created (see Figure 31) to represent the categories of feminine and gender neutral. Creating a masculine color palette was difficult, due to the fact that only one toy—the Magformers Rescue Set—was labeled as masculine. However, several toys resulted as inconclusive as they fell between gender neutral and masculine. A gender-neutral color palette is shown below as inspiration for potential design options, however further testing is needed to measure effectiveness among different genders.

Figure 31. Color Palettes: Based off Questionnaire Feedback

Ideo's "Top 5" activity was implemented to find emerging themes and ideas, three concepts were considered, and then narrowed down to one design solution. The next steps toward a working prototype involved additional brainstorming, mind mapping, sketching mockups, mood boarding, and comparing similar toys and resources. The proposed design solution can be described by the following framework (see Table 3).

Table 3: Design Framework. IDEO's framework method

Design Framework

Design solution should . . .	**Design solution should not . . .**
● Encourage creativity and provide open-ended play ● Introduce STEM topics ● Be gender neutral ● Be made of sustainable and/or recyclable materials	● Be tied to beauty products or gender stereotypes ● Exclude specific genders, races, or socioeconomic groups ● Be a one-time use, wasteful toy

IV. RESULTS

Proposed Solution

The design solution is a product called BoxLab, a DIY making kit for kids ages five to eight, which promotes creativity through tactile building and play while introducing STEM concepts. As defined by the framework in Table 3, BoxLab is gender-neutral and provides children with opportunities of open-ended play, utilizing sustainable and recyclable household products. By using recycled household materials, BoxLab is an affordable toy for five- to eight–year-old children from diverse socioeconomic backgrounds. BoxLab includes age-appropriate construction tools, building tutorials, DIY project plans, learning opportunities/curriculum, and prompts users to build their own creations.

Existing mailbox subscription kits and arts & crafts toy kits exist (most of which are gender-neutral) and provide "making" opportunities; however, these products don't provide open-ended play. Products like KiwiCrate, a STEM-based mailbox subscription, provide users with a closed set of instructions and a final product (see Figure 32). With BoxLab, children are given tools, shown ideas and building tips, and then provided with opportunities for open-ended play. Open-ended play is one The Toy Association's characteristics of STEM toys, previously mentioned in chapter II (see Figure 9.) There is a significant amount of research regarding the importance of open-ended play. Researchers from Oregon State University performed an ethnographic study of open-ended play and STEM activities/toys. They found that parents often overschedule children daily activities and regulate play environments, which results in a diminishing amount of open-ended play opportunities; additionally, the toys and activities that parents buy are often highly structured and academic goal-oriented (Bachman, 2011). Even though play is considered a fun, informal activity, it often requires parental supervision or facilitation. Open-ended play provides children with

autonomy, helps build confidence in STEM, and allows children to become co-creators and to control the environment in which they learn (ibid). BoxLab's goal of providing open-ended play allows children to create, to imagine, and to explore STEM topics.

Figure 32. KiwiCrate: Subscription Box Contents (Kiwicrate, n.d.)

Prototype

A prototype has been created to show how this concept translates into a visualized brand experience. However, this is a minimal viable product, as the human-centered design process relies on future testing and multiple iterations. As this research concludes, gender neutral design is an incentive for parents to purchase a toy. The significance of color has been discussed extensively—primarily the messaging of traditional female colors, such as pink and purple. As a result, BoxLab uses a gender-neutral color palette inspired by the gender-neutral STEM toys from the questionnaire (see Figure 31). The name BoxLab is designed to be gender-neutral and is derived from the following meanings (Table 4).

Table 4. BoxLab Etymology

BoxLab Etymology

Box + Lab	
The box = limitless creativity Whether it's educational building blocks, an empty refrigerator box, or even a Minecraft block; the box shape is associated with building, learning, and creativity.	The lab = a safe place to tinker Fabrication labs, aka makerspaces, STEAM labs, and even science laboratories all represent a safe and controlled space to experiment and learn.

IDEO defines design principles as the "guardrails of your solution" or the most important elements that define a product's integrity and values. BoxLab's design principles include being gender neutral, open-ended, promoting creativity & independent play, introducing STEM concepts, and promoting sustainability (see Figure 33). Additionally, BoxLab supports 12 out of the 14 "unifying characteristics of STEM/STEAM toys" outlined by The Toy Association (see Table 5). However, future expansion of the product could include "relates to the real world" and building "social and emotional skills" by introducing additional topics and curriculum in the future.

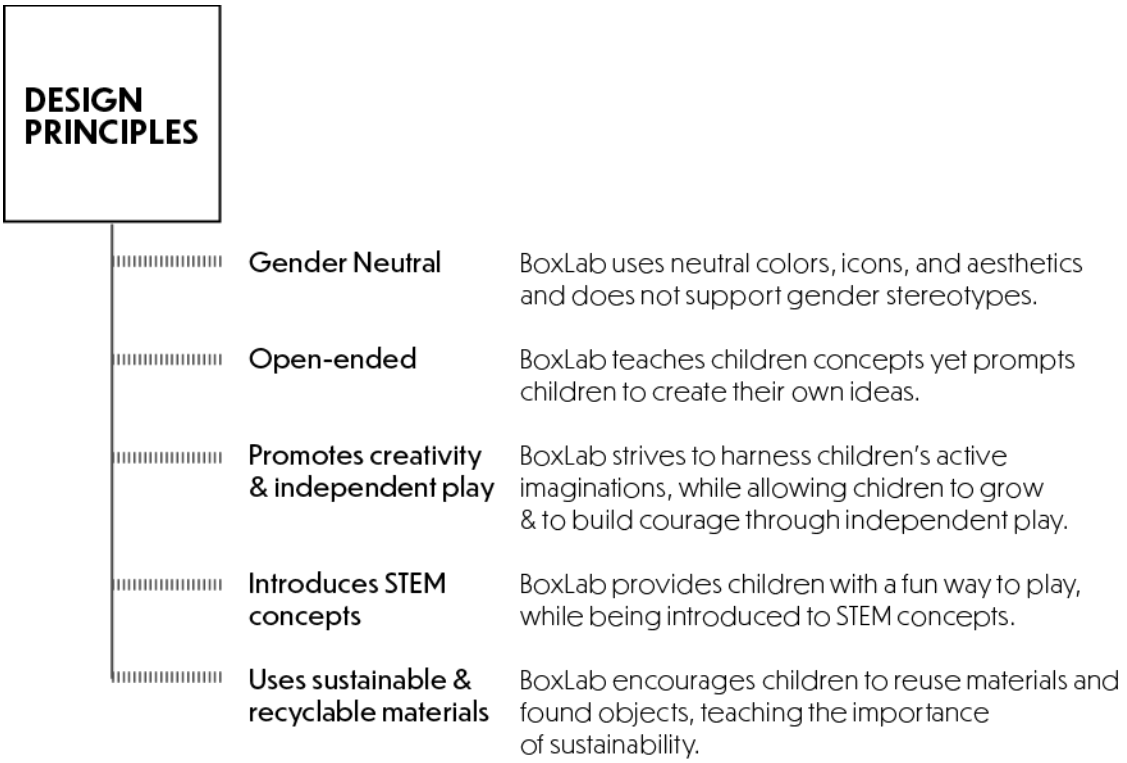


Figure 33. Design Principles

Table 5. Characteristics of STEM/STEAM Toys

Characteristics of STEM/STEAM Toys

✓	Explores an Aspect of STEM	✓	Problem Solving
✓	Fun	✓	Includes Curriculum
✓	Open-ended	✓	Gender Neutral and Inclusive
	Relates to the Real World	✓	Supports parents
✓	Allows for Trial & Error	✓	Builds Confidence
✓	Hands-On	✓	Encourages Creativity
✓	Child-Led		Social and Emotional Skills

Initially, BoxLab would be purchased online (BoxLab.com) or through Amazon.com, however future growth could evolve to include in-store purchasing. A

storyboard has been created to show how BoxLab works (see Appendix C). The first BoxLab kit arrives 3–4 weeks after ordering and contains child-safe tools (see Figure 34), DIY recipes, and cardboard building tips which help teach children how to construct, design, and make their own projects.

Figure 34. BoxLab Contents: Contains a child-safe rotary cutter, ruler, cardboard cutting tool, bonefolder, brads, plastic needle and thread, DIY recipes book, stencil patterns, toolkit carrying case, and notebook.

The first step of receiving BoxLab (kit No. one) is to assemble and decorate the BoxLab toolkit. Children will be prompted to flip the shipping box inside out and decorate with included stencils or household supplies. Each kit includes two building activities, as well as ideas for future projects children can create using common household supplies such as empty boxes, straws, paper, paper towel rolls, etc. The second step is for children to put together the two building activities; kit No. one teaches children about building shelter and the two activities include building a lamp and building a table and chairs. Building a lamp entails teaching a child to connect an LED light to a battery and constructing a lamp shade. Building a table and chairs teaches a child how to use various cardboard building techniques.

Building activity instructions will rely heavily on iconography, so early readers can comprehend more easily (see Figure 35). After working through the two guided activities, children can apply what they've learned to come up with own shelter, whether it's a home, a fort, a castle, or a space station.

Figure 35. BoxLab Activities: Each BoxLab features two guided activity lessons and a prompted building challenge. Additionally, the inside front cover features a storage pocket and ideas for future BoxLab project materials.

Subsequent boxes are smaller flat boxes, which contain additional building activities and curriculum. Every package that arrives from BoxLab can be repurposed into a guided building activity. Curriculum varies per box (see Figure 36).

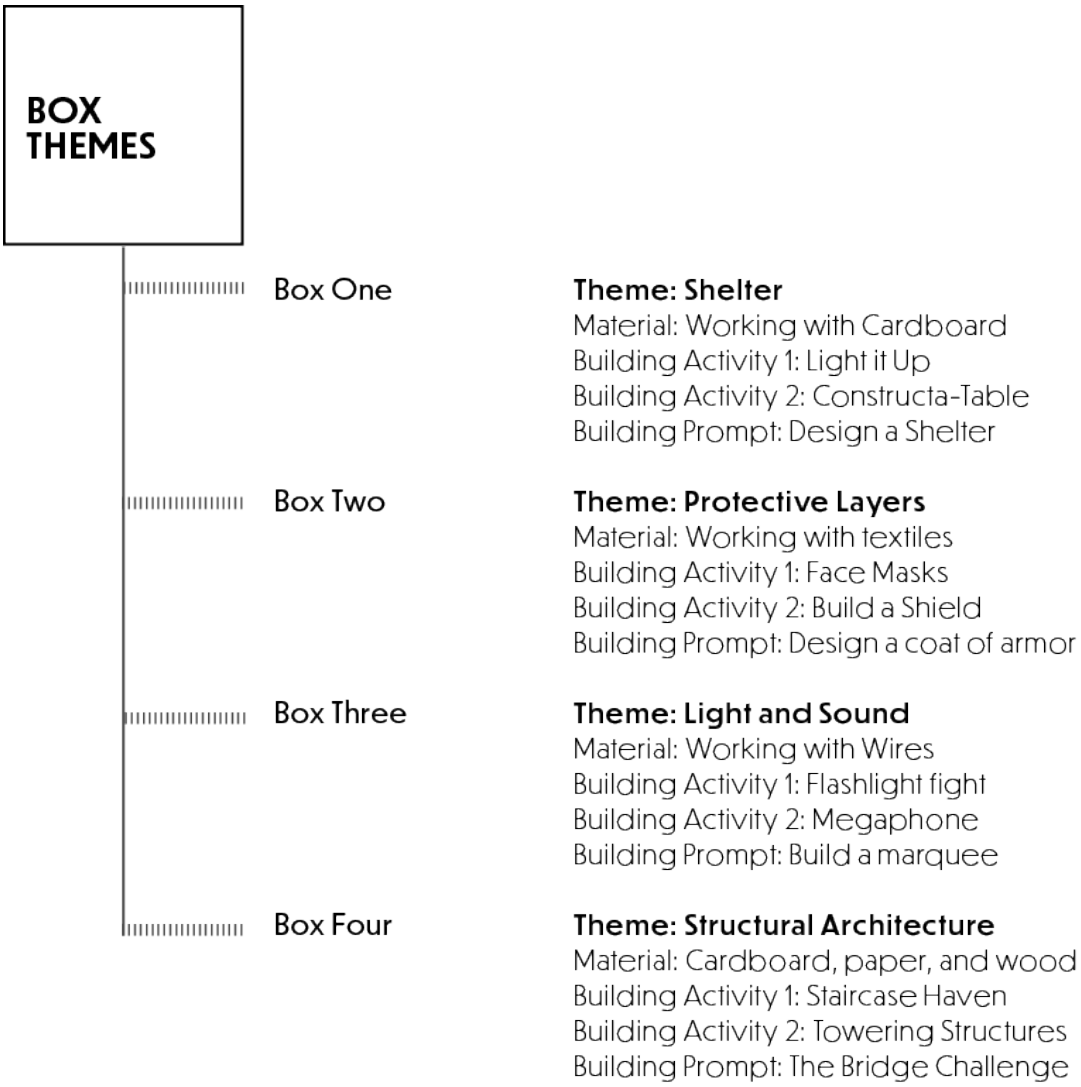


Figure 36. BoxLab Curriculum: Each BoxLab will include curriculum and activities designed around a specific theme, as well as design and building ideas for a specific medium.

V. CONCLUSION

While there's extensive research on gender schema—previously discussed in chapter II—and the importance of play which spans decades, STEM toys are a relatively new toy type. This research includes a comprehensive examination of existing primary and secondary research; however, technology and popular culture are quickly changing which leads to further research.

Future Investigations

This section describes a number of future investigations, which have not been listed in order of significance or importance. To begin, the parent questionnaire was informative; however future investigations should consider additional data points and classifications. One of the most important aspects would be to expand the reach of the questionnaire to include a national and global reach. Additionally, race and income level should be collected to determine cultural and socioeconomic trends. Expanding the reach of the questionnaire could lead to further data which addresses inclusivity and diversity opportunities. Additionally, the parent questionnaire was limited due to the digital platform used to gather data. An in-person interview, where parents can hold and view toy packaging, could lead to more thorough research. This questionnaire measured feedback from parents and adults, however future research could be conducted which measure children's preferences directly. Children's preferences could be measured through focus groups or individual questionnaires. The existing questionnaire broke down toy categories into several categories outlined by The Toy Association; however, there were gray areas to what these categories entailed. For example, games and puzzles were among the most common toys for boys and girls ages five

to eight, but it's unclear what percentage of these toys referred to board games versus video games consoles. Additional information specifically on digital gaming is needed.

Product testing with parents and children needs to be done in order to evaluate the effectiveness of the design solution. The prototype needs user testing and additional iterations in order to become a viable product. Additionally, user feedback would help understand customers' needs and wants, and to help create research-focused content and curriculum.

While BoxLab is a DIY tool kit, there's room to expand the product line to include a full-scale social media and marketing plan. As this research shows, YouTube is a popular platform to reach children. In the future, BoxLab could expand to include a YouTube channel which includes weekly DIY project videos, providing additional instruction, visuals, and inspiration. Additionally, there's an opportunity for children to show their own DIYs and projects through social media hashtags and uploading project photos. For example, Instagram could be a possible platform where parents share their children's projects.

Another option for future expansion would be for a large retailer, such as Amazon, to partner with BoxLab. Amazon is already mailing out large quantities of shipping boxes, packaging, and other possible BoxLab materials; it could be a good opportunity for them to promote STEM learning and open-ended play with their customers who have children. Doing so would create sustainable opportunities for the packaging that's already being delivered. BoxLab could be a STEM learning initiative, that's made available to Amazon Prime members, for example.

At the time this thesis was written, the COVID-19 global pandemic has drastically changed the toy, education, and children's media industries. Market reports show a growing need for educational toys as well as a 66% increase in sales (Lieber, 2020), but it's unknown

whether this trend will continue. As parents work from home, often attempting to homeschool while balancing work conference calls and school meetings, additional support for individual autonomous learning and play opportunities may be needed. The parent questionnaire (distributed prior to the global pandemic) indicated a future interest to participate in STEM camps, after-school programs, and mail subscriptions; however, with school and camp being cancelled there may be other opportunities for STEM-based learning. Future research could also consider how the pandemic has affected STEM camp enrollment. For example, many camps have opened over the summer, but with limited capacity. Does this affect the number of girls participating?

Retailers have struggled to compete with online retail giants, like Amazon, even before COVID-19. As of March 2020, the need for stores to provide curbside pickup has increased. Future research should evaluate recent sales data to determine if online sales and curbside pickup affect how parents purchase toys. With more buyers purchasing online, retailers could track user experience of digital storefronts by evaluating hot zones, time spent on page, cart abandonment, digital promotions, etc. In-person shopping habits could be examined to see how interactive displays performed, specifically if they're more effective and whether shoppers are spending more or less time browsing. How successful are interactive displays, and are there additional opportunities for digital interactive experiences (such as Walmart's Toy Lab mentioned in chapter II)?

Future regulations of children's online media could help filter out non-educational shows and provide parents with the ability to make more informed decisions. As stated in chapter II, there's a shift away from physical toys to online and digital learning platforms (Cross, 2009). Despite the importance of hands-on tactile learning, there is a need—especially with digital learning and online homeschooling—for children to learn

technological skills and aptitudes which opens a potentially limitless opportunity for online educational STEM programs. Given this shift, it's equally as important to consider children's digital security and privacy. Some toys have received criticism for listening and collecting data from children, specifically smart toys, tablets, apps, and Bluetooth connected devices (Dickson, 2018). Children should continue to be a protected class, and future legislation could dictate the type of content and parental consent for online children's media, programming, and gaming. The Children's Television Act of 1990 created stringent broadcasting regulations, especially when it comes to educational media (Federal Communications Commission Fact Sheet, 1995). However, little regulation exists for online programming and streaming services.

Further research on augmented reality (AR) and virtual reality (VR) could provide future building and construction opportunities in a digitally tactile way; however, these are new technologies and little research exists on the effects of these technologies when it comes to children's development. Most VR headsets are designed for children ages 13 or older (Hicks, 2018) and a study by Common Sense Media states that VR could have negative side effects including sensory and vision effects, increased aggression, social isolation, and the inability to develop executive function skills (2018). AR/VR could also be a strategy to get kids out of the classroom, or even out of their homes during shelter-in-place ordinances. This area could have potential for future learning opportunities.

Future studies could also interview women working or teaching in STEM, specifically the toys they played with as children, to collect data. A future questionnaire for women working in STEM could uncover potential trends between childhood activities and successful careers in STEM. Additionally, the data could be split globally to differentiate trends by regions.

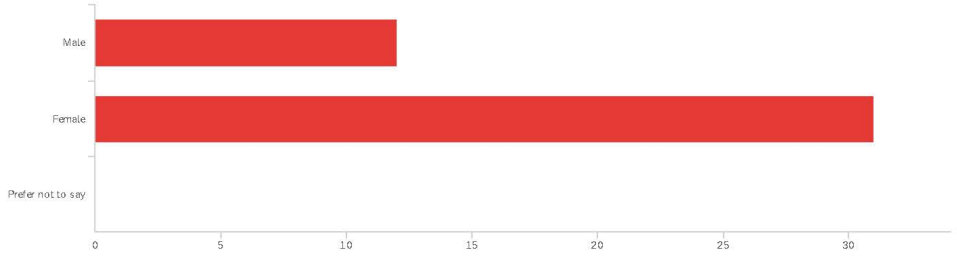
Final Thoughts

STEM products influence the way in which children learn and play; whether it's in the classroom, at an afterschool program, or at home. STEM toys are marketed to kids as young as two years old and can be found almost anywhere including big box retail chains, grocery stores, bookstores; as well as within popular culture and mainstream media. As a result, STEM products—whether they're toys, media, camps, books—should strive to avoid perpetuating outdated gender stereotypes. This research suggests that parents, teachers, and the mainstream media can alleviate negative gender stereotypes by exposing children to astereotypical images and products; thereby changing the status quo. Toy manufacturers should be encouraged by this research to strive for inclusive open-ended play toys that avoid implicit gender cues, whether it's through gender neutral design or by introducing counter-stereotypical gender concepts.

APPENDIX SECTION

Appendix A: Group A Questionnaire No. 1

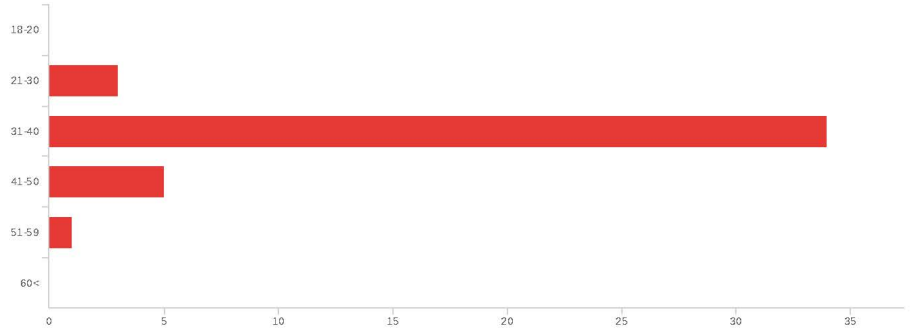
What is your gender?



#	Field		Choice Count
1	Male	27.91%	12
2	Female	72.09%	31
3	Prefer not to say	0.00%	0
			43

Showing rows 1 - 4 of 4

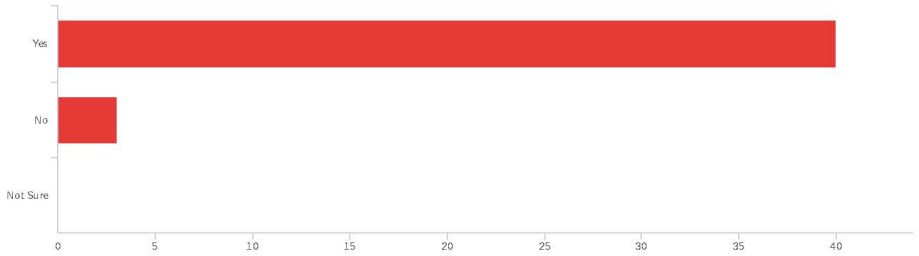
What is your age group?



#	Field		Choice Count
1	18-20	0.00%	0
2	21-30	6.98%	3
3	31-40	79.07%	34
4	41-50	11.63%	5
5	51-59	2.33%	1
6	60<	0.00%	0
			43

Showing rows 1 - 7 of 7

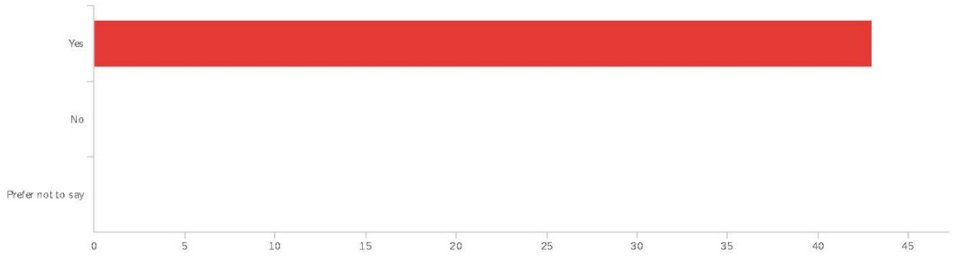
Are you familiar with the acronym STEM (Science, Technology, Engineering, Math)?



#	Field		Choice Count
10	Yes	93.02%	40
11	No	6.98%	3
12	Not Sure	0.00%	0
			43

Showing rows 1 - 4 of 4

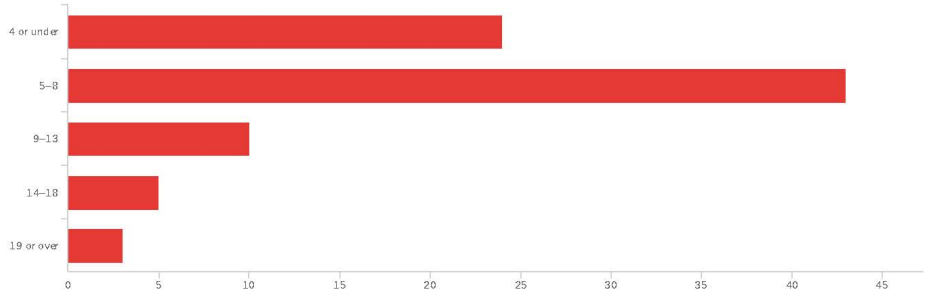
Do you have any children?



#	Field	Choice Count	
1	Yes	100.00%	43
2	No	0.00%	0
3	Prefer not to say	0.00%	0
			43

Showing rows 1 - 4 of 4

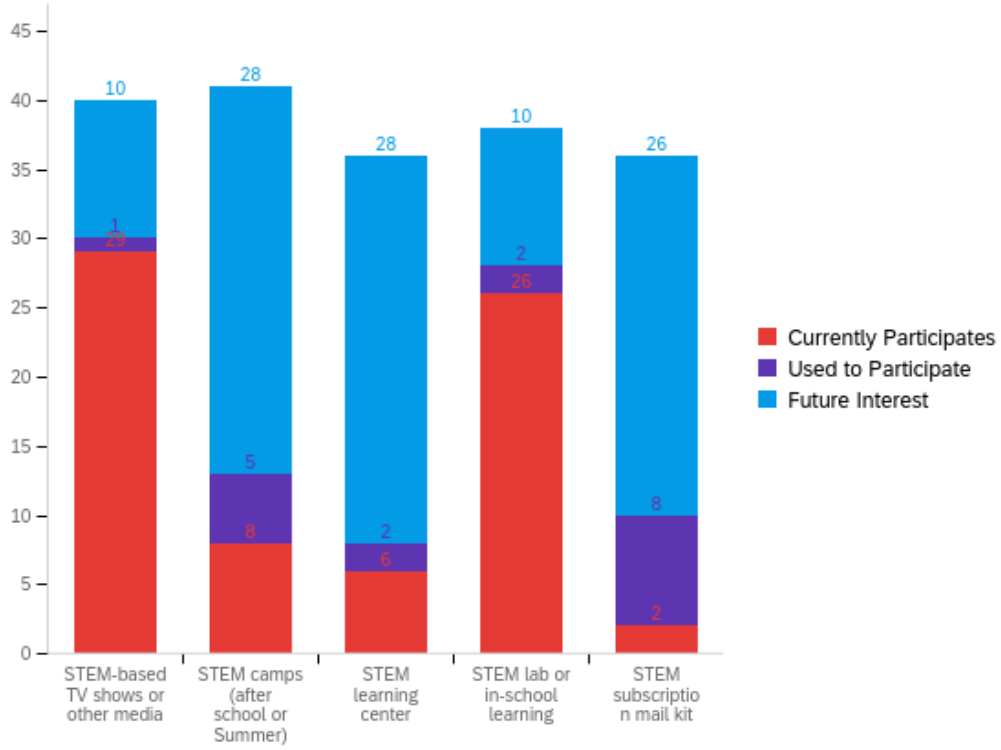
Which age group(s) describe your children? (Select all that apply)



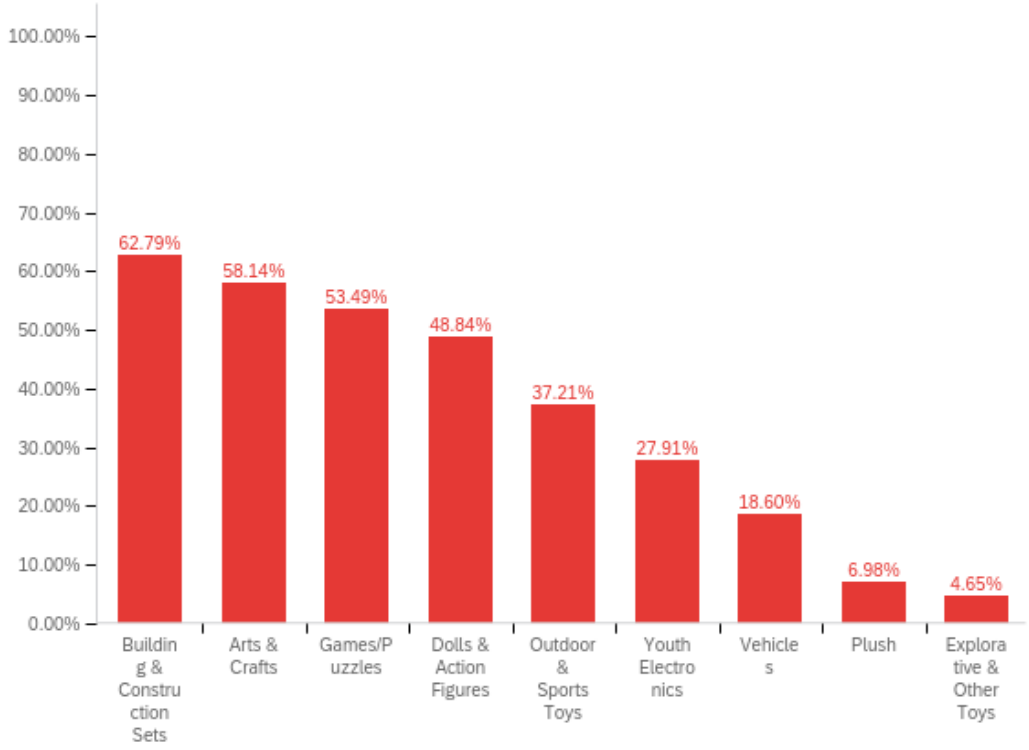
#	Field	Choice Count	
1	4 or under	28.24%	24
2	5–8	50.59%	43
3	9–13	11.76%	10
4	14–18	5.88%	5
5	19 or over	3.53%	3
			85

Showing rows 1 - 6 of 6

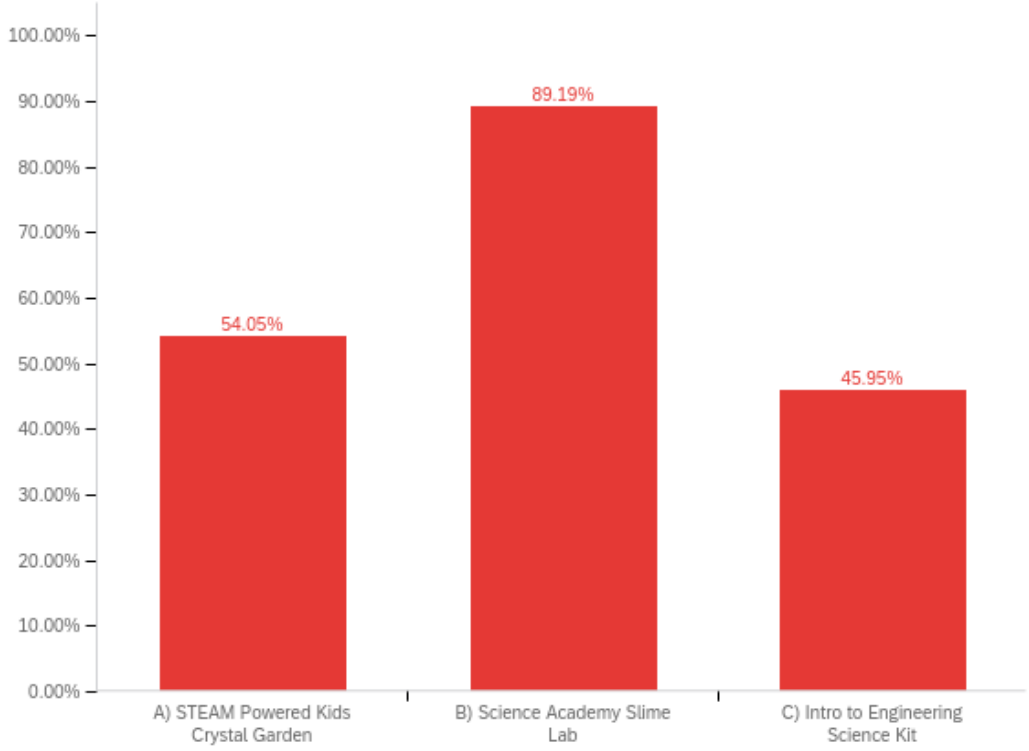
Indicate whether your child(ren) participates in the following activities:



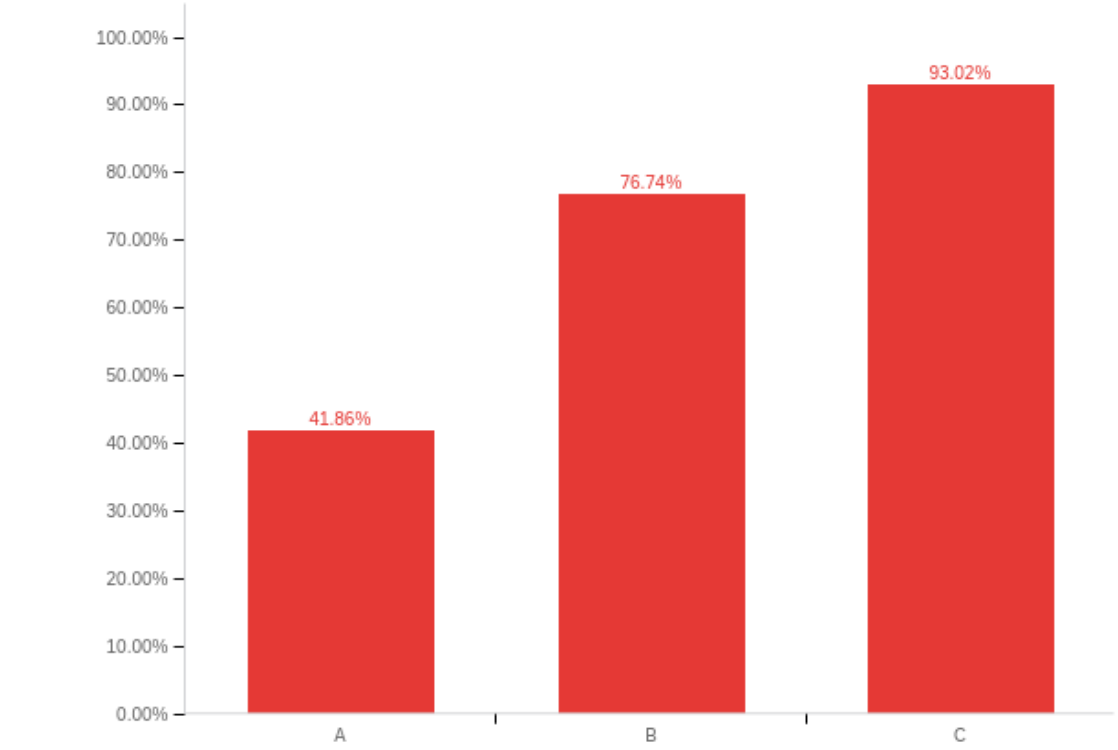
What are the three (3) most common types of toys in your home?



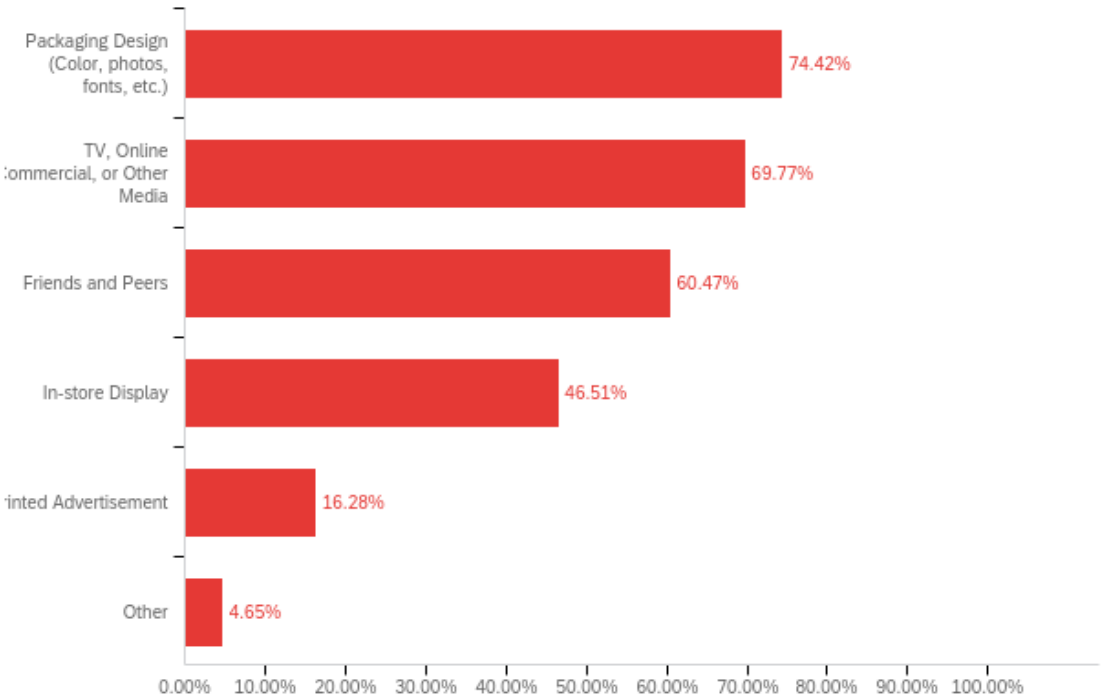
Which of these STEM toys appeal to your child(ren)? (Check all that apply)



Which of the STEM toys shown above would you categorize as gender-neutral? (Check all that apply)



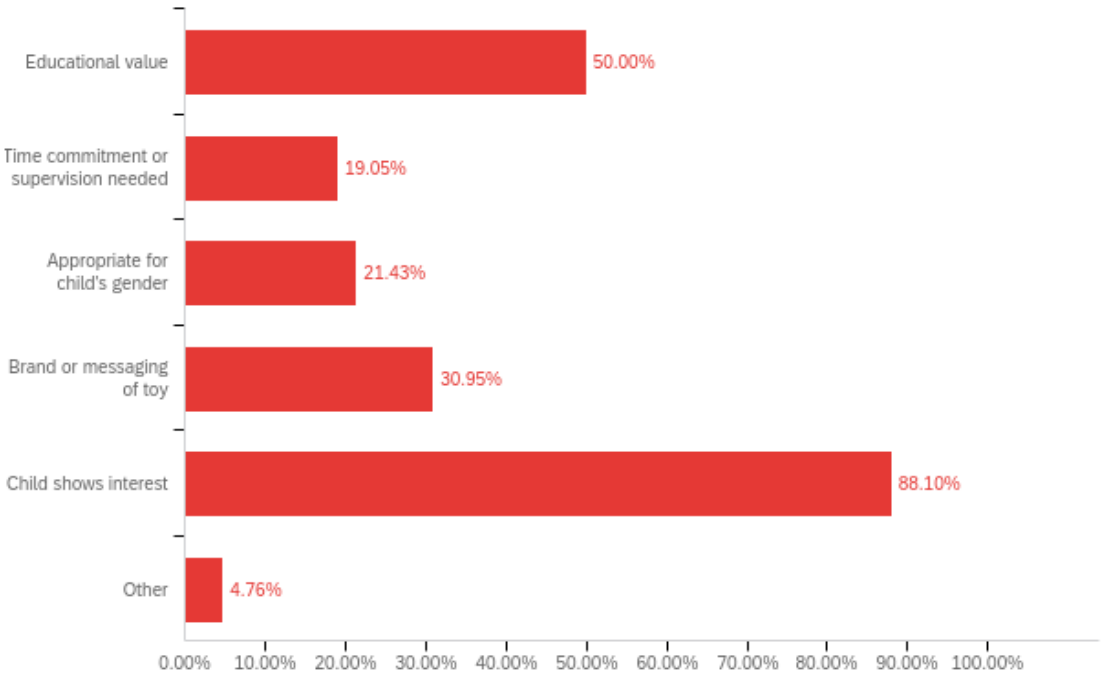
In your opinion, which factors influence the type of toys your children want? (Check all that apply)



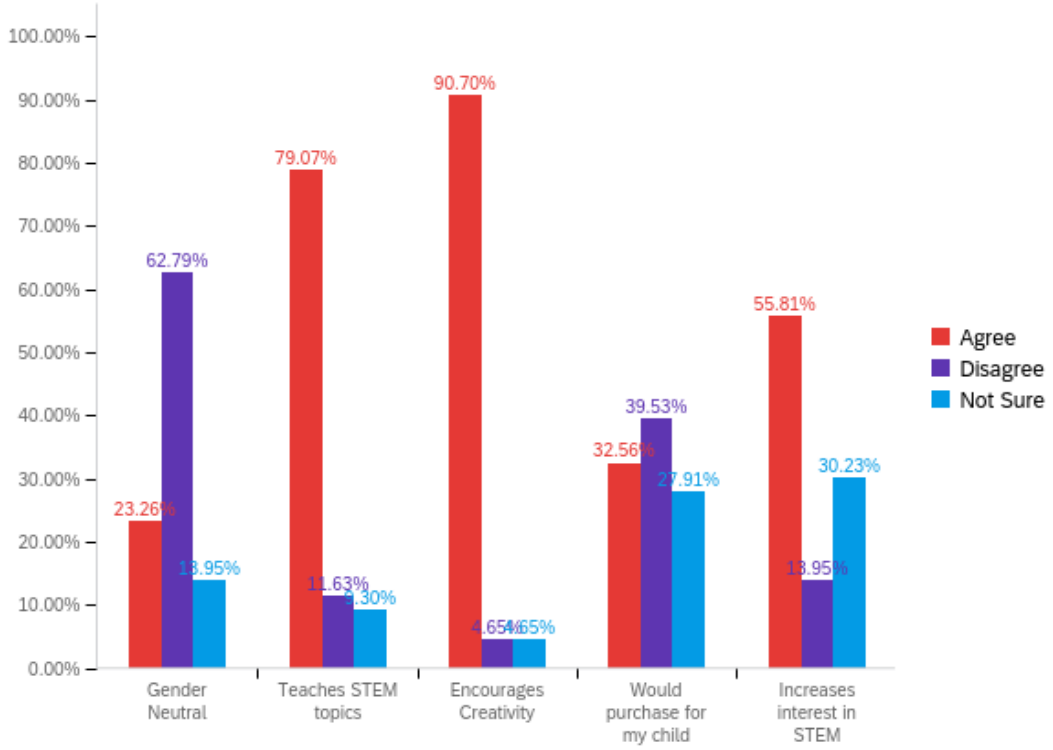
In your opinion, which of the following toys would increase your child's (or children's) interest in STEM? Check all that apply.

#	Answer	%	Count
1	Grow N' Glow Terrarium	8.81%	14
2	Magna-Tiles Metropolis	9.43%	15
3	Robot Engineer	6.29%	10
4	KidzLabs Pump Rocket Science	8.18%	13
5	Deluxe Shimmer Lab	3.14%	5
6	Squishy Human Body	4.40%	7
7	KidzLabs Magnet Science	7.55%	12
8	Craft City Make-Your-Own Lip Kit	2.52%	4
9	Nintendo LABO VR Starter Set	6.92%	11
10	Smithsonian Microscope	5.66%	9
11	Robotic Hedgehog	5.03%	8
12	Project MC2 Lip Balm Kit	3.14%	5
13	Magic Science Kit	6.92%	11
14	Osmo Creative Kit	5.66%	9
15	Crayola Chemistry Lab Set	6.29%	10
16	Slime Lab	10.06%	16
	Total	100%	159

What factors determined this decision? Check all that apply.

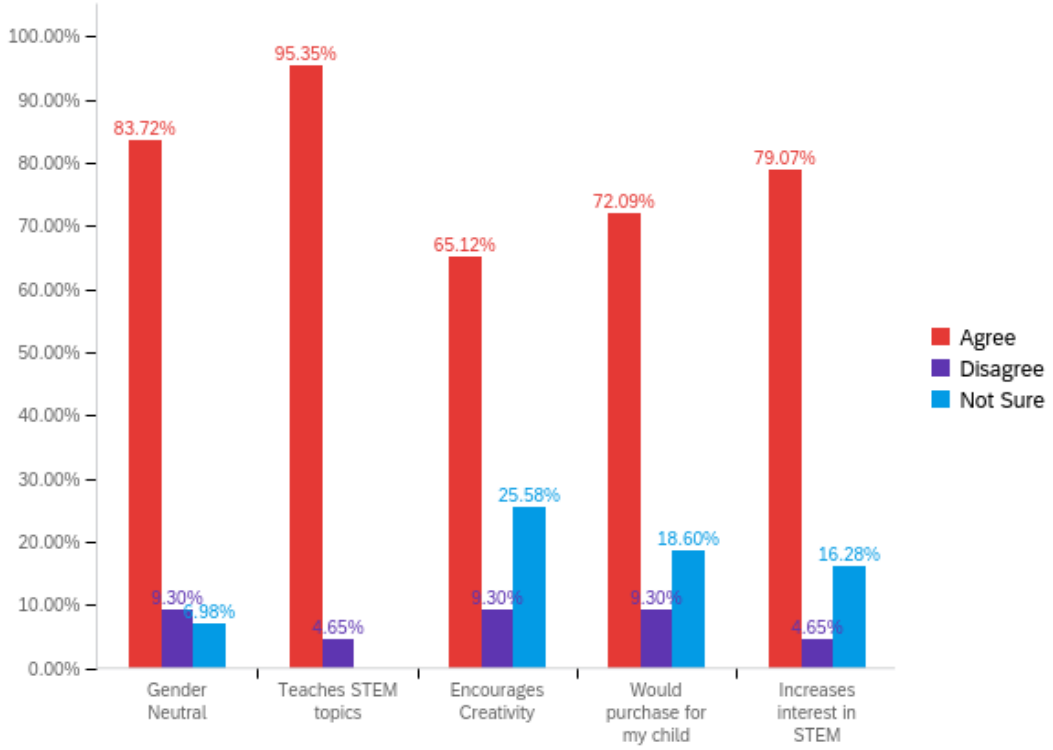


Project MC2 Glitter Volcano



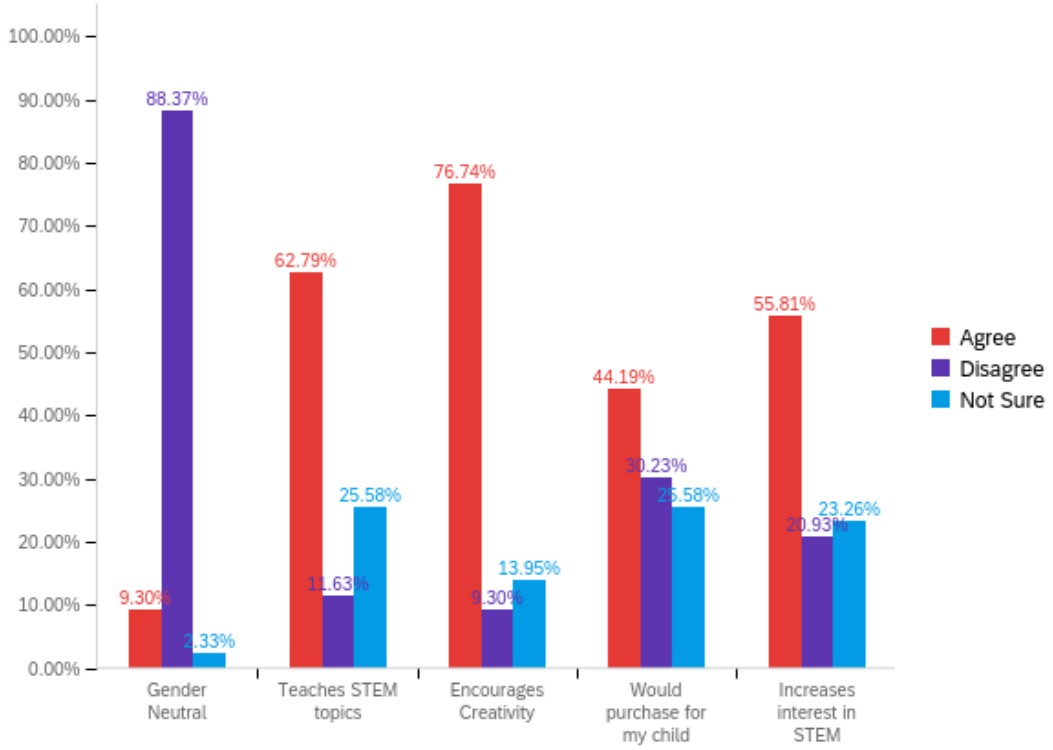
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	23.26%	10	62.79%	27	13.95%	6	43
2	Teaches STEM topics	79.07%	34	11.63%	5	9.30%	4	43
3	Encourages Creativity	90.70%	39	4.65%	2	4.65%	2	43
4	Would purchase for my child	32.56%	14	39.53%	17	27.91%	12	43
5	Increases interest in STEM	55.81%	24	13.95%	6	30.23%	13	43

Discovery Glowing Volcano



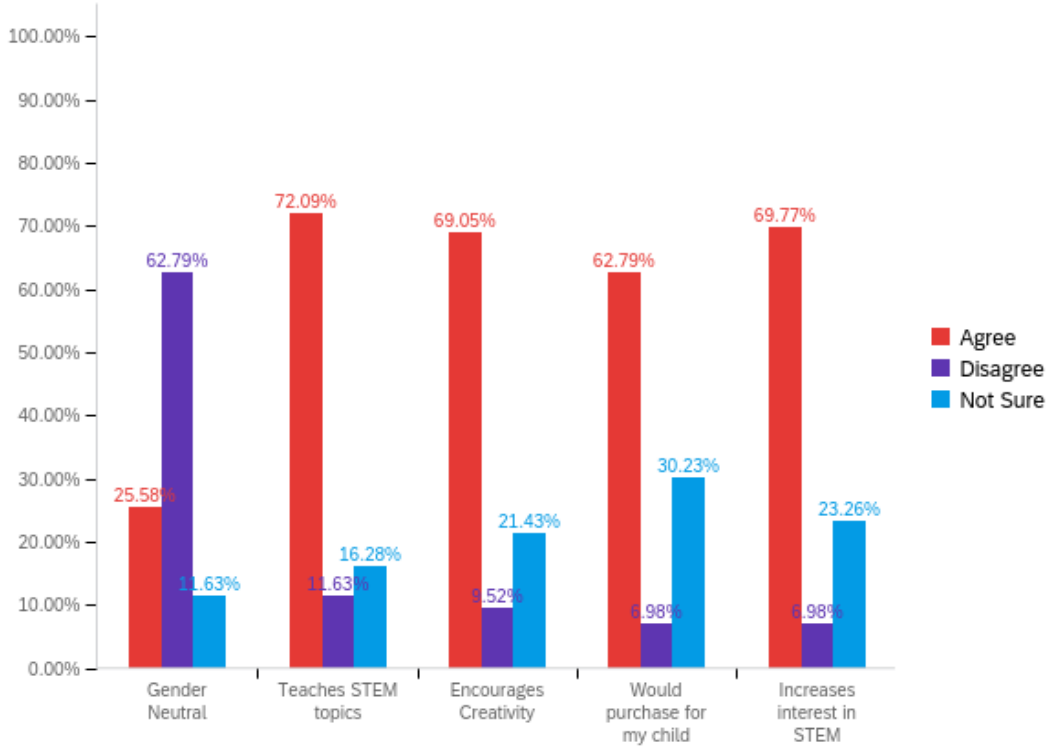
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	83.72%	36	9.30%	4	6.98%	3	43
2	Teaches STEM topics	95.35%	41	4.65%	2	0.00%	0	43
3	Encourages Creativity	65.12%	28	9.30%	4	25.58%	11	43
4	Would purchase for my child	72.09%	31	9.30%	4	18.60%	8	43
5	Increases interest in STEM	79.07%	34	4.65%	2	16.28%	7	43

Magformers Mini House Set



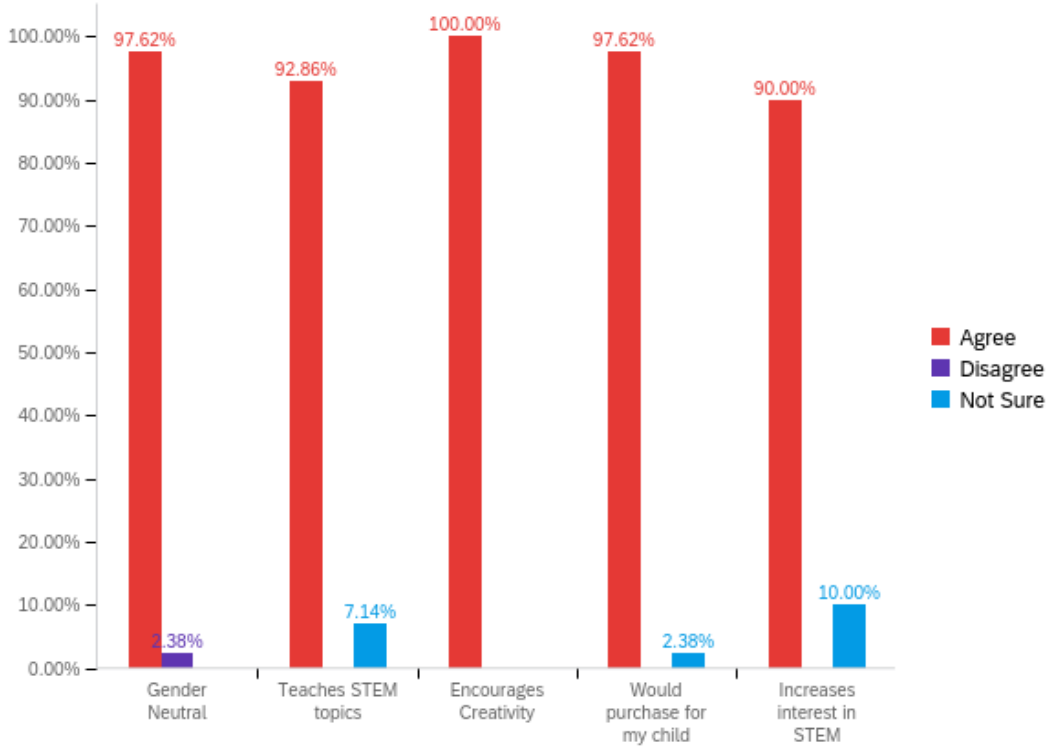
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	9.30%	4	88.37%	38	2.33%	1	43
2	Teaches STEM topics	62.79%	27	11.63%	5	25.58%	11	43
3	Encourages Creativity	76.74%	33	9.30%	4	13.95%	6	43
4	Would purchase for my child	44.19%	19	30.23%	13	25.58%	11	43
5	Increases interest in STEM	55.81%	24	20.93%	9	23.26%	10	43

Magformers Amazing Rescue Set



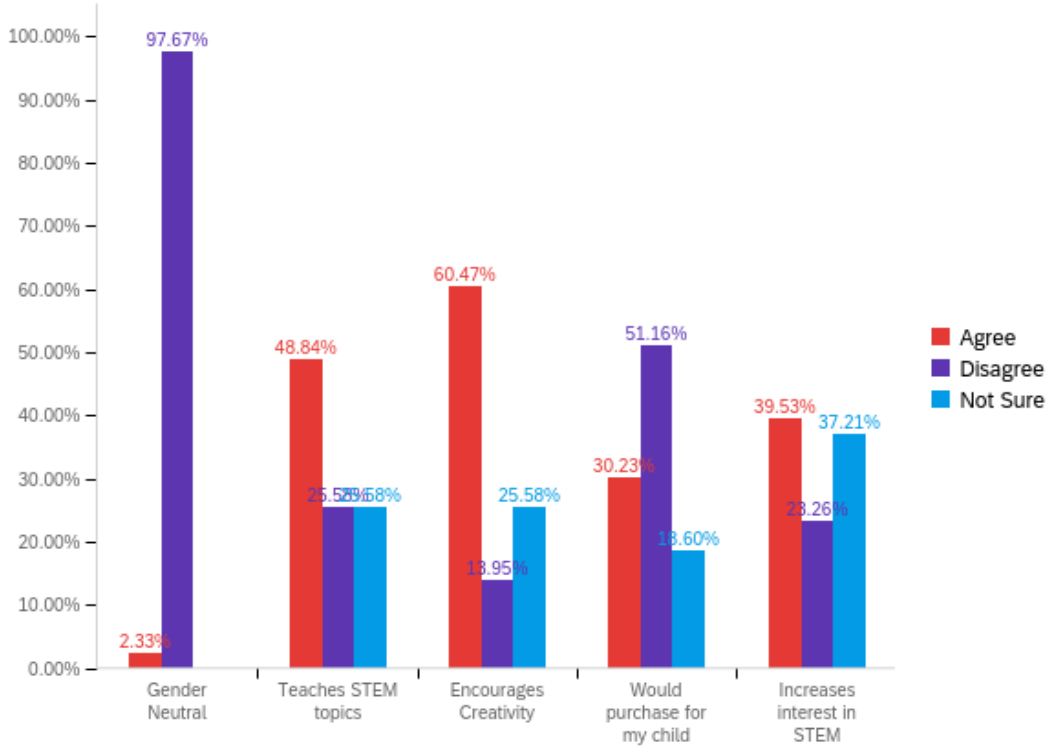
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	25.58%	11	62.79%	27	11.63%	5	43
2	Teaches STEM topics	72.09%	31	11.63%	5	16.28%	7	43
3	Encourages Creativity	69.05%	29	9.52%	4	21.43%	9	42
4	Would purchase for my child	62.79%	27	6.98%	3	30.23%	13	43
5	Increases interest in STEM	69.77%	30	6.98%	3	23.26%	10	43

Magformers Designer Set



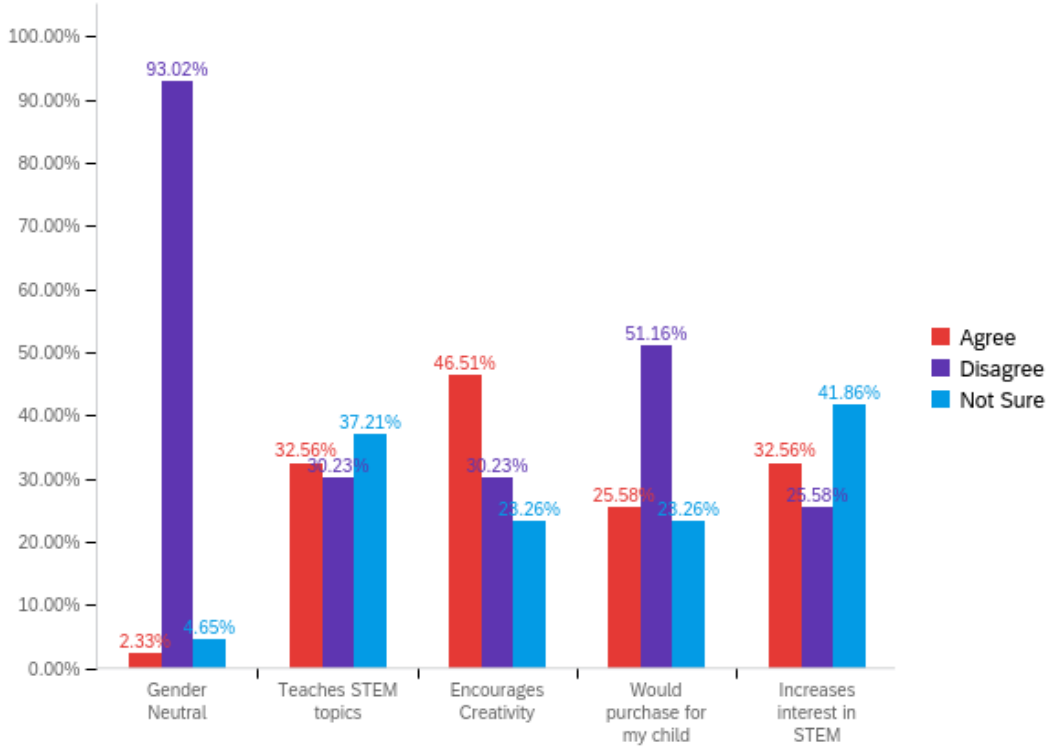
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	97.62%	41	2.38%	1	0.00%	0	42
2	Teaches STEM topics	92.86%	39	0.00%	0	7.14%	3	42
3	Encourages Creativity	100.00%	42	0.00%	0	0.00%	0	42
4	Would purchase for my child	97.62%	41	0.00%	0	2.38%	1	42
5	Increases interest in STEM	90.00%	36	0.00%	0	10.00%	4	40

Barbie STEM Kit



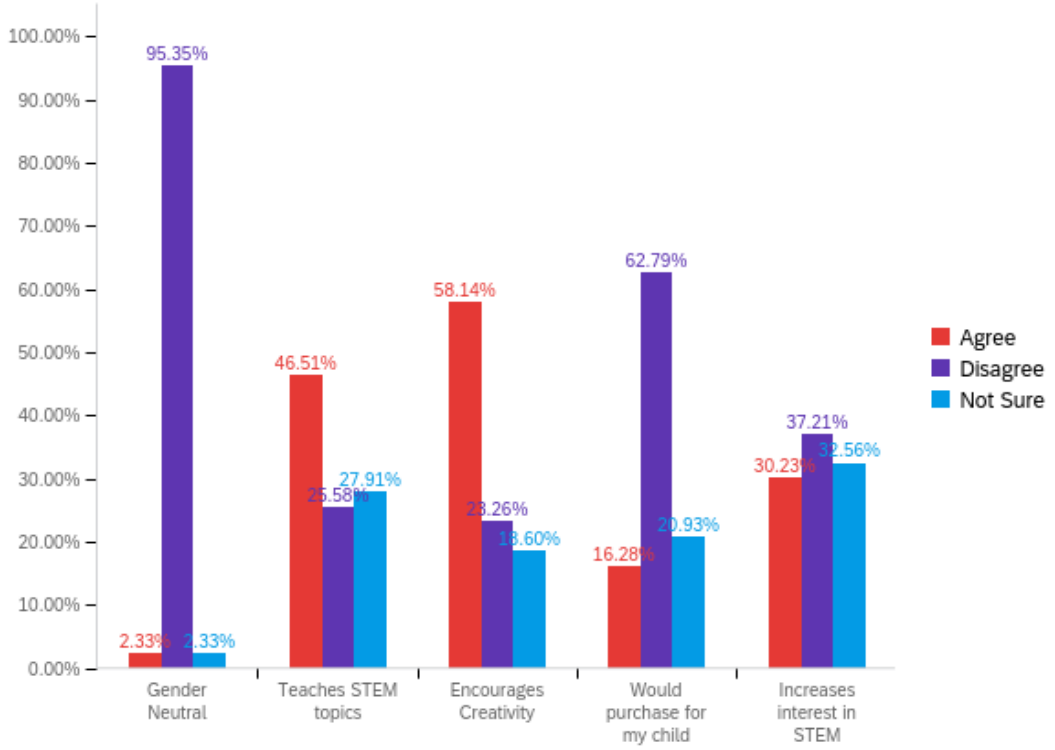
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	2.33%	1	97.67%	42	0.00%	0	43
2	Teaches STEM topics	48.84%	21	25.58%	11	25.58%	11	43
3	Encourages Creativity	60.47%	26	13.95%	6	25.58%	11	43
4	Would purchase for my child	30.23%	13	51.16%	22	18.60%	8	43
5	Increases interest in STEM	39.53%	17	23.26%	10	37.21%	16	43

Ruby Rails Skydive Action Figure



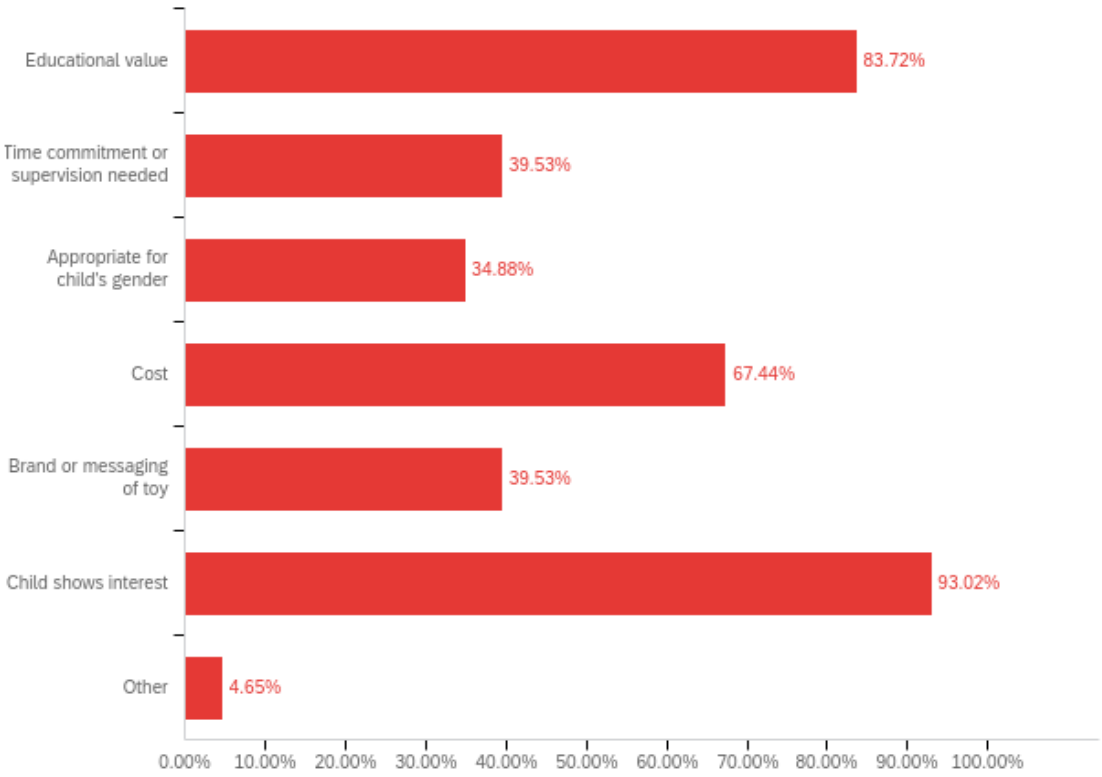
#	Question	Agree		Disagree		Not Sure		Total
1	Gender Neutral	2.33%	1	93.02%	40	4.65%	2	43
2	Teaches STEM topics	32.56%	14	30.23%	13	37.21%	16	43
3	Encourages Creativity	46.51%	20	30.23%	13	23.26%	10	43
4	Would purchase for my child	25.58%	11	51.16%	22	23.26%	10	43
5	Increases interest in STEM	32.56%	14	25.58%	11	41.86%	18	43

Project MC2 Adrienne's Perfume

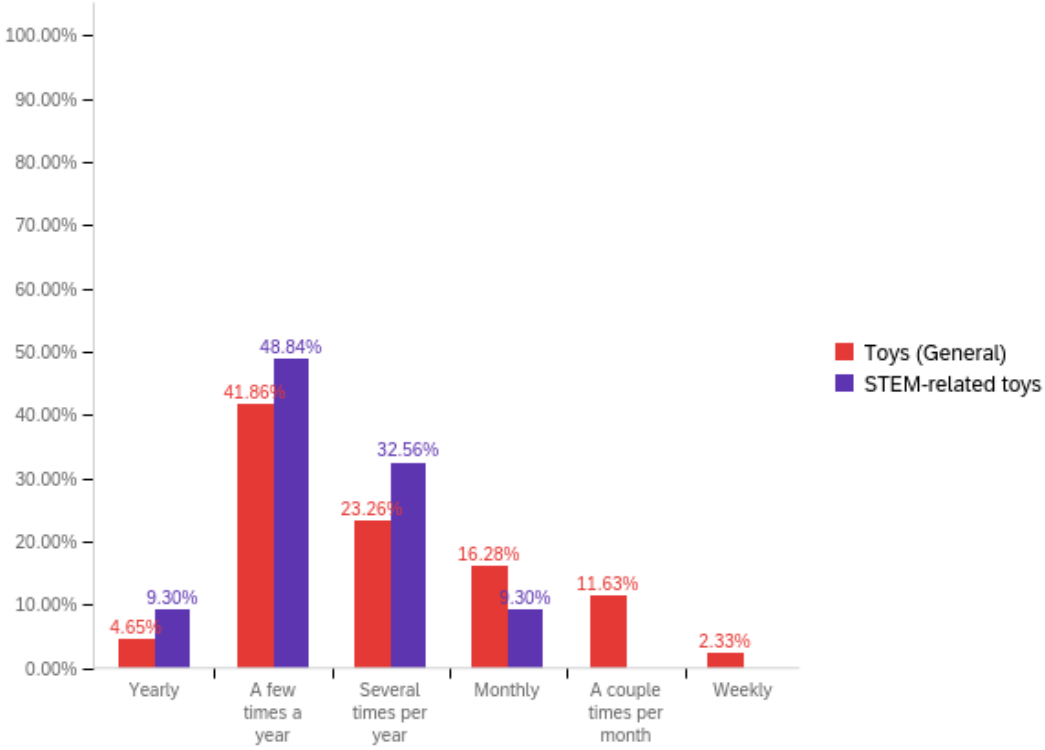


#	Question	Agree	Disagree	Not Sure	Total
1	Gender Neutral	2.33%	95.35%	2.33%	43
2	Teaches STEM topics	46.51%	25.58%	27.91%	43
3	Encourages Creativity	58.14%	23.26%	18.60%	43
4	Would purchase for my child	16.28%	62.79%	20.93%	43
5	Increases interest in STEM	30.23%	37.21%	32.56%	43

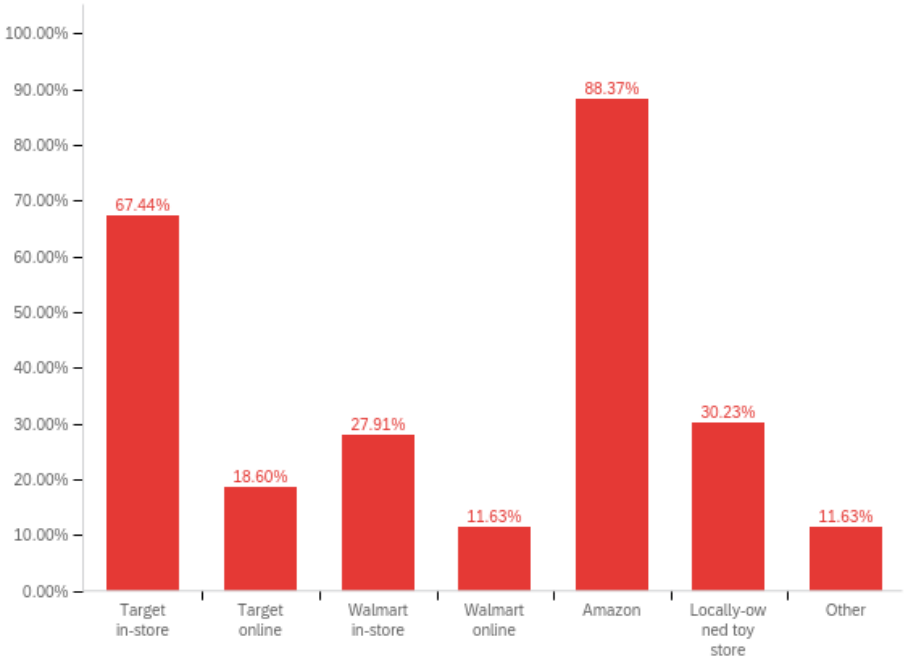
What affects your decision to buy a specific toy? (Check all that apply)



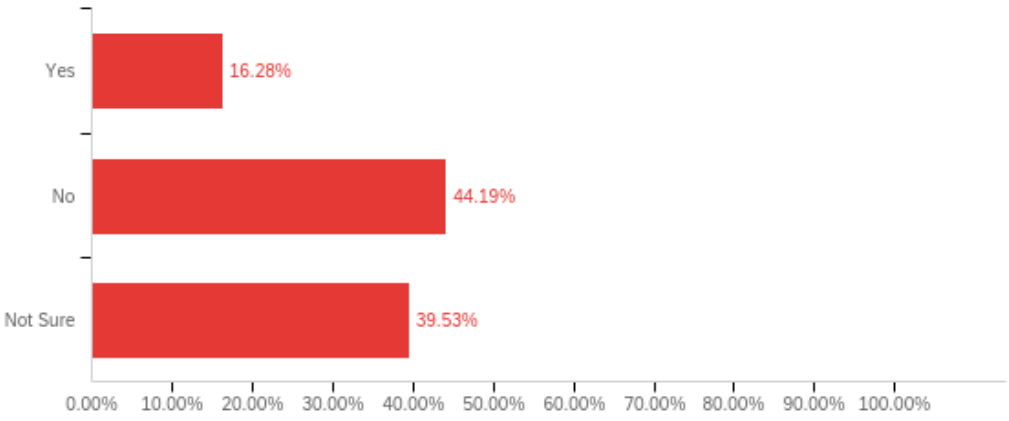
How often do you purchase toys?



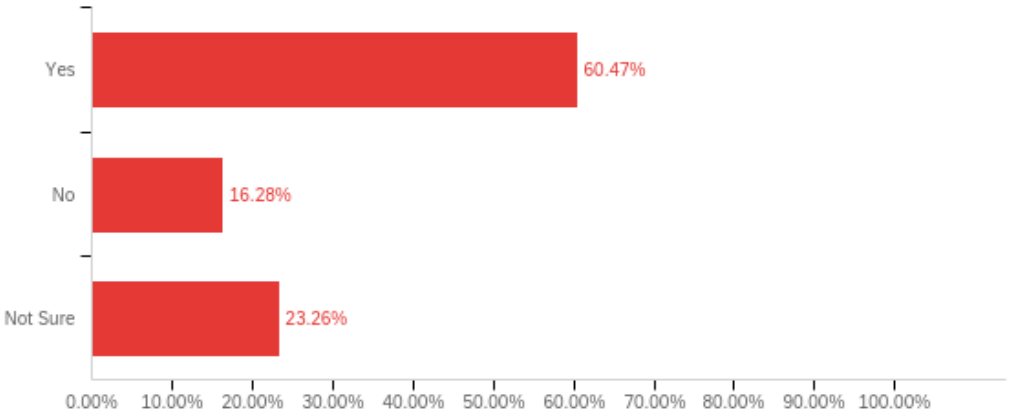
Where are you most likely to purchase toys, including STEM toys? Check all that apply.



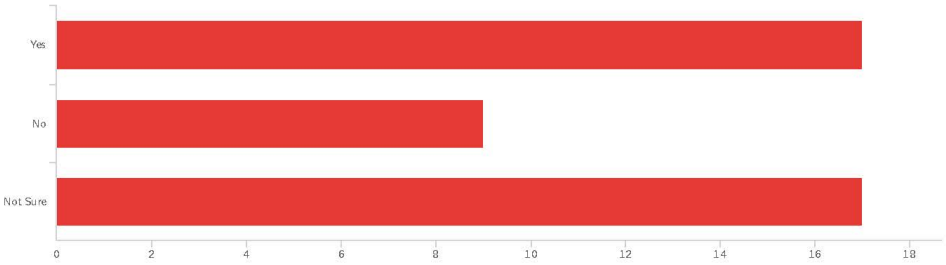
Should STEM toys be marketed toward specific genders?



Do children prefer toys that relate their own gender?



In your opinion, do STEM toys marketed specifically toward girls increase their interest in STEM topics?

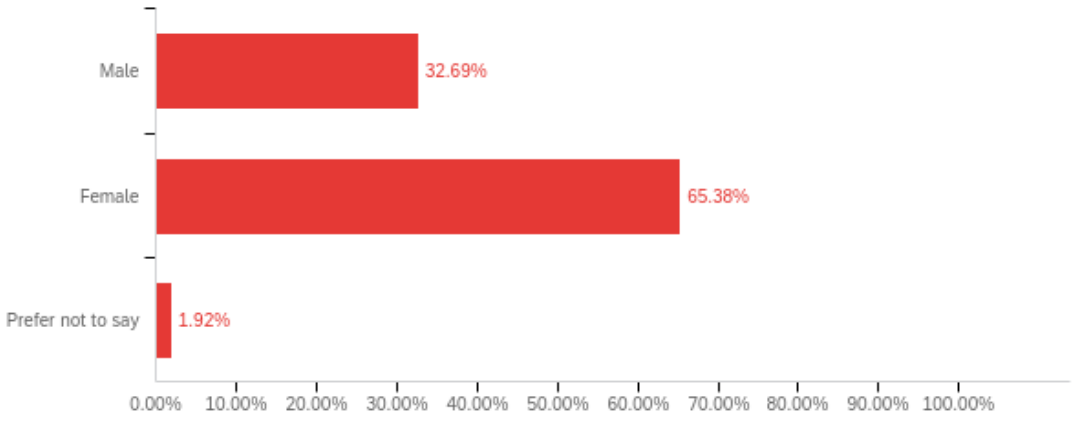


#	Field		Choice Count
1	Yes	39.53%	17
2	No	20.93%	9
3	Not Sure	39.53%	17
			43

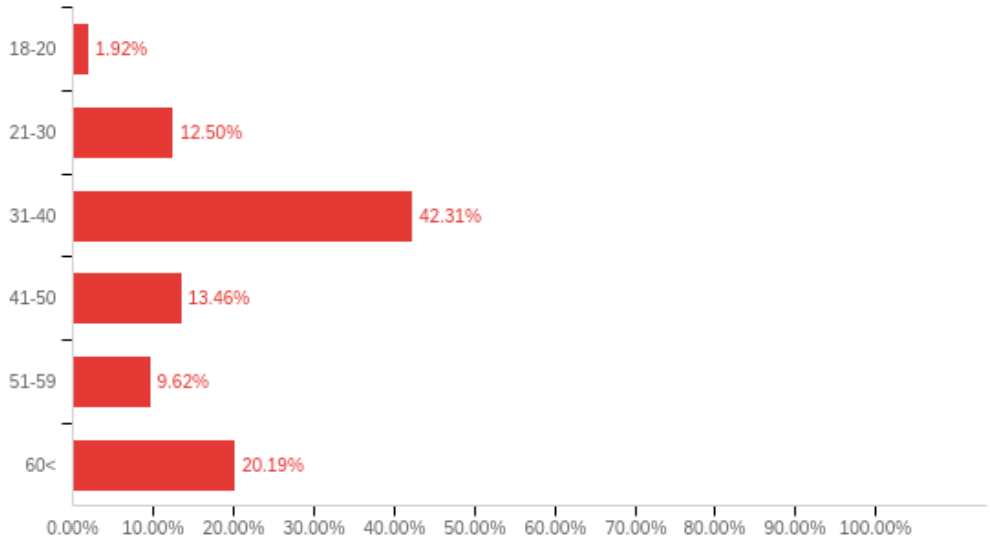
Showing rows 1 - 4 of 4

Appendix B: Group B Questionnaire No. 2

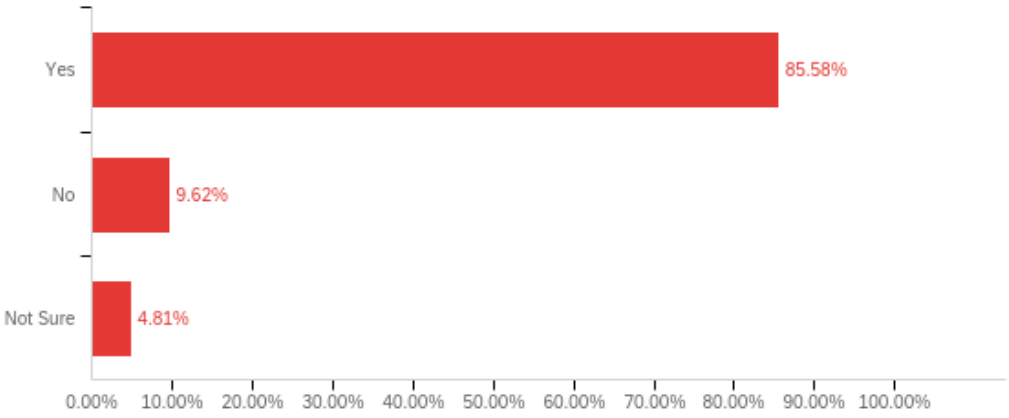
What is your gender?



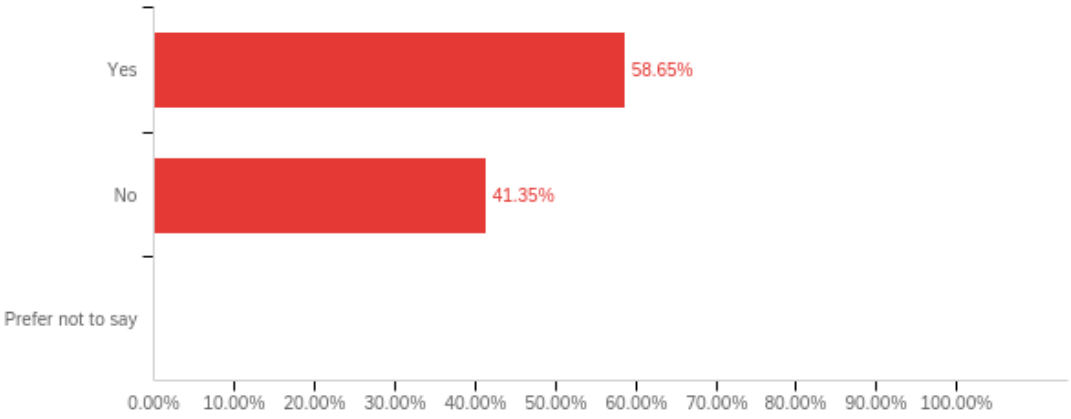
What is your age group?



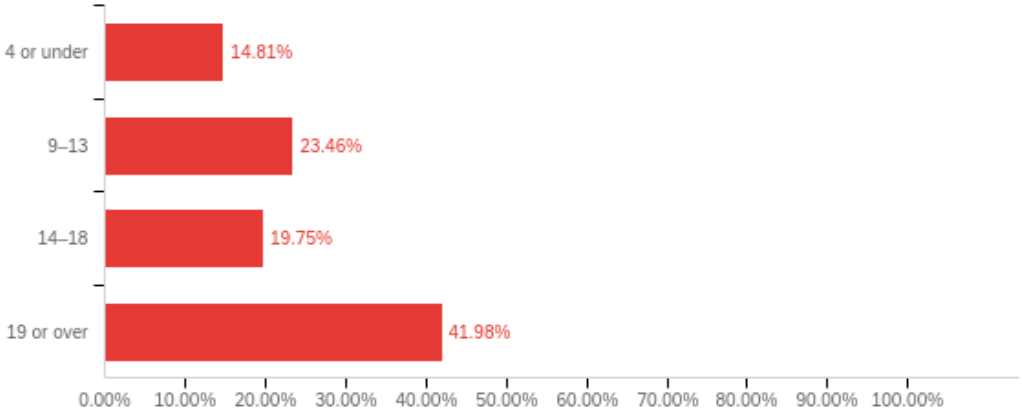
Are you familiar with the acronym STEM (Science, Technology, Engineering, Math)?



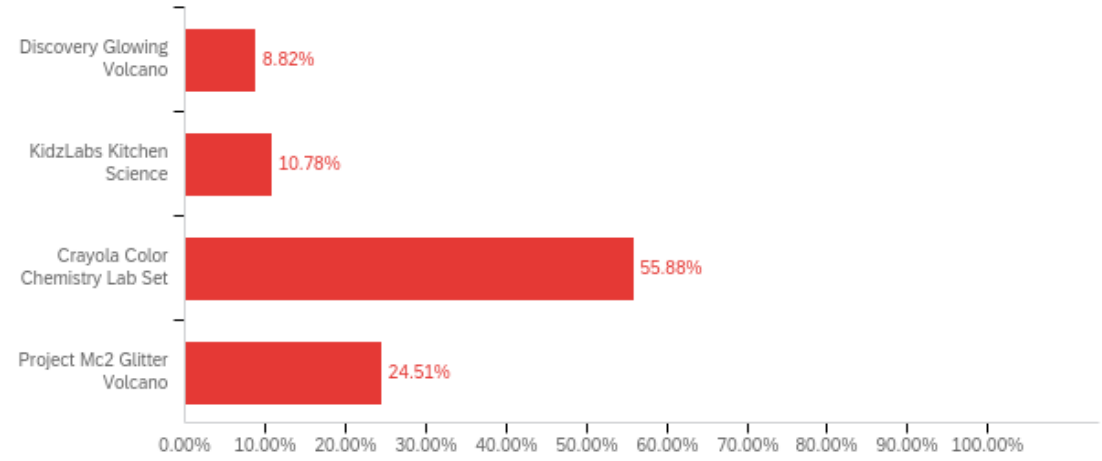
Do you have any children?



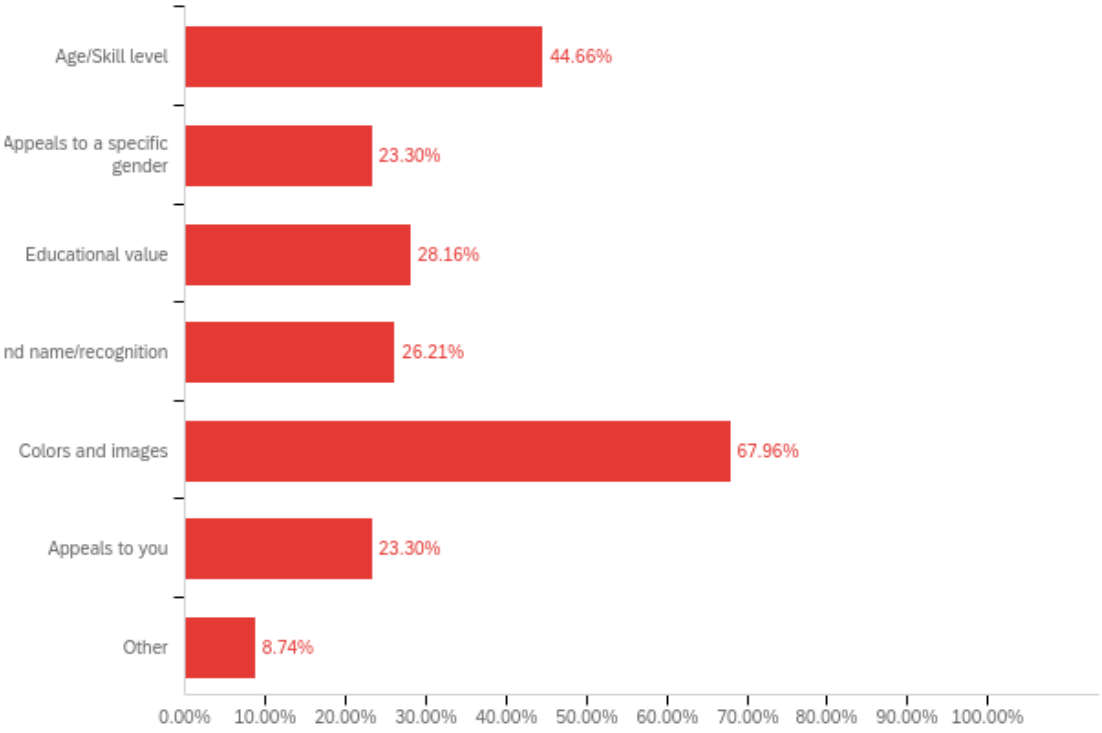
Which age group(s) describe your children? (Select all that apply)



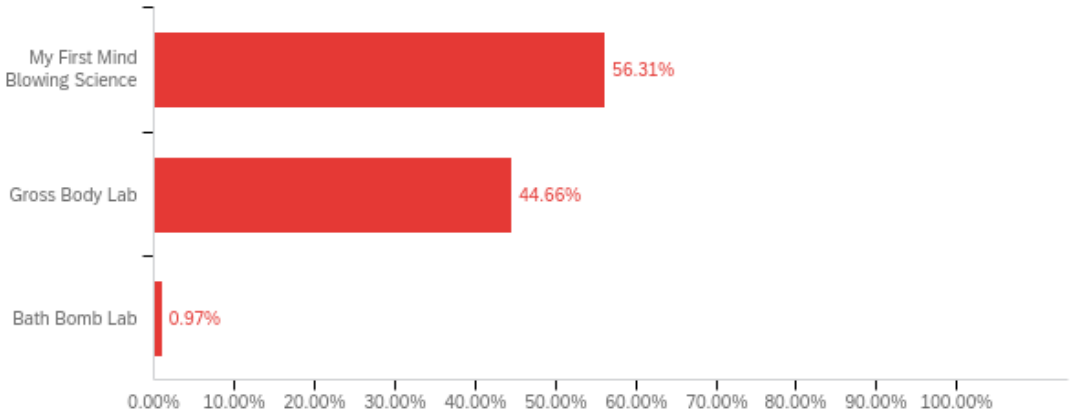
You're attending a six-year-old girl's birthday party. Which STEM toy would you purchase for her? (Choose one)



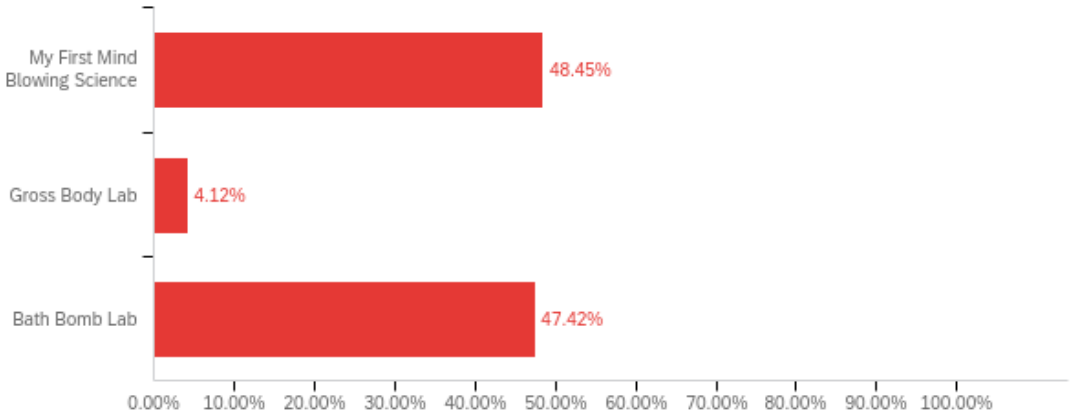
Which factors influenced your decision? (Check all that apply)



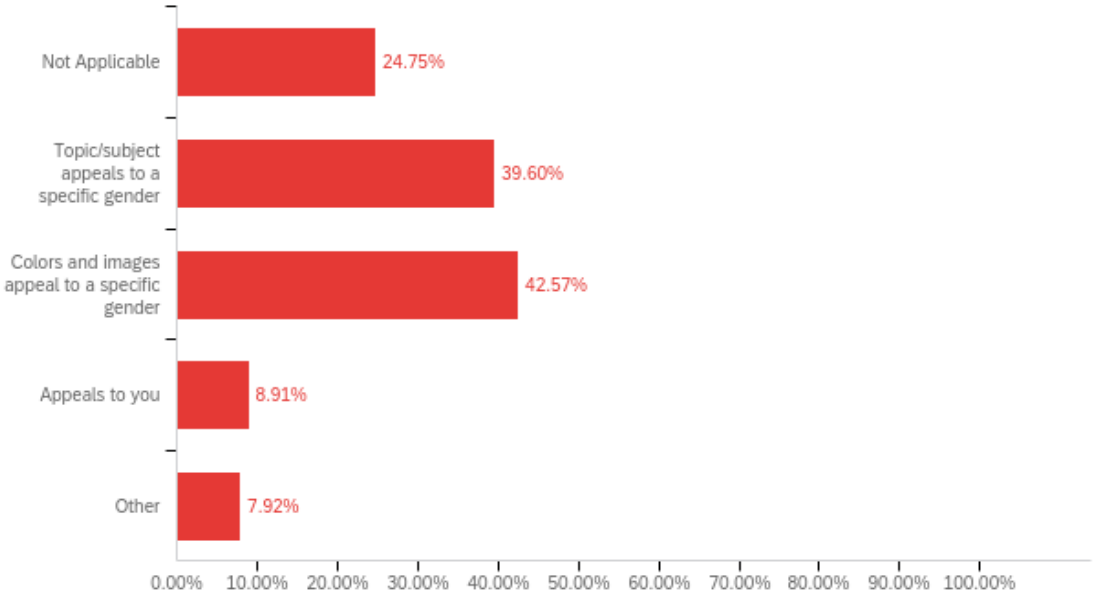
You're buying a STEM toy for a 7-year-old boy. Which toy do you buy him?



Same question, but this time you're buying a toy for a 7-year-old girl. Which toy do you buy her?

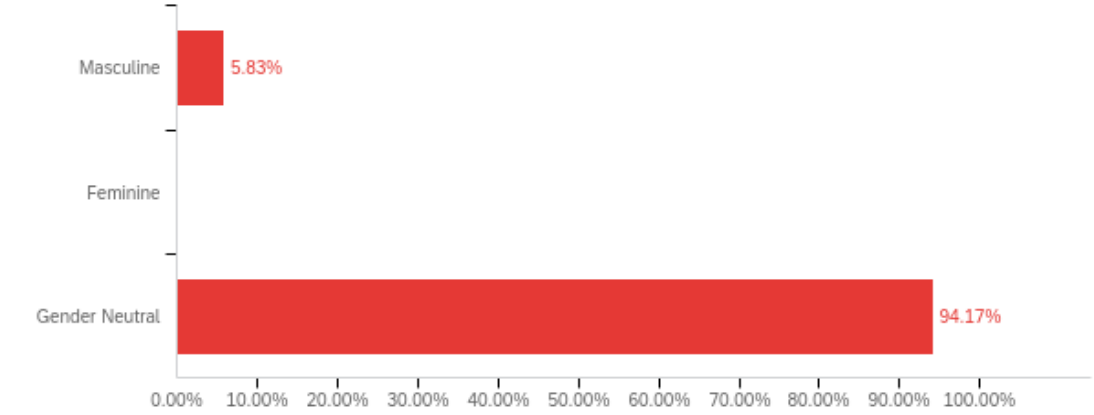


Why did this vary? (Check all that apply)

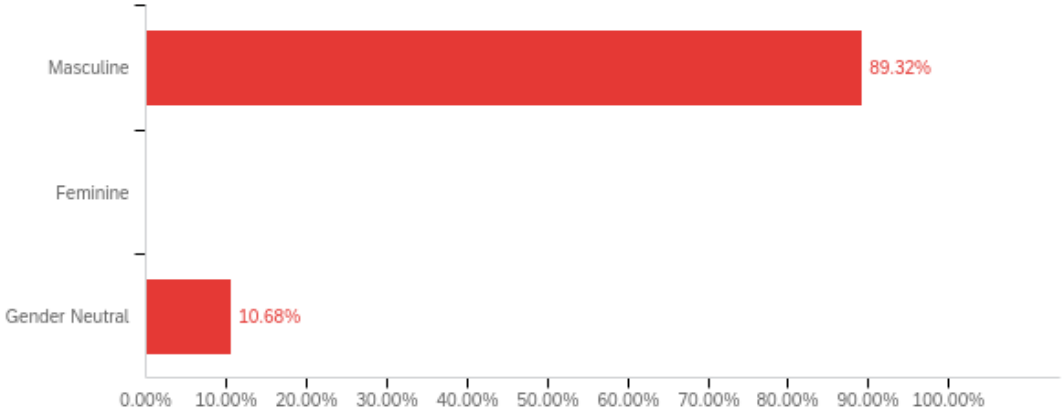


Directions: Rate the following toys as masculine, feminine, or gender neutral.

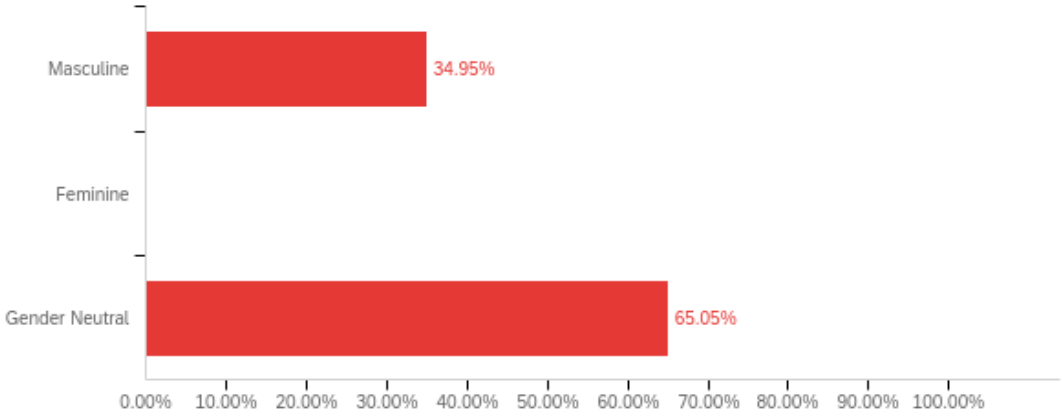
Botley the Coding Robot



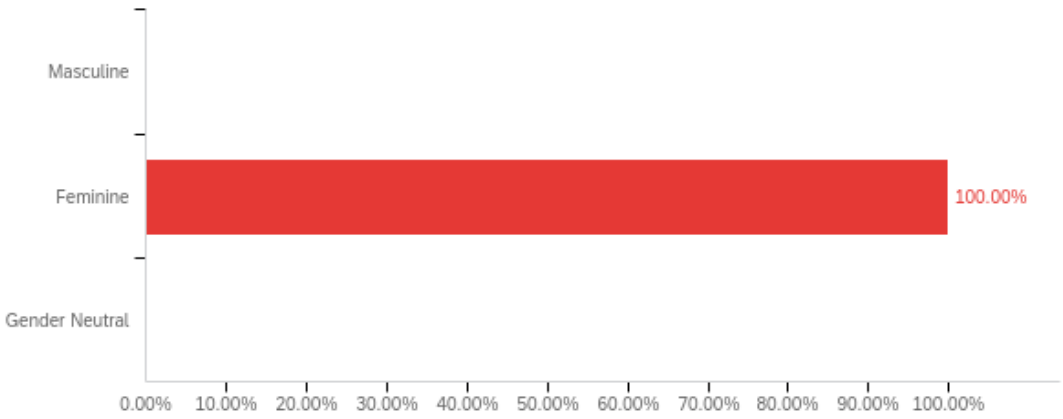
Magformers Amazing Rescue Set



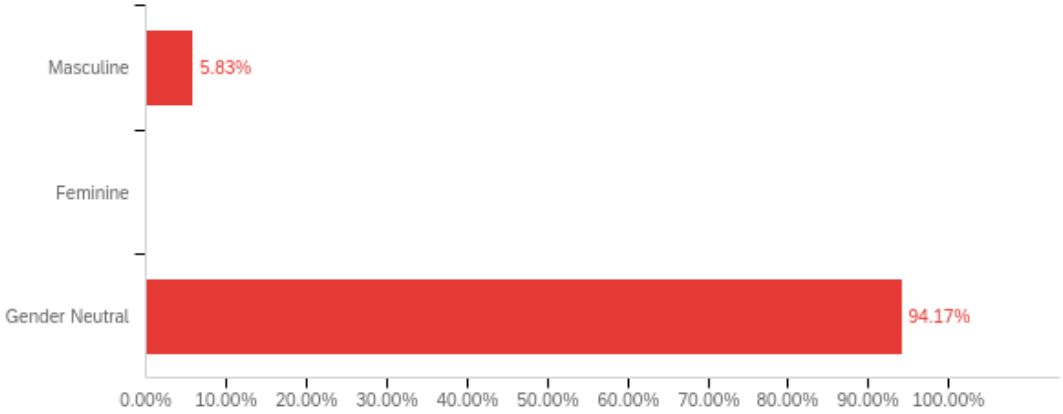
Smithsonian Museum Craft Kit



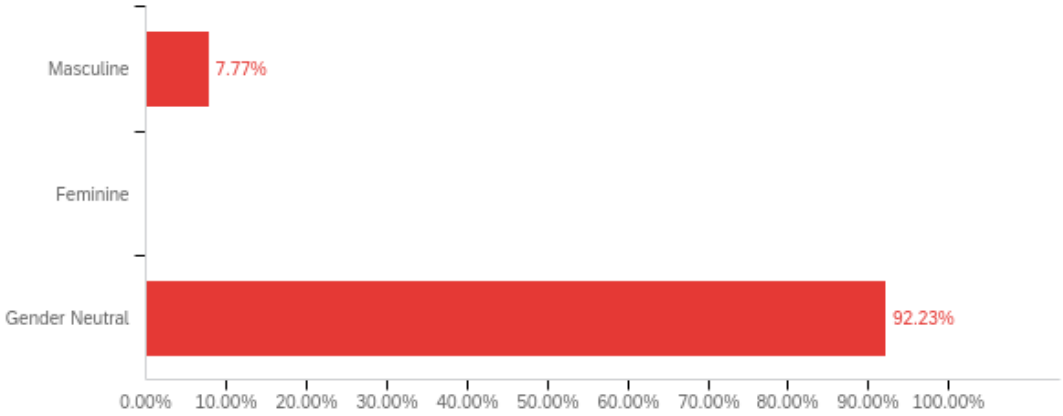
Craft City Make-Your-Own Lip Kit



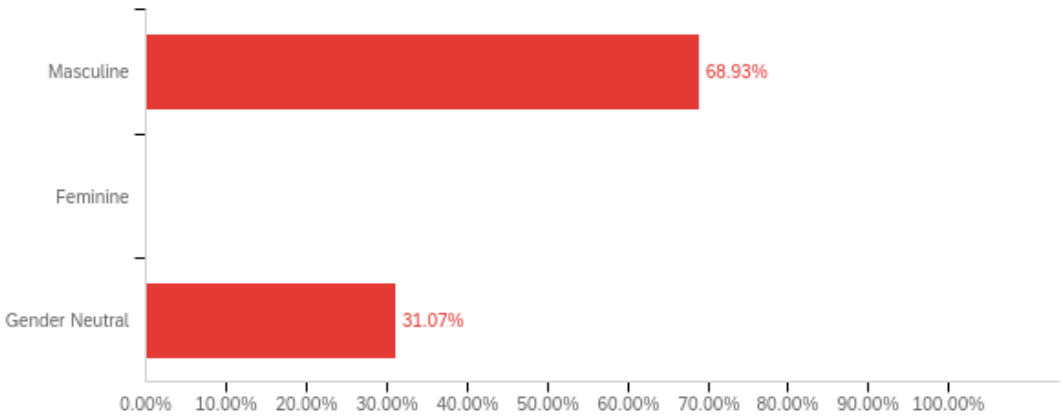
Squishy Human Body



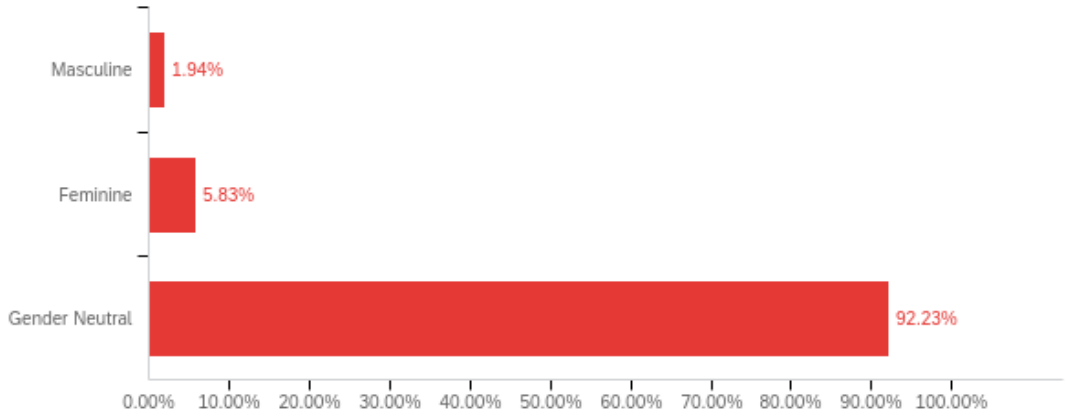
Science Academy Slime Lab



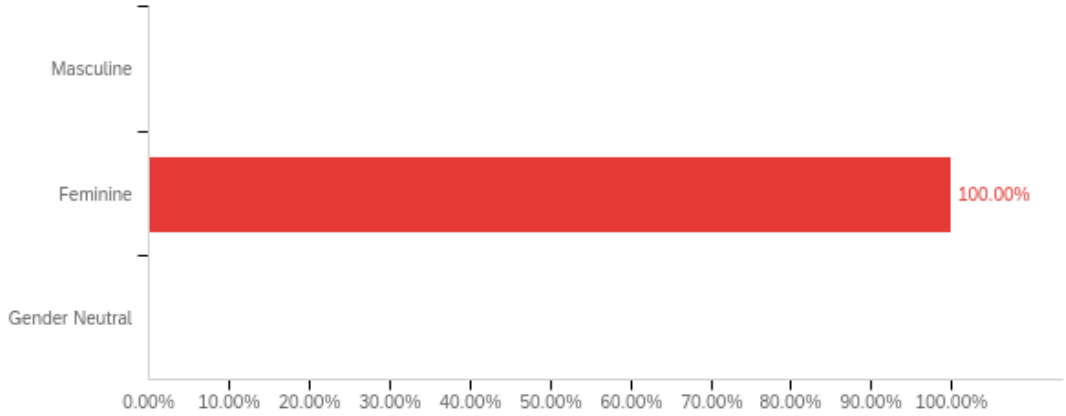
LEGO City



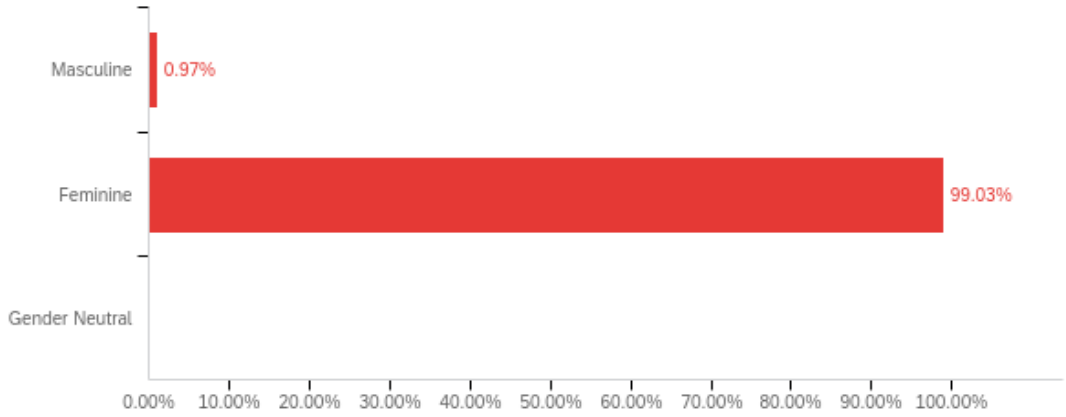
Magna-Tiles Metropolis



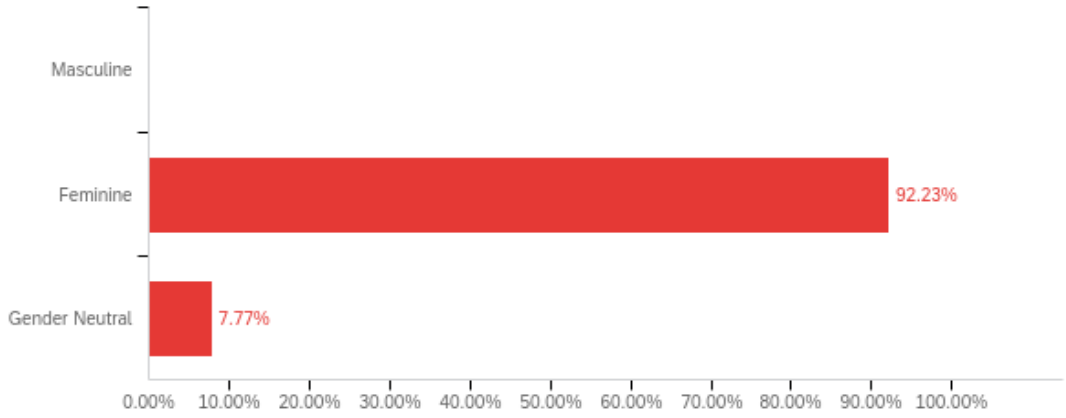
Magformers Mini House Set



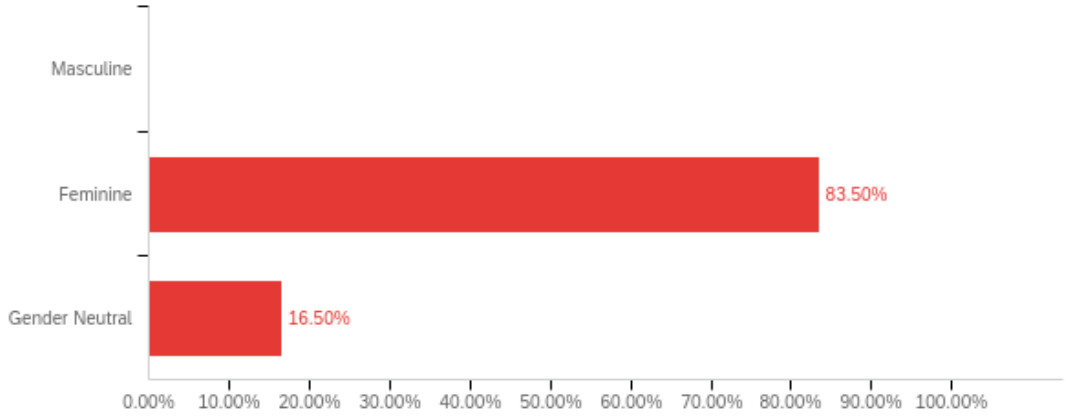
Mc2 Adrienne's Perfume Experiment



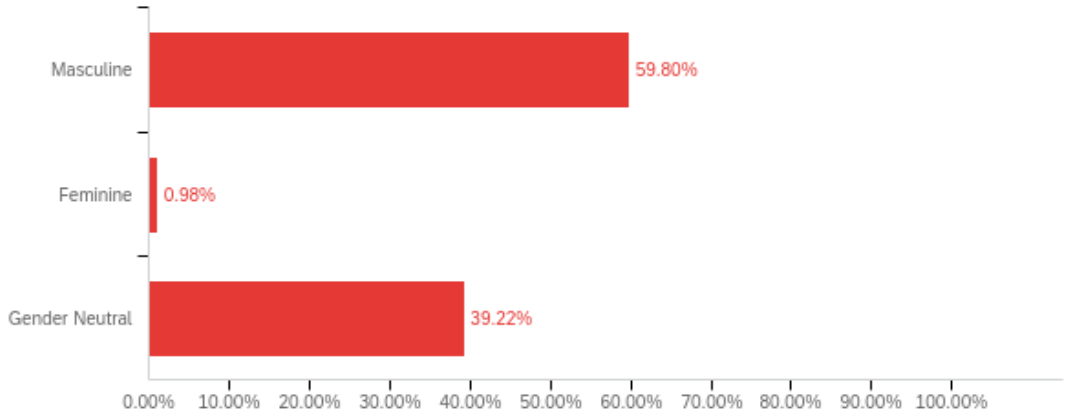
STEAM Powered Girls Crystal Garden



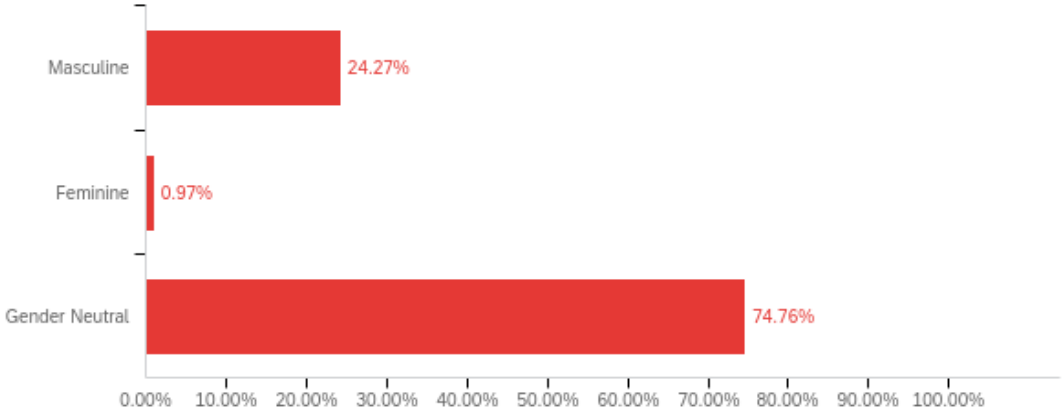
Science Academy Deluxe Shimmer Lab



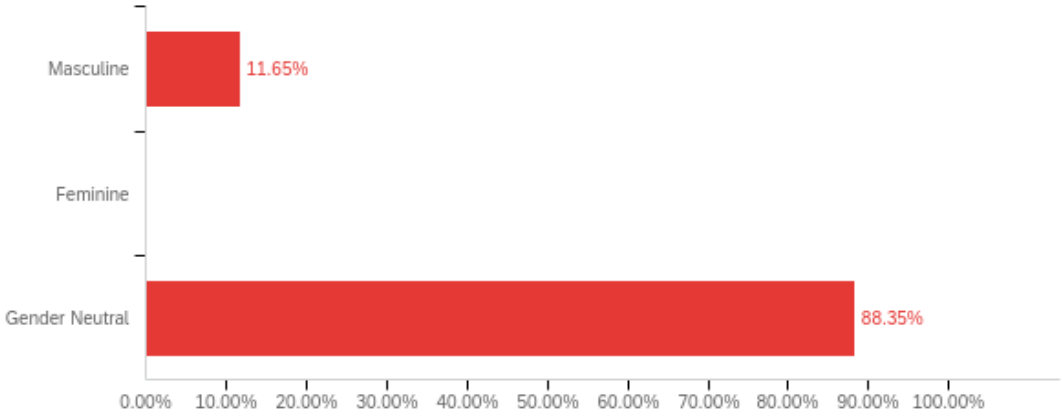
LEGO Boost



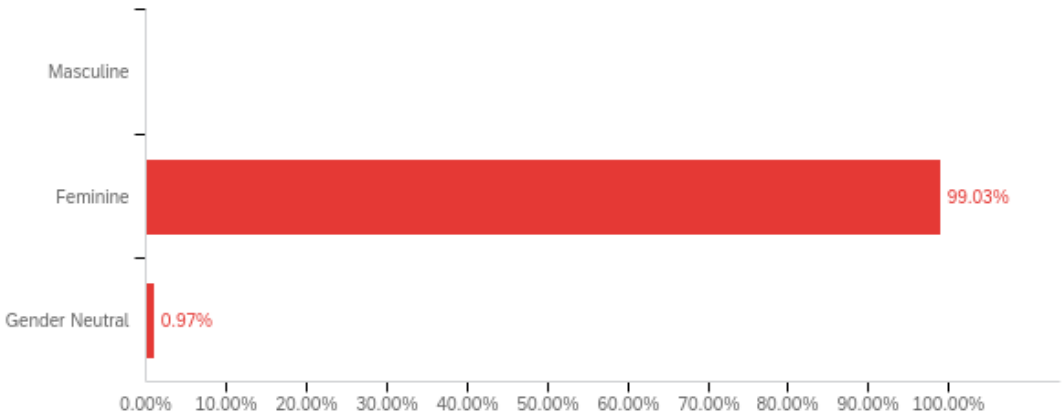
Disgusting Science



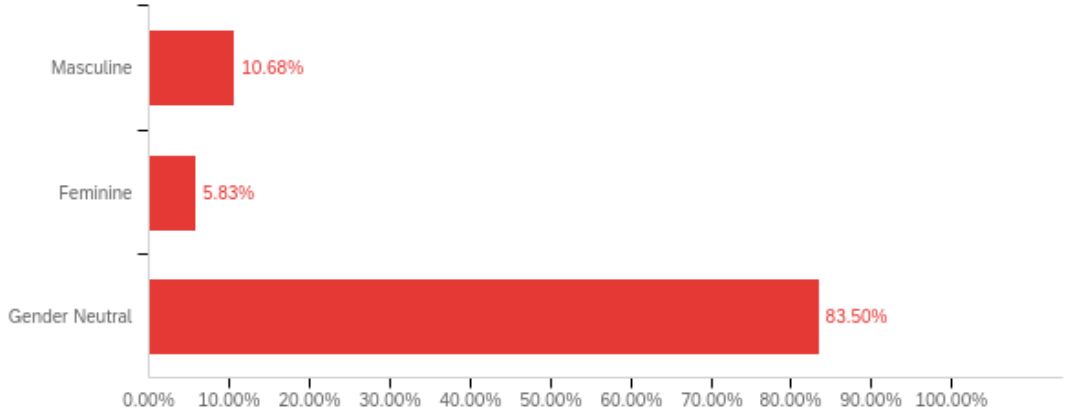
Mad Matter Quantum Builder Pack



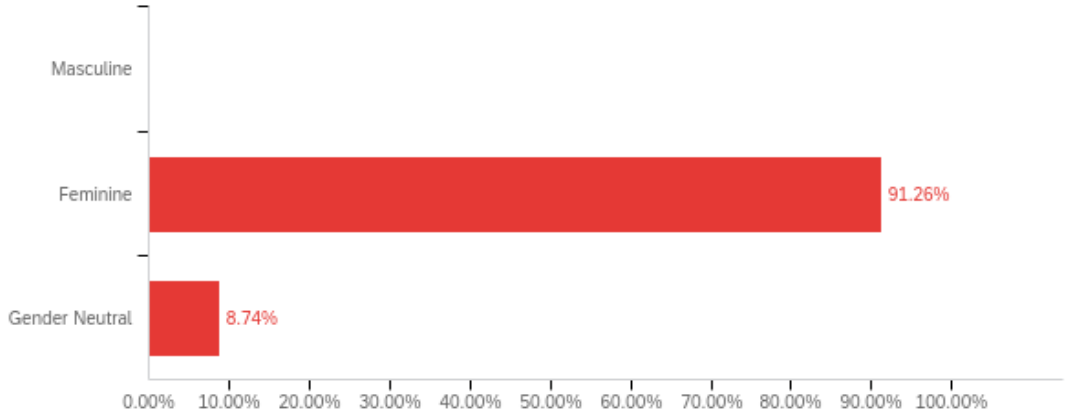
Ruby Rails Skydive Action Figure



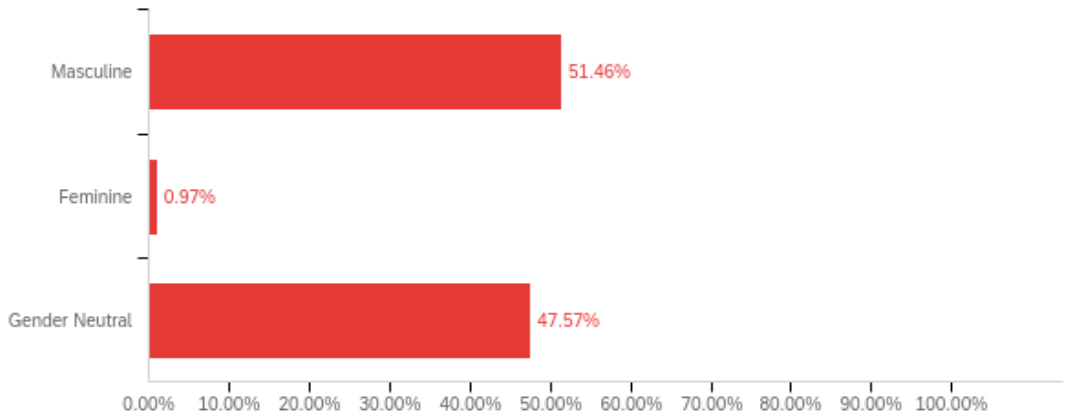
Kids First Aircraft Engineer



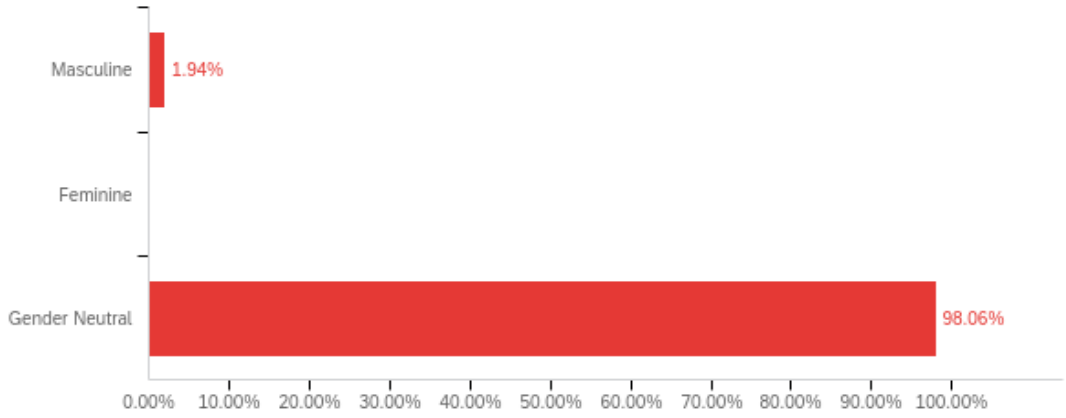
Sparkle Marble Run



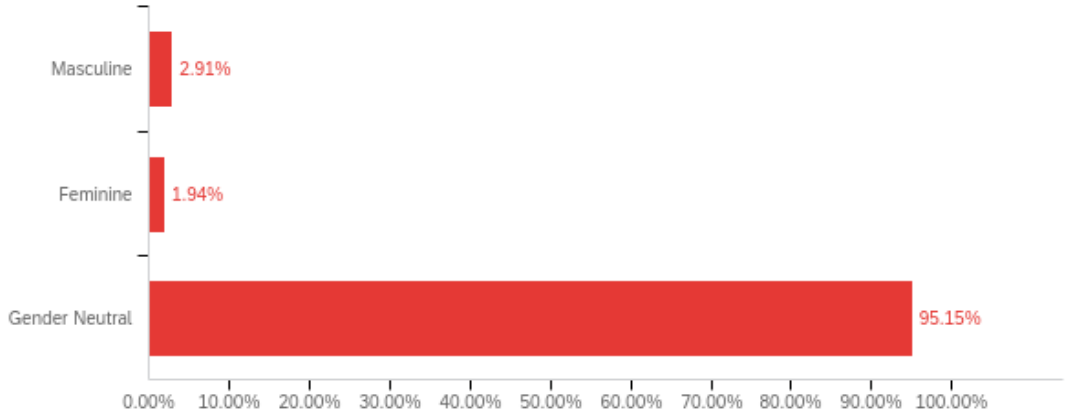
Robotic Hedgehog



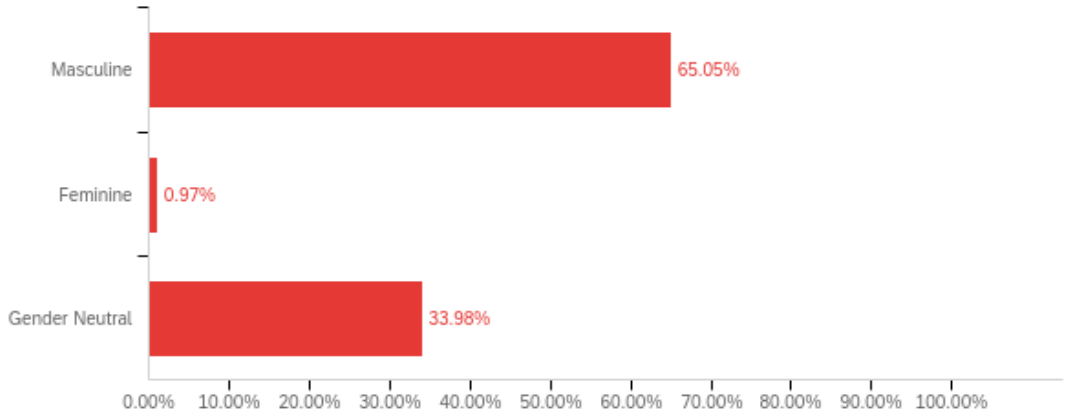
KANO Computer Kit



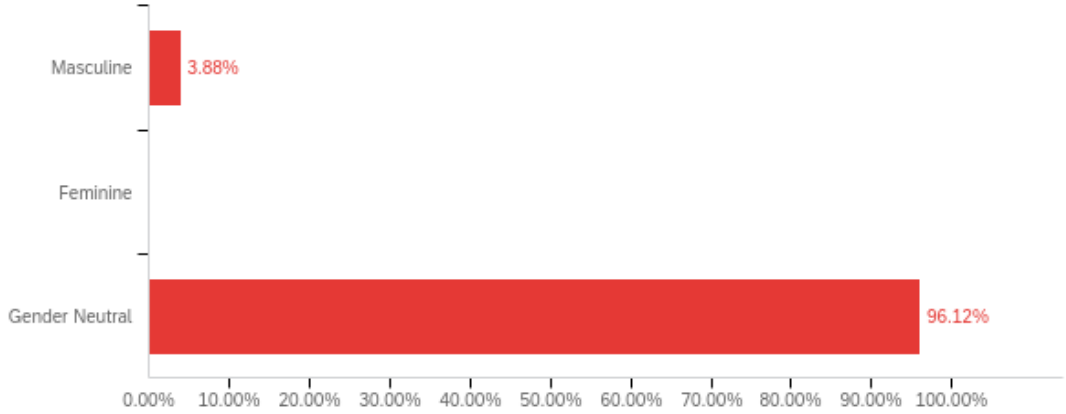
Osmo



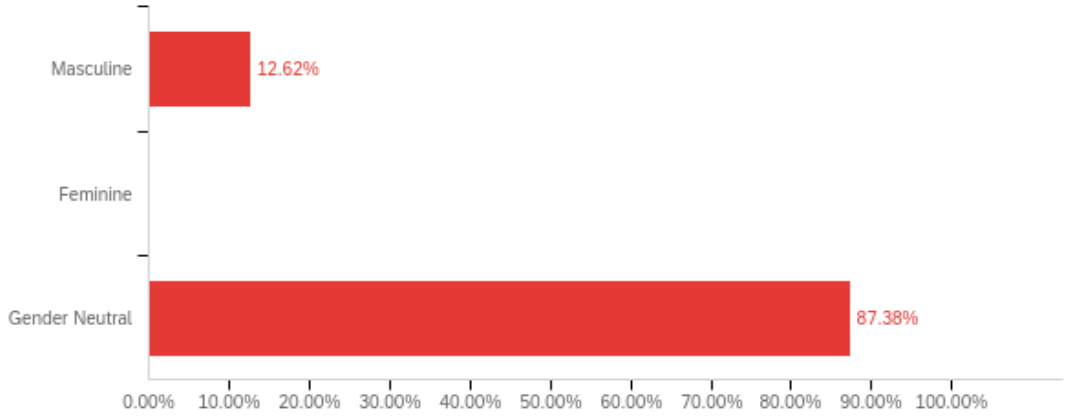
LEGO Boost Star Wars



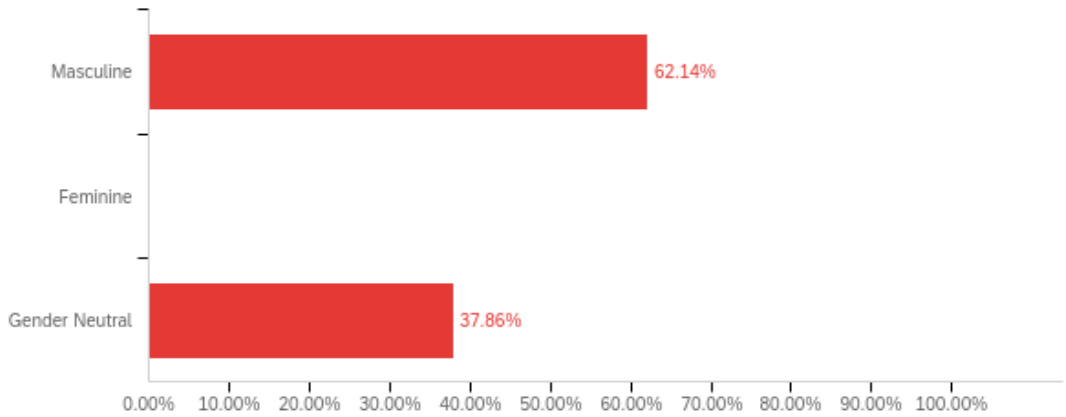
Glow-in-the-Dark Marble Run



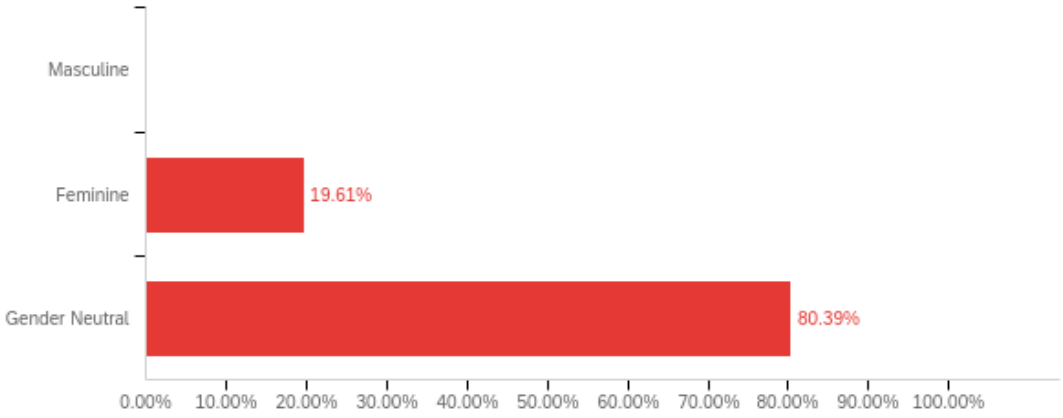
Mega Slime & Putty Lab



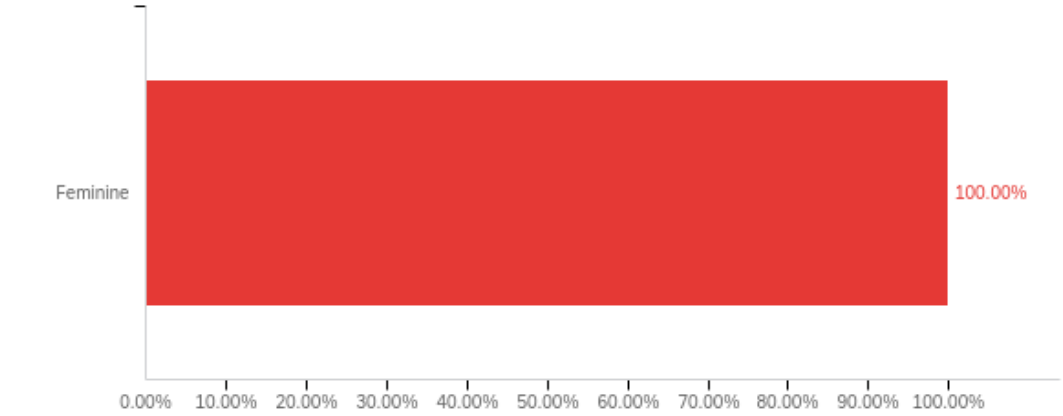
Vex Robotics Fuel Truck



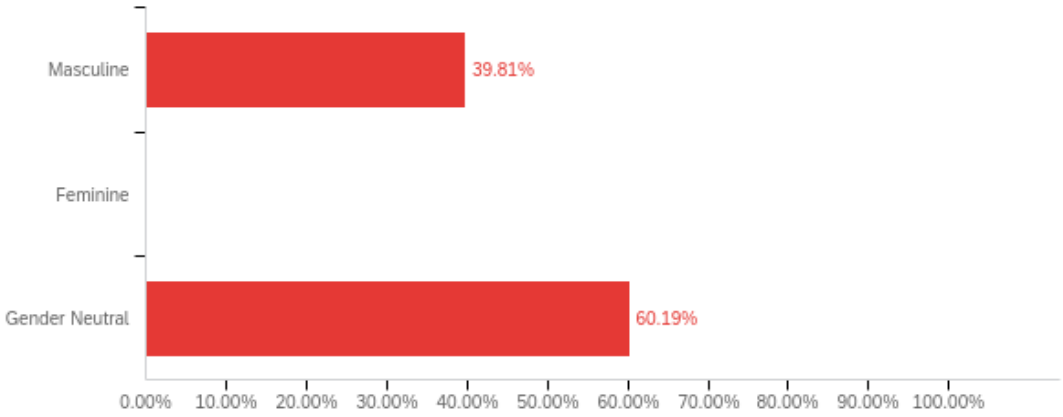
Mega Crystal Growing Lab



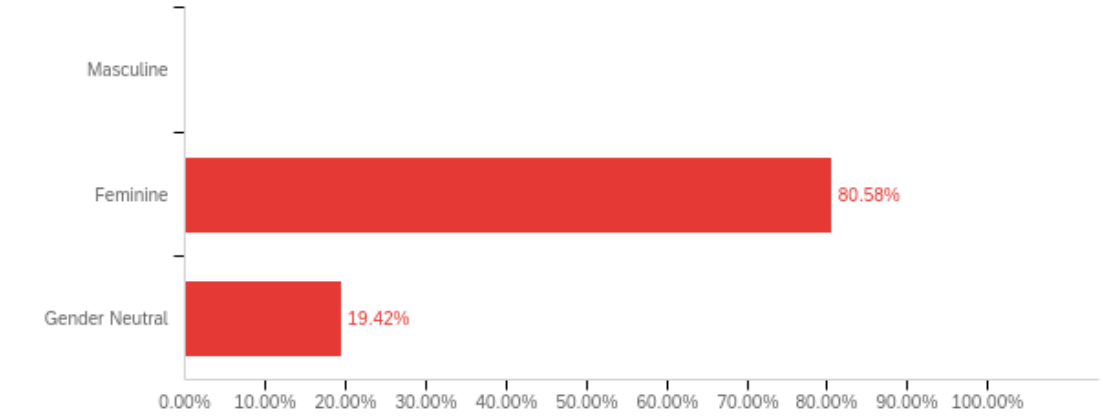
Barbie STEM Kit



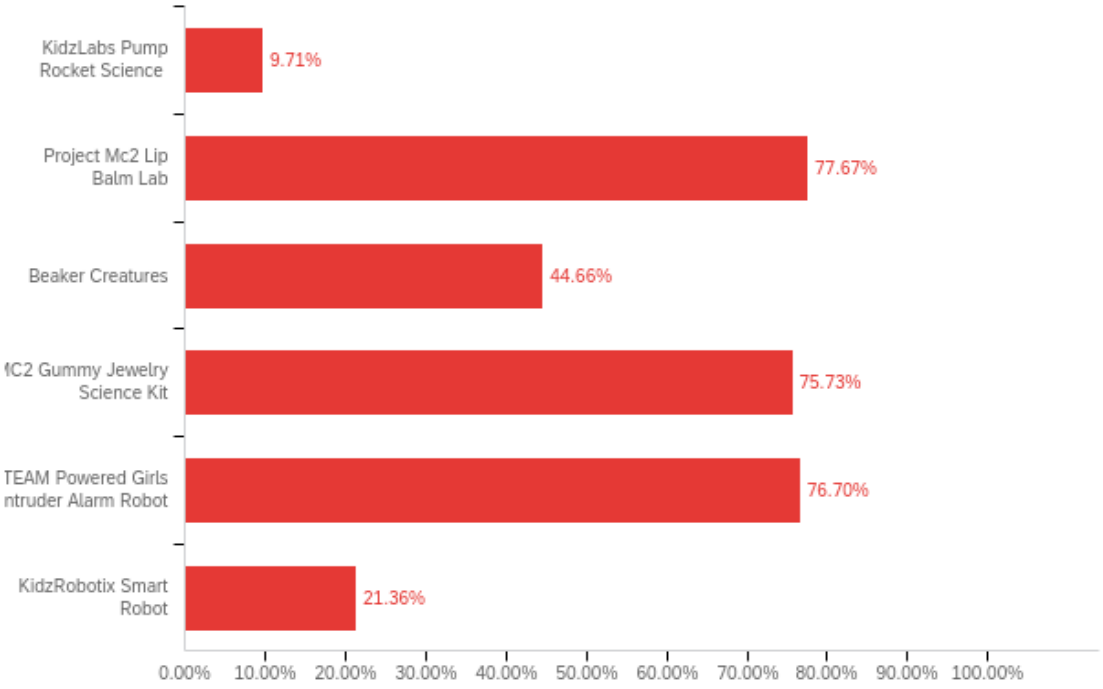
Nintendo LABO VR Kit



Pop Fizz Glow-in-the-Dark Bath Bomb Lab



In your opinion, which of these STEM toys appeal to girls age 5–8? (Check all that apply)



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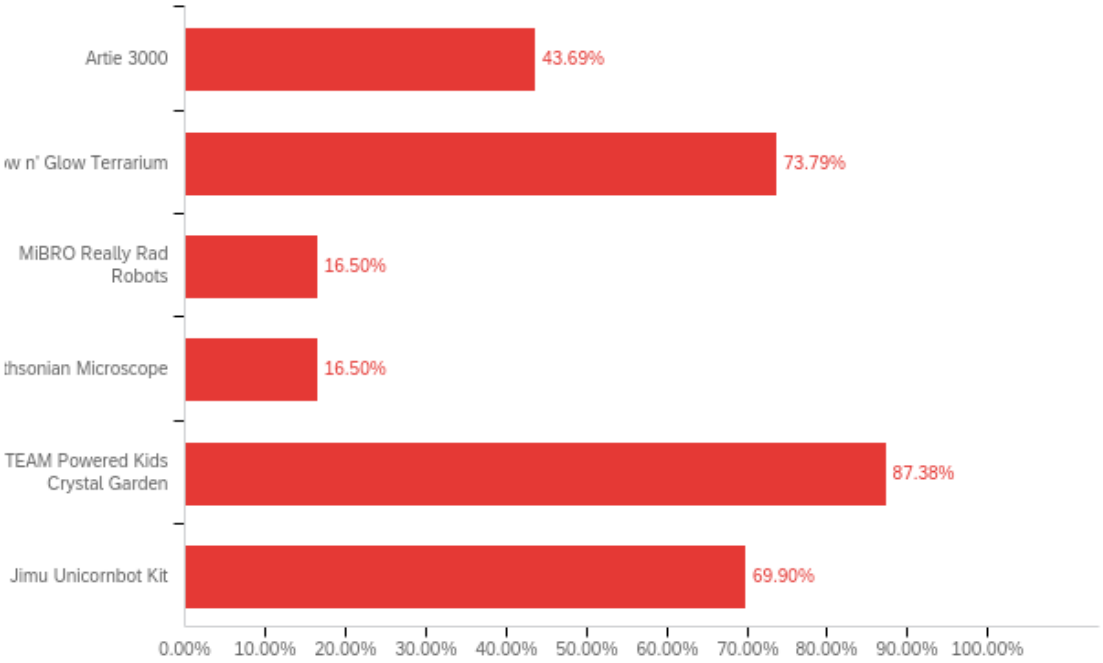
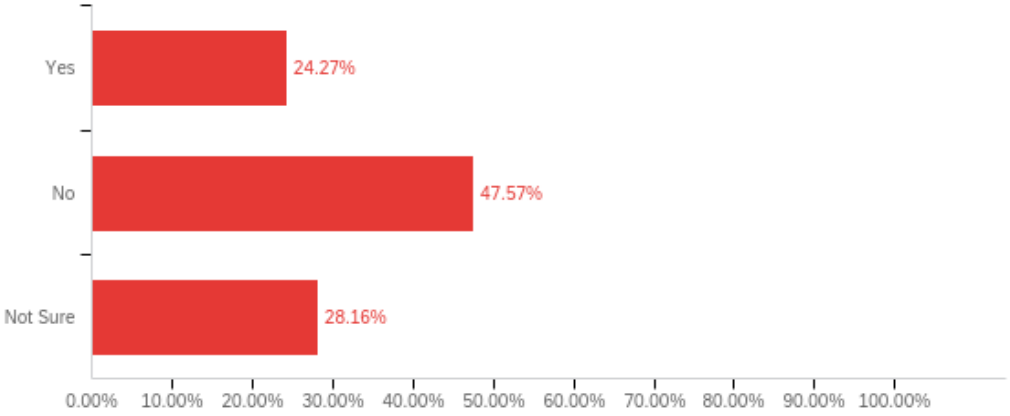
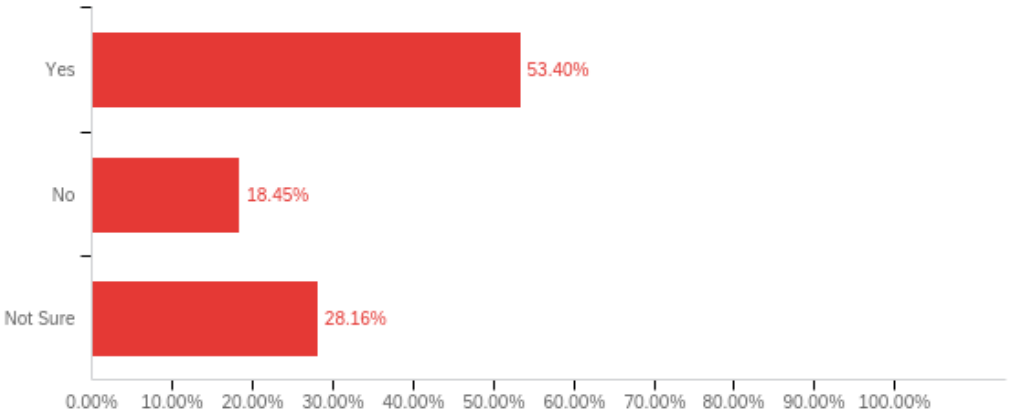


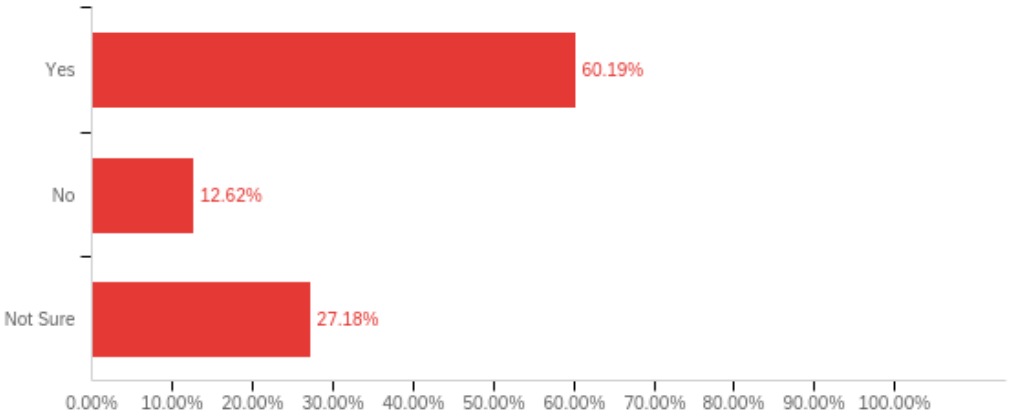
Should STEM toys be marketed toward specific genders?



Do children prefer toys that relate to their own gender?

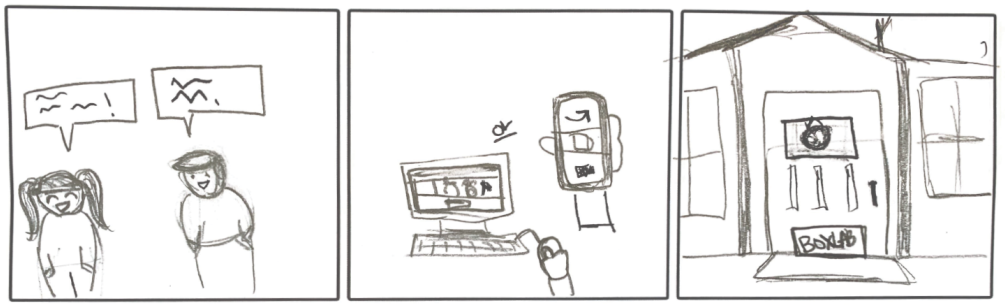


In your opinion, do STEM toys marketed specifically toward girls increase their interest in STEM topics?



Appendix C: BoxLab Storyboard

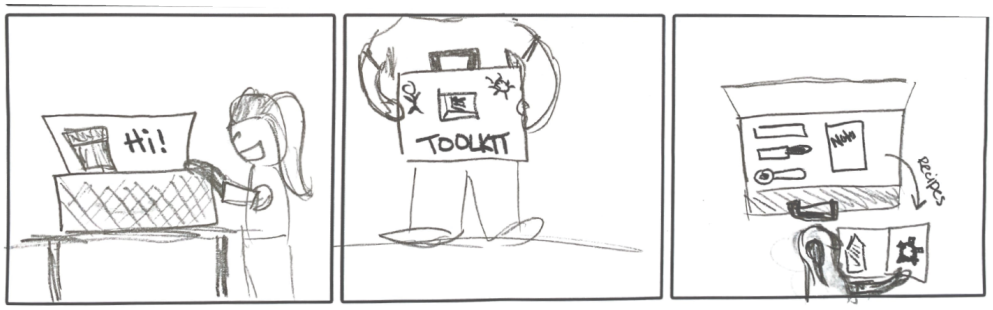
Storyboard 1 of 2



A child hears about BoxLab (from a friend at school) and tells her parent about it.

The parent goes to Amazon to purchase BoxLab.

BoxLab is delivered to the child's front door, 3-4 weeks after ordering.



The child opens BoxLab and receives welcome instructions.

Step 1: The child assembles and decorates the BoxLab Toolkit.

The child opens the curriculum notebook, including DIY recipes.

The curriculum shows the child what types of household items can be reused to create and build.

Step 2: The child completes activity one, which teaches building techniques and provides guided learning.

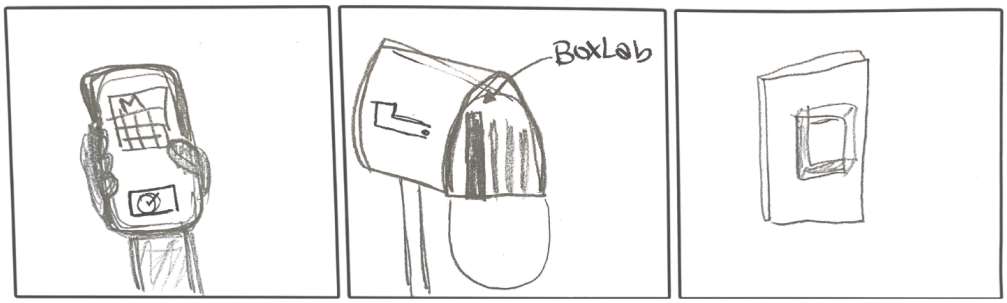
The child shows off the creation and may incorporate it with toys they already own (action figures, dolls, etc.)

Storyboard 2 of 2

The child completes activity two, which teaches additional building techniques.

The child is given a prompt, for example, "make a building." The child is given ideas, but the design solution is left up to the child.

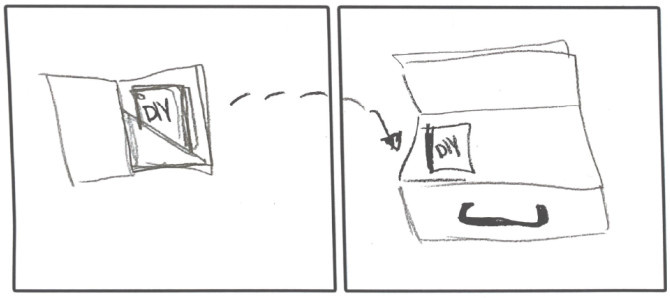
The child shows off their creation.



The parent can order the next BoxLab, or set up orders as subscribe and save.

BoxLab arrives in the mailbox 2-4 weeks later.

Packaging is much smaller and only contains recipe cards, curriculum, and small building pieces (batteries, wires, etc.)



The child completes the activities.

The child stores additional materials in the BoxLab Toolkit.

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