Michiko Maruyama

Integrating Industrial Design and Cardiac Surgery:

Changing the World One Toy at a Time

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If you can think it, you can draw it.
If you can draw it, you can build it.
If you build it, you will change the world.

– Dr. Shaun Robinson

To my husband for putting up with all my crazy.

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Abstract

Integrating Industrial Design and Cardiac Surgery:
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Background: There are many educational resources to teach the adult population about cardiovascular disease and living a "heart healthy" lifestyle, however, there are few resources that target the pediatric population. In fact, many of the pediatric educational resources are intended for the parents or guardians rather than the children.

Objectives: To integrate toy design and cardiac surgery to build educational toys that will teach cardiac anatomy, introduce medical terminology, discuss the importance of cardiac health and encourage a cardiac healthy lifestyle for the pediatric population.

Methods: The research was divided into five mini projects and focuses primarily on the design process. After formulating the design problem and creating a list of objectives, background research was conducted on the target audience. The next step involved brainstorming ideas followed by examining the pre-existing educational resources. Prototypes of the selected toy ideas were created. Prototype testing was performed throughout the design process in the form of workshops with the target audience. Informal feedback was acquired to guide the development of the design solution.

Results: Since once of the methods that children learn through is through, a series of toys were created to explore cardiac health. Low cost and sustainability were key factors in the design and resulted in paper toys. Overall, the toys were very well-received, especially Doctors Against Tragedies which has grown into a multidisciplinary non-profit organization. MEDCRAFT on the other hand was not successful. It did not meet the low-cost objective and unfortunately, there was no funding to pursue it further.

Conclusions: The design process used for each mini project resulted in unique educational resources in the form of toys. The toys were well-received and the feedback from the target audience was, overall, very positive. Future research would involve examining the level of knowledge translation through play with the educational resources created. By introducing the importance of cardiac health at an early age, a possible long-term outcome is a decrease in the incidence of cardiac disease in the adult population.

Key words: industrial design, toy design, cardiac surgery, medical education

A little about me

My name is Michiko Maruyama. I am half Japanese and half Irish, a unique combination that I call “Jirish”. My Japanese grandmother named me “Michiko” which, depending on how it is written, means “beautiful wise child,” “child of a thousand beauties,” or “child of the road.” My grandmother chose “child of the road” because she wanted my life to be filled with twists, turns and adventures.

She named me well.

I spent my childhood training and competing in the sport of Judo, ultimately winning the title of National Judo Champion. Judo took me around the world, but I had to choose between a life as a professional athlete which involved constant competing and always trying to loose weight, or academics. I was tired of stepping onto a scale. So, I chose academics.

In 2008, I graduated with distinction from the University of Alberta’s Industrial Design Bachelor Degree Program, Engineering Route. As an industrial designer, I found my niche in toy design and children’s furniture. Unfortunately, I was diagnosed with a rare type of cancer requiring surgery, radiation and chemotherapy. As a designer, I was inspired by everything that I saw and experienced as a patient. My interest in medicine continued to grow and in 2010, I was accepted into medical school at the University of British Columbia Northern Medical Program in Price George.

Throughout medical school, I continued to explore art and design. At the end of each day, I transformed what I learned into a “Daily Doodle.” By combining studying and drawing, each doodle acted as a learning tool and a creative exercise. I transformed my medical doodles and illustrations into a website for other medical students to use and enjoy: www.artoflearning.ca. In addition, during medical school, I became the first apprentice of Haida Artist Clarence Mills. Under his mentorship, I studied Haida culture, totem pole carving, traditional silk screen printing and repoussé jewelry.

While in medical school, I fell in love with cardiovascular health. I am now in my fourth year of cardiac surgery residency training at the University of Alberta. Despite the long hours in the operating room, overnight call shifts and training to be an open-heart surgeon, I continued to explore art and design. To further my knowledge and skills as an industrial designer in the field of medicine, I decided to undertake graduate studies.

Drawing on my unique combination of industrial design, graphic art, and medical training, I aim to create educational resources that facilitate knowledge transfer and communication between physician and child. This research topic was inspired by my experiences as a medical student during my pediatric rotation and my background in toy design. Since children learn through play, I decided to dedicate my Master of Industrial Design Thesis Work to the creation of education toys.

My path to graduate studies has been filled with many twists and turns – from studying design to being diagnosed with cancer to pursuing a career in open heart surgery. Along the way, I have been fortunate to have many mentors in my life who have provided me with support and encouragement.

INTERESTS & ACTIVITIES

The heart
Judo
Magic
History of Medicine
Industrial Design
Visual Design
3D Printing
Art and Painting
Photography
Creative Writing
Live Theatre

Contents

Integrating Industrial Design and Cardiac Surgery: Changing the World One Toy at a Time

Introduction

Integrating Industrial Design and Cardiac Surgery

"Integrating Industrial Design and Cardiac Surgery: Changing the World One Toy at a Time" is a part of ongoing research that aims to integrate the fields of industrial design and cardiac surgery. The research is funded by the Divisions of Industrial Design and Cardiac Surgery and the Departments of Surgery and Art & Design at the University of Alberta. The research has also received funding from the Social Sciences and Humanities Research Council (SSHRC), the Alberta Medical Association and the Canadian Medical Association in the form of an Emerging Leaders in Health Promotion Grant and the Edmonton Community Foundation. The majority of the projects are in collaboration with the Mazankowski Heart Institute and the Stollery Children's Hospital.

The research started in 2011 at the University of British Columbia in collaboration with BC Children's Hospital and the Office of Pediatric Surgical Evaluation and Innovation (OPSEI). OPSEI is a program that connects medical students with mentors to work on various summer projects, ranging from clinical research to patient education [1].

Integrating Art, Design and Medicine

Imagine a surgeon that has the ability to improve existing medical equipment and the creativity and skill set to invent new tools and develop new procedures. Imagine the impact that this doctor will make to the medical field.

The first project "Lights, Camera, Surgery!". It involved filming, editing, and producing high quality videos of surgeries (with patient consent) at the BC Children's Hospital. These videos were subsequently used to create an educational video archive available to medical students and residents for learning purposes [2].

In 2012, the project took on a new form with the fitting name of "TEACH". This project focused on the education of patients and families within the Department of Pediatric Surgery at the BC Children's Hospital. A variety of procedures and topics were selected for the development of educational resources. One procedure was the creation of an ostomy which involved dividing the intestines and connecting one end to an opening in the abdominal wall where the intestinal contents can drain into a bag. To help children with ostomies understand the procedure, function and anatomy, a series of toys were created as educational resources. A plush toy in the form

of a bear with an abdominal flap demonstrated the anatomy and surgical procedure. In addition, the plush toy intended to teach children how to properly take care of their ostomies [2].

As an extension of prior research, "Integrating Industrial Design and Cardiac Surgery" is composed of five projects, each exploring different methods of integrating industrial design and cardiac surgery with a focus on toy design.

Mini Project List:

1. Organami
2. Sternotomy Bear
3. Doctors Against Tragedies
4. MEDCRAFT
5. Junior Edition

Integrating Industrial Design and Cardiac Surgery

Since the research involves integrating two different fields, it is important to establish a fundamental understanding of both areas to bridge the gap effectively between them. To start, "What is Industrial Design?"

Industrial Design emerged as a professional practice in the early 19th century; however, it has been in existence since man used a rock as a tool. The definition of industrial design is always evolving. Charles Eames, who is deemed as one of the most important American designers of the 20th century, defined design as "A plan for arranging elements in such a way as best to accomplish a particular purpose" [3]. Although design is often considered as a tangible product, it is important to remember that design can take the form of a system or concept. It does not have to be seen nor held.

From the tangible to the intangible, industrial design is an immense field. To narrow the research topic, one area of design was selected for its playful use of creativity and innovation – toy design. Why toy design? Because, children learn through play [4]. Although the main purpose of toys is entertainment, they can also be used as powerful teaching tools. In addition, toys help to stimulate imagination and creativity [4].

The challenge that this research faces is how to create a toy that is both fun and educational.

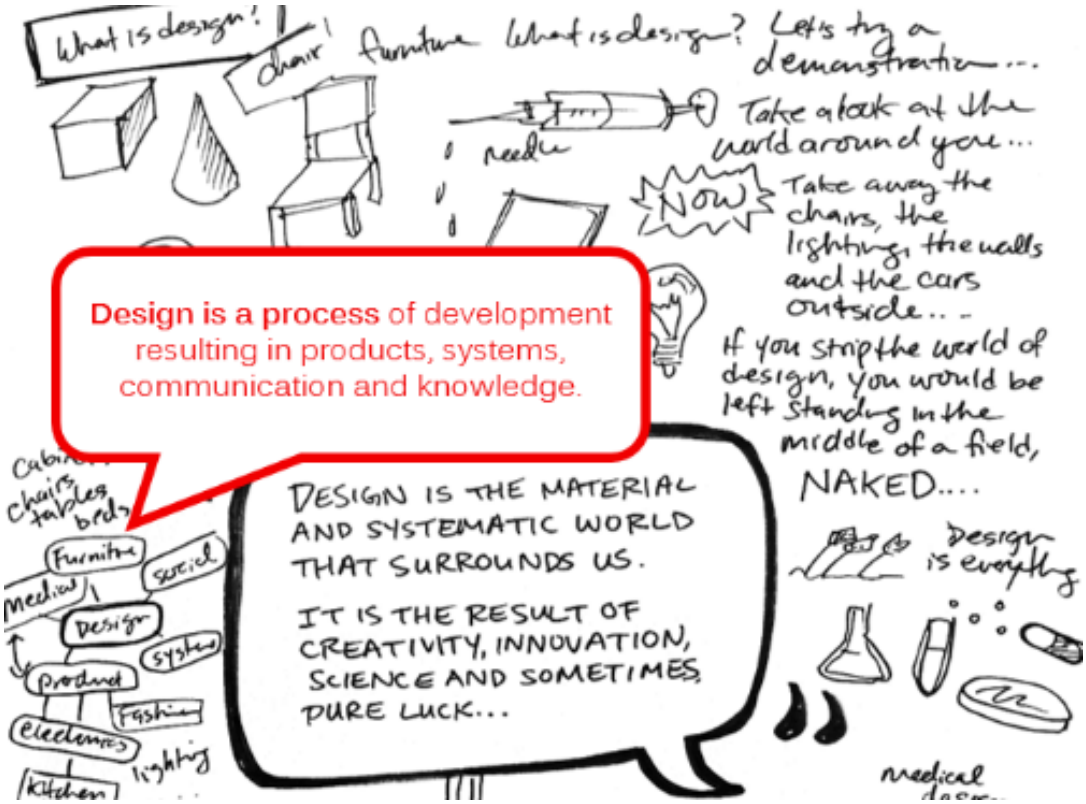


Figure 1: Defining 'Design'

Cardiac Surgery

Often confused with cardiology, cardiac surgery is the field of medicine that involves surgical treatment of the heart and great vessels. The era of cardiac surgery is said to have started with a stab wound to the heart which was first successfully repaired by Ludwig Rehn of Frankfurt in 1896 [5].

Since the development of the heart-lung machine in 1953 by Dr. John Gibbons, the field of cardiac surgery has rapidly progressed. The heart-lung machine made "open heart" surgery and the repair of intracardiac lesions possible [6].

Traditionally, cardiac surgery involved a "full sternotomy" where access to the heart is gained from dividing the entire sternum in half. Although some procedures still require a full sternotomy, such as coronary artery bypass graft surgery (CABG), other procedures are becoming "minimally invasive". Aortic valves are often replaced through a mini-sternotomy, where only half of the sternum is divided. Most recently, through a non-invasive procedure called "transcatheter aortic valve implantation", also known as TAVI, the

aortic valve can be replaced without any division of the sternum. Instead, a new valve is implanted through accessing the femoral artery [6].

From minimally invasive to robotic heart surgery, cardiac surgery is on the forefront of medical innovation.

Research Question

Although each mini-project has its own set of objectives, the main question addressed by the research is:

> *How can toy design and cardiac surgery be integrated to create educational resources for the purpose of teaching cardiac health?*

The research presented focuses on the industrial design process used to solve the main research question and address the list of objectives. It does not involve the formal gathering of data to investigate the effectiveness or impact of the design solution. Instead, the research explores the methodology for answering the design question and the steps used to formulate the solution.

Although there are multiple modalities of learning as discussed later, the research focuses primarily on play [7]. Out of all the different learning theories, play was selected because it offers opportunities for engagement and interaction. In addition, play can be used to initiate a conversation and build relationships, which is highly important in the medical field [4].

To note, the research is not an evaluation of the different learning theories. The focus of the research is to explore the industrial design process.

Research Methodologies

This research involves applying the industrial design process to address various issues within cardiac surgery, while using knowledge from cardiac surgery to design solutions to the problems.

The industrial design process generally starts with identifying a problem. For each project, an individual problem was identified in the context of the main research question. After the problem was identified, the following steps were taken:

- Problem analysis
- Target audience research
- Creative thinking (brainstorming)
- Background research on current solutions to the design problem
- Critical review of brainstormed ideas
- Design development of the selected concept
- Focus group testing
- Design analysis and evaluation
- Redesign and finalization
- Value of project (personal reflection)

The same design process was used for each mini-project. The first project is used as a model to elaborate on each step. For the other mini-projects, only highlights are provided.

Assumptions and Limitations

The research focuses on the industrial design process used to create a series of cardiac surgery educational toys. It does not explore any statistical results of the effectiveness of the educational resources.

No official data was collected from prototype sessions. Informal feedback was gathered to aid the design process.

Further studies will need to be conducted to determine the statistical significance and efficacy of each project listed in the research.

Project 1: Organami

Identifying, Analyzing and Understanding the Problem

In medicine, communication can often be a challenge. From language barriers to delirium, providing medical information or gathering consent can be difficult. If possible, translators can be provided or next of kin can be contacted. For pediatric medicine, communication is even more challenging as the patient's level of development, language, understanding and maturity are all compounding factors.

Unfortunately, with pediatric patients, "patient" education is often directed at the parents or guardians. There are many explanations why children are excluded from their own health education, including: not enough time, inexperience of the physician, child perceived as 'too young' to understand, child not interested in their health, parents interrupting or speaking for the child and many more [8].

Most studies about doctor-parent-child communication focus predominantly on the dyadic interactions between the physician and parent rather than the physician and child [9]. After reviewing the literature and finding the predominance of the triad of doctor-parent-child relationship turning into a dyad of just the doctor and parent, the main purpose of this mini-project focused on creating a way to encourage physicians and parents to involve the child in important educational conversations.

The Design Problem:

To design creative educational resources for pediatric cardiac surgery patients that encourage participation of the child.

Project Objectives

1. To create educational toys that will teach children about cardiac health. For example, these educational toys will teach basic cardiac anatomy, introduce medical terminology, discuss the importance of cardiac health and encourage a cardiac healthy lifestyle.
2. To promote cardiac health amongst the pediatric population. By introducing the importance of cardiac health at an early age, the long-term goal is to decrease the incidence of cardiac disease amongst the adult population in the future.
3. To enhance the doctor-parent-child relationship.
4. Integrate art, design and medicine.

Target Audience Research

In Alberta, the pediatric population typically covers children up to the age of 16 [10]. For the purpose of this mini-project, the target audience was divided into 3 groups based on grade school level:

1. Kindergarten to Grade 3 (ages 5 to 8)
2. Grade 4 to 6 (ages 9 to 12)
3. Grade 7 (age 13) and above

Since the research involves creating educational resources, background research in how the target audience learns was conducted.

According to the VARK model described by Flemmnig and Mills, there are four modalities of learning: Visual, Auditory, Read and Write, and Kinesthetic [11].

1. Visual: videos, illustrations, diagrams
2. Auditory: verbal instructions, discussion, audiobooks
3. Read and Write (Tactile): notetaking, drawing
4. Kinesthetic: hands-on activities, prefer to act rather than watch or listen

It is important to recognize that not everyone learns in the same way. For most adults, their method of learning is a different combination or ratio of the four modalities. Children on the other hand, may not be able to read or write depending on their age or level of development. Psychologist, Jean Piaget, breaks down the learning process of infants and young children into four stages of child development [12]:

1. Sensorimotor stage (birth to 2 years old): Infants build an understanding about themselves and their environment through senses and manipulation of objects. Knowledge is based on physical interactions and experiences.
2. Preoperational stage (ages 2 to 7): During this stage, children begin to develop language, memory and imagination develop. They require concrete simple examples because more complex concepts are difficult to grasp. Their actions are typically egocentric and intuitive, but not logical.
3. Concrete operations (ages 7 to 11): Children begin to think abstractly and can conceptualize ideas. Their thinking becomes less egocentric with increased awareness of surrounding environment and external events.
4. Formal operations (adolescence to adulthood): Cognition reaches its final form. Adolescent is capable of deductive and hypothetical reasoning and use logic to solve problems.

During the design process, it is important to take into consideration the different modalities of learning to enhance knowledge translation. However, it is equally important to consider other components, such as enjoyment and excitement, that captures the user's interest.

Learning Through Play

It is well known that children learn through play. Play teaches children about different interactions and relationships between both the environment and others [7]. Through play, children learn and explore the concepts of physics, the foundations of math, the consistency of paint, right versus wrong and how 'fair' the world is. They develop problem solving skills, interpersonal skills, negotiation techniques and so on. Play, although sometimes viewed as a waste of time, is essential.

Although they are often seen as sources of entertainment, toys are also tools. They help children learn about themselves, others and the world around them. Some toys may not be purposely designed as a learning tool, but they aid in the development of both gross and fine motor skills that are essential to growth and development [13]. The challenge is to make the toy fun, exciting and educational at the same time.

What's Hot in the Toy World

Research was conducted into the popular trends of toys, cartoons and games through online searches, social media, commercials, toy stores and asking the target audience directly. The top toys, games and cartoons of 2016 include [14] [15]:

Top Toys: Hatchimals, Star Wars, Tsum Tsum, Torch My Blazin Dragon, Think and Learn Code-a-Pillar, Lego

Top Games: Minecraft, Pie Face Show Down, Speak Out, Pokemon

Top Cartoons: Amazing World of Gumball, Steven Universe, The Loud House, Rick and Morty, Adventure Time

By developing a sense of what each target audience found interesting, the different trends can be used as inspiration during the design process. Researching the target audience is highly important because it is the target audience that will be using the end design and not the designer.

Brainstorming

To note, research of current solutions to the problem was avoided until after the brainstorming session to create an unbiased perspective. The brainstorming phase involved unrestricted creative thinking. Mind mapping techniques which involved word associations and visually organizing ideas with circles and lines, were used to develop topics and inspire ideas. To note, no ideas were eliminated during the brainstorming process.

Current Solutions

After researching the target audience and brainstorming ideas, further research was conducted into current solutions to the design problem. Examples of existing pediatric cardiac surgery educational resources included colouring books and brochures which were more geared towards the overall hospital experience rather than cardiac surgery. In a few pediatric cardiac clinics at the Mazankowski Alberta Heart Institute, plastic heart models were available to use as resources; however, these models are expensive and not easily adapted to teach about the different cardiac pathologies or congenital heart defects.

"I Heart Guts" is a collection of stuffed organs including the heart, lungs, kidney, pancreas and more. Created by illustrator Wendy Lazar, these toys are simplistic representation of organs and are more for entertainment than education [16].

Another popular medically-inspired line of toys and comic books is the "Awkward Yeti". It is designed for humor and entertainment rather than education [17].

Various educational programs directed at children, such as the D.A.R.E Program (Drug Awareness Resistance Education Program) and "Do Bugs Need Drugs" were used as references of successful health promotion programs [18].

Critical Review of Brainstormed Ideas

After researching current and similar solutions to the design problem, the list and sketches of ideas created during the brainstorming process were reviewed. Ideas that were impractical, financially unfeasible or non-sustainable were eliminated. Next, ideas that did not fit in the time constraints of the mini project were also rejected. The remaining ideas were critically reviewed. In the end, one idea "Organami", was selected to pursue based on sustainability and cost analysis.

Design Development

The selected design concept was a heart model used to teach children about their cardiac anatomy. Most anatomical heart models available in stores or for purchase online range between $50 to hundreds of dollars depending on size and detail. In addition, few models existed that demonstrated different congenital heart defects. After learning about the cost and inaccessibility to anatomically accurate heart models, the goal of the mini-project became the development of low cost, anatomically correct model that could easily be adapted to show different diseases or congenital heart defects.

Research was conducted into different materials and production methods, from 3D printing to plush stuffed hearts. Unfortunately, after performing a cost analysis, the majority of the materials were too expensive to pursue. The one material that was low cost, accessible and easy to work with was paper.

Inspiration was gathered from paper-based crafts. Origami, the Japanese art of folding paper into three-dimensional objects such as animals, was explored. The design development task became: How to turn a piece of

paper into a three dimensional anatomically correct representation of the heart. The key was easy reproducibility.

The prototype design process started with creating a simple two-dimensional representation of a heart for preschool to Grade 3 children. Pencil sketches were created followed by black ink and coloured with pencil crayons. After completion, the drawing was scanned and combined with text using Adobe Illustrator.

The final design was a locket where the outside showed the surface anatomy of the heart including the coronary arteries, muscle and fat. The inside of the heart featured the atrium, ventricles and valves.

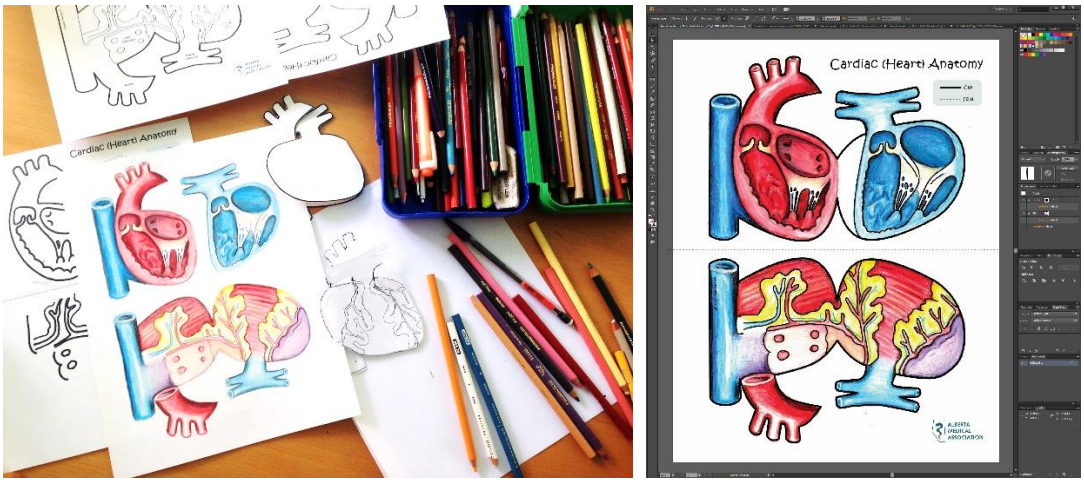


Figure 2: Photographs of two-dimensional heart model design process, from drawing board to Adobe Illustrator.

The next stage of the prototype making design-process was to create a three-dimensional heart model. The first attempt involved creating a computer-aided design file of a geometric heart using Rhinoceros 3D rendering software. The surfaces of each side were traced, and the heart was virtually 'unrolled' to create a two-dimensional blue print. Unfortunately, this process was highly time consuming and unsuccessful.

An easier and surprisingly more efficient method of converting a flat piece of paper into a three-dimensional heart was trial and error. Sketch model after sketch model was cut, folded and glued until the design started to take form. Textbooks including *Gray's Anatomy* and the *Colour Atlas of Anatomy* were used as references [19] [20].

After finalizing the structure, the blue print was traced, scanned and modified in Adobe Illustrator software to include folding, cutting and gluing lines. A simple set of instructions was created to be included with the design.

To highlight the origami inspiration, these heart models were called “Organami”.

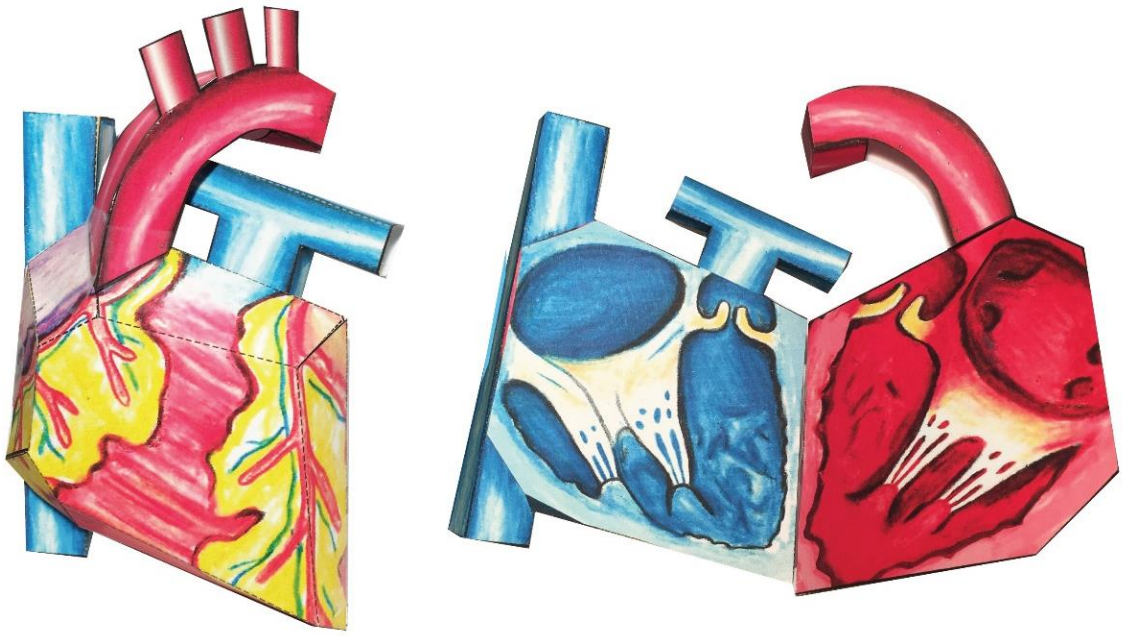


Figure 3: Photograph of 3D Organami Heart that opens like a locket.
Next two pages: Printable Organami Heart activity sheets available at www.artoflearning.ca

Don't forget to cut these **thick** solid lines
This tab glues on to the back of the left atrium, near the pulmonary veins
Don't fold this tab, glue pulmonary artery here.
organami - right heart
designed by Michiko Maruyama, www.artoflearning.ca
Cut
Fold
ALBERTA MEDICAL ASSOCIATION
ASSOCIATION MÉDICALE CANADIENNE
CANADIAN MEDICAL ASSOCIATION

organami - left heart
designed by Michiko Maruyama, www.artoflearning.ca
Cut
Fold
top of aporta
Glue these tabs around the side of the aorta to create a tube like structure.
Assemble the aorta and glue it to the right atrium using this tab.
aorta side
right atrium
aorta side
Assemble the aorta and glue it to the right atrium using this tab.

Focus Group Testing

A series of prototype testing were carried out between March to June 2017 (to note, no information was collected for data analysis). The prototyping sessions were an opportunity to see how the target audience interacts with the design and to ask questions about how the design could be improved. For example, challenging areas, such as the great vessels, were simplified to make cutting easier and the instructions were made clearer, as many children jumped to cutting out the heart before folding and gluing.

The motor skills involved in cutting along a dotted line varied significantly, especially amongst kindergarten to Grade 3. All children were able to complete the two-dimensional heart model with minimal help from an adult. A surprising observation was that the complex three-dimensional heart model, that was intended for Grades 7 and above, also tested well with Grades 4 to 6. Although the children in the Grades 4 to 6 age group required more help from the adult volunteers, they were still able to complete their own three-dimensional paper heart model.

The main event, where the heart model educational resources were introduced to the target audience, was held on July 31 to August 3 and August 14 to 18, 2017 during the University of Alberta's "Rockin Doc" camp.

Before each workshop, the design was reviewed with a team of medical student volunteers. Expectations of what the children should learn through interacting with each toy was discussed. During the event, the volunteers walked around the room, helped the children with cutting if needed and asked questions to gather their level of understanding and what they learned.

Design Analysis and Evaluation

Multiple prototype testing sessions were held which involved having children create and interact with the Organami heart models. Feedback and comments were informally gathered through direct conversation while the children were creating and playing with the educational resources. These comments and feedback were used to further improve the design during the various stages of the design process.

There were approximately 200 children in the target group. This is an accumulative number throughout the multiple prototype testing sessions. Indirectly, the educational resources have reached many more children in Edmonton by handing out copies to Child Life Services, on the ward and during the clinic. In addition, parents and children around the world can

access the resources for free through the Art of Learning website (www.artoflearning.ca).

From intuitive design, the ease of assembly and the general appeal were observed. In addition to observation, volunteers were able to sit down with the children and interact through playing with their new heart models. They asked questions to develop an understanding of the knowledge translation that occurred from the making and playing with the heart models. For example: what structure is this, which way does the blood flow, Overall, the Organami mini research project was a great success. We received significant positive feedback from the target group as well as interest from the media, including Global News, Edmonton Journal, Metro newspaper and CTV.

The results of the project showed that toys can be used as creative educational resources to teach children about cardiac health and various topics in pediatric cardiac surgery. Not only did the children enjoy making and playing with the toys, they displayed a further understanding and knowledge in the area.

Workshop Photographs

Figure 4: Rockin Docs Organami Workshop, 2017

Value of Project (Personal Reflection)

The “Organami” mini project targets the topic of cardiac anatomy and cardiovascular health in the pediatric population. Why is this important? As a physician, I believe that a basic understanding of cardiac anatomy will greatly help a patient’s understanding of their cardiovascular health. Also, when it comes to complex congenital anatomy, having a model that patients can see, hold and use to ask questions helps with discussion and treatment planning. Through my general observations, I have discovered that children are often intrigued and curious about their anatomy.

Another reason why it is important to start educating children about cardiovascular health and living a cardiac-healthy lifestyle is because cardiovascular disease is on the rise. Many health education programs have been created to educate the adult population on cardiovascular disease and how to live a cardiac-healthy lifestyle; however, few programs have been targeted to educate the pediatric population.

Although the target audience for “Organami” is elementary school children, it can also be used as an educational resource and teaching tool for learners of all ages and even adult patients. The “Organami” models were used in several teaching sessions for medical students and nursing students. It provided a low cost, three-dimensional model for students to review anatomy. Different versions of the models were made available, including full coloured, labelled and blank. The blank models allowed students to test their own knowledge or add further detail.

Project 2: Sternotomy Bear

The Problem

The mini project, Organami, inspired the development of several additional educational resources for pediatric cardiac surgery patients. Other areas of pediatric cardiac surgery were explored. An area that required new and updated educational resources was the peri-operative surgery experience. This included before surgery (clinics and work-up), surgery (what the procedure entails) and post-operative recovery.

Project Objectives

1. To create educational toys that teach children various cardiac surgery terminology.
2. To familiarize the patient with the perioperative experience.
3. To teach children proper sternal wound care and sternal precautions.
4. To enhance the doctor-parent-child relationship and communication.
5. To create educational resources for siblings and other family members.
6. To develop cost efficient and sustainable educational resources.

Design Solution

After following the same design process described above, a solution to this new design problem was reached. The solution involved designing a paper "doll" in the form of a teddy bear. A teddy bear was selected to keep with the theme of the Stollery Children's Hospital Bear. Prior to pursuing the design further, the Alberta Health Services marketing division was contacted in terms of gather permission to use the bear mascot. Unfortunately, in order to use the bear logo, it could not be altered in any way, such as making the bear stand versus sit. Since the position of the bear was important in the context of the design, it was decided that the design solution would look similar but would not be the actual Stollery bear logo. This solution was acceptable to the Stollery Hospital and also allowed for the creation of different accessories.

The Sternotomy Bear has two flaps that divide the sternum and chest in half. When the flaps are opened, the heart is exposed. The division of the sternum is called a midline sternotomy. At the bottom of the sternotomy bear sheet, there is a little "Mini Book of Hearts" that provides a brief

description of the function of the heart and basic vocabulary. Future plans include creating a series of “Mini-Books” that children can collect at clinic visits and during their hospital stay, adding more to their knowledge and growing their vocabulary.

The Sterntomy Bear comes with an additional two sheets of accessories. One sheet of accessories includes a patient gown, medication, a heart healthy diet, a telemetry monitor, sternal wound dressings and “get well soon” balloons. Although they seem trivial, these accessories serve an important function other than fun and entertainment while recovering on the ward. The sternal wound dressings can be used to teach children about proper wound care. The telemetry monitor is to show that the patient will be connected to several ‘machines’ following their surgery. The heart healthy diet is to promote a cardiac healthy lifestyle at an early age and the medications are to normalize the idea of “taking pills”. One of the challenges facing pediatric cardiac surgeons is non-compliance during adolescence and teenage years. By demonstrating the importance of taking medications at an early age, the goal is to work towards patient compliance in the future.

The second sheet of accessories is a “Cardiac Surgeon” kit. The sternotomy bear can be turned into a cardiac surgeon using the scrubs, gloves, mask, anatomy charts, notepad and medications. These accessories were designed to reduce the fear of doctors or “White Coat Syndrome”. It is also used to help turn the surgeon into a positive role model.

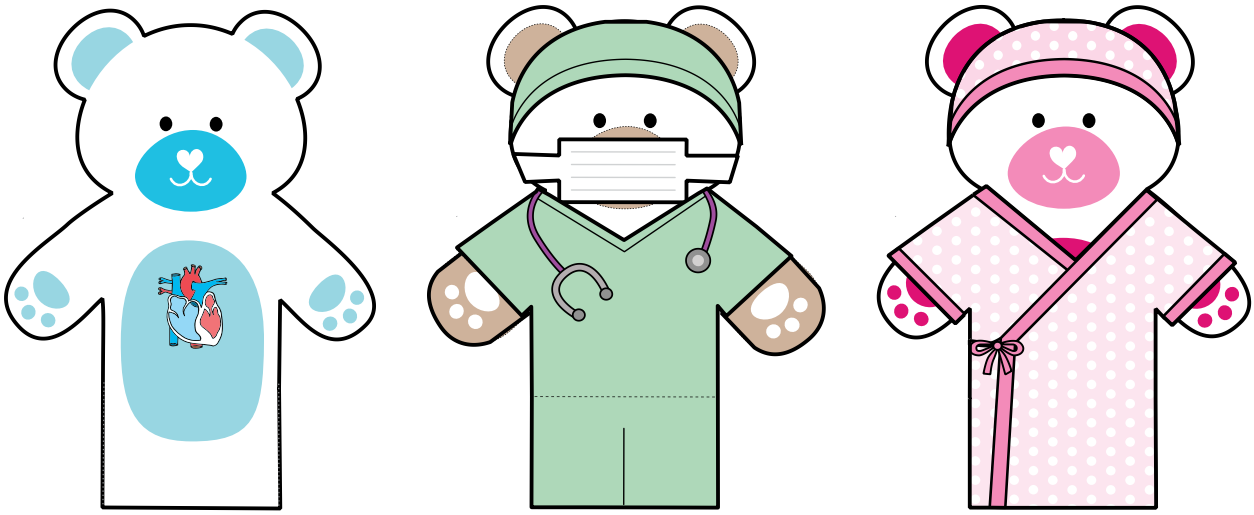


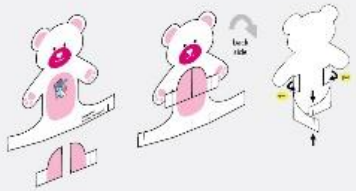
Figure 5: Sternotomy Bear and accessories
Next three pages: Printable Sternotomy Bear Activity sheets available at www.artoflearning.ca

Sternotomy Bear

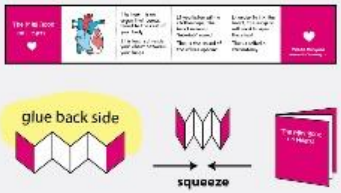
Zeddy needs open heart surgery through a midline sternotomy.

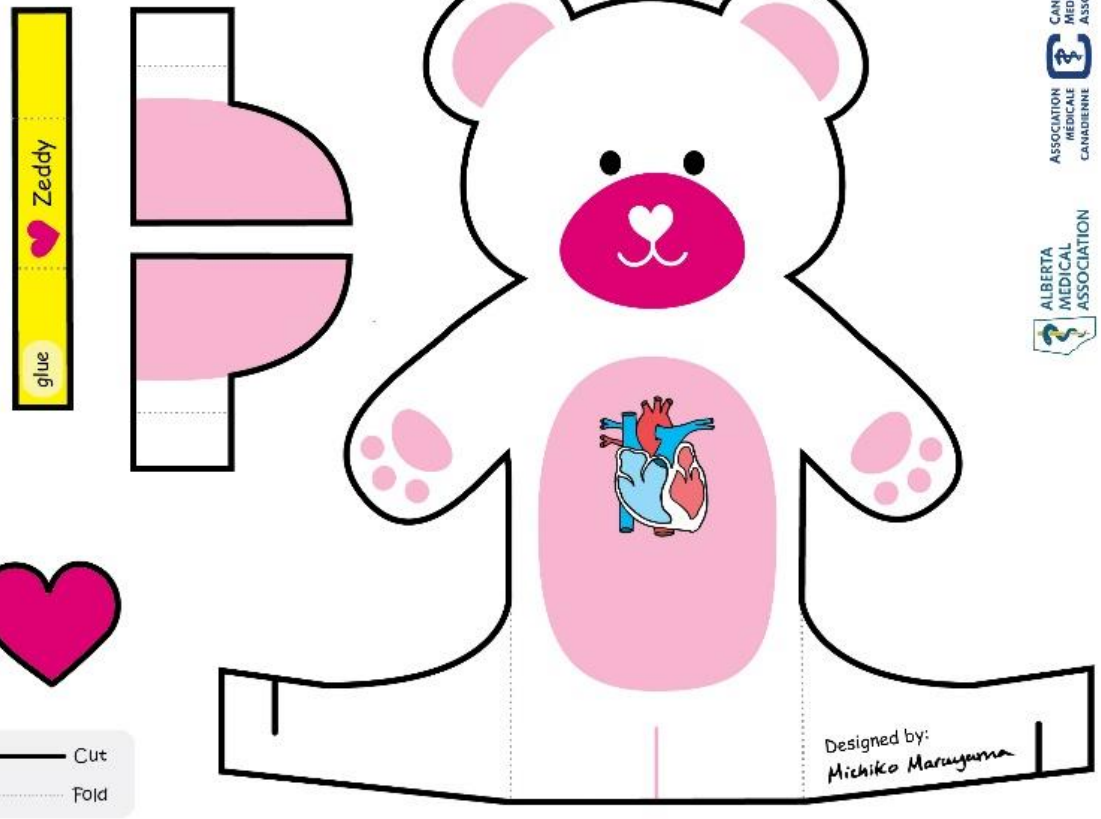
Instructions:

Cut out all the pieces along the solid black lines. Place Zeddy's chest piece ontop of his heart and fold the tabs around. Glue the tabs to Zeddy's back-side. Fold along the dotted lines and slide the two slots together so Zeddy stands up on his own.

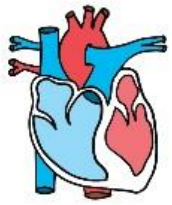


Fold along the dotted lines, back and forth, like an fan. Place glue on the back and squeeze together to make a book.





The Mini Book on Hearts



The heart is an organ that pumps blood to the rest of your body.

It is located inside your chest between your lungs.

If you listen with a stethoscope, the heart makes a "lub-dub" sound.

This is the sound of the valves opening.

In order to fix the heart, the surgeon will need to open the chest.

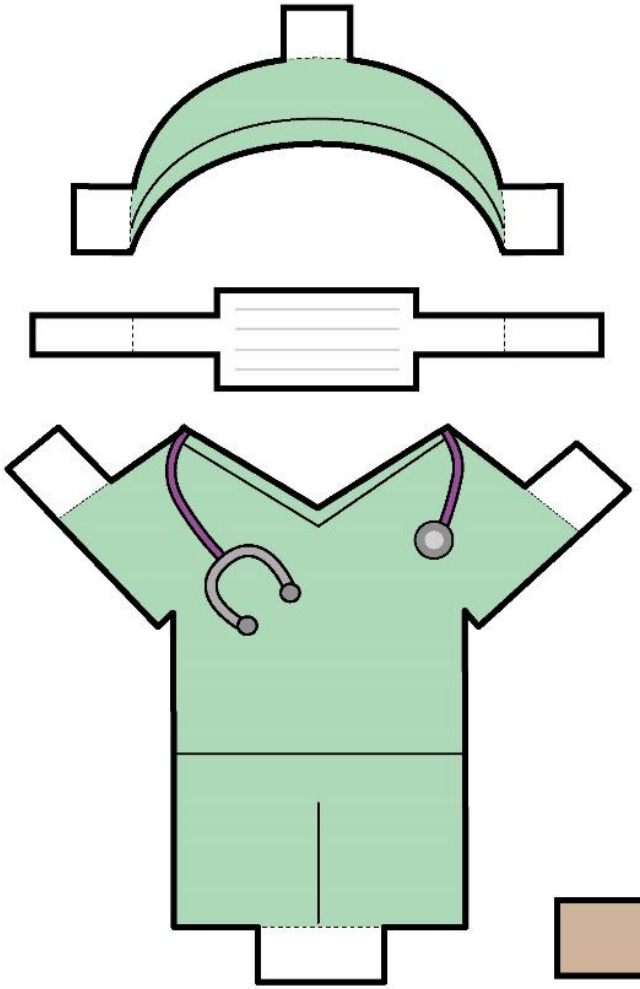
This is called a **sternotomy**.

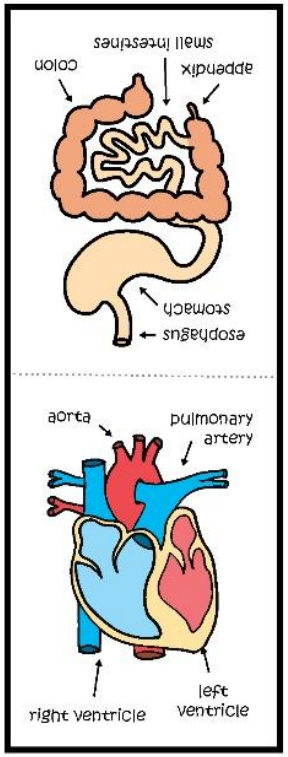
Michiko Maruyama
www.artoflearning.ca


Sternotomy Doll
Here are some accessories for Zeddy!
A hospital gown, bandages, medicine, balloons and some healthy food!
Cut, fold and glue the pieces together.
You will need scissors and glue.
Designed by:
Michiko Maruyama
Cut
Fold
cap
bandages
Gown
120/80 98% 90
heart monitor (ECG)
heart pillow
Food
Get Well Soon!
balloons
medicine
glue
glue
ALBERTA MEDICAL ASSOCIATION
ASSOCIATION MÉDICALE CANADIENNE
CANADIAN MEDICAL ASSOCIATION

Cardiac Surgeon

Dr. Zeddy is a cardiac surgeon.
Cut, fold and glue the pieces together.
You will need scissors and glue.

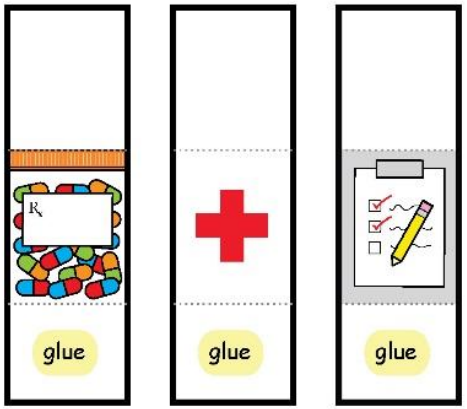


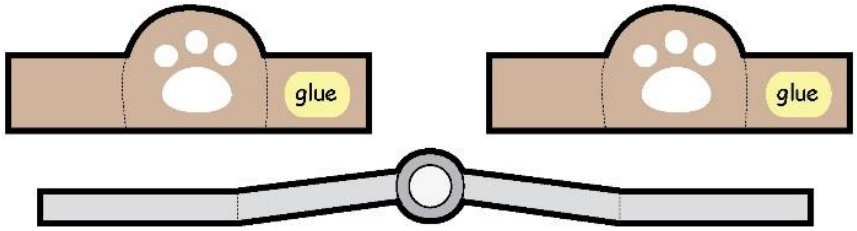


Cut
Fold

ALBERTA MEDICAL ASSOCIATION

ASSOCIATION MÉDICALE CANADIENNE
CANADIAN MEDICAL ASSOCIATION





Designed by:
Michiko Maruyama
www.artoflearning.ca

Design Analysis and Evaluation

The Sternotomy Bear and its accessories were analyzed and evaluated in the same method as the Organami mini project. The Sternotomy Bear underwent several informal prototype testing sessions and it was also showcased at the Rockin' Docs Camp.

The project received very positive feedback from both cardiac surgery pediatric patients as well as elementary children not undergoing heart surgery. The children found heart surgery fascinating and playing with the sternotomy bear stimulated many discussions and questions.

Workshop Photographs

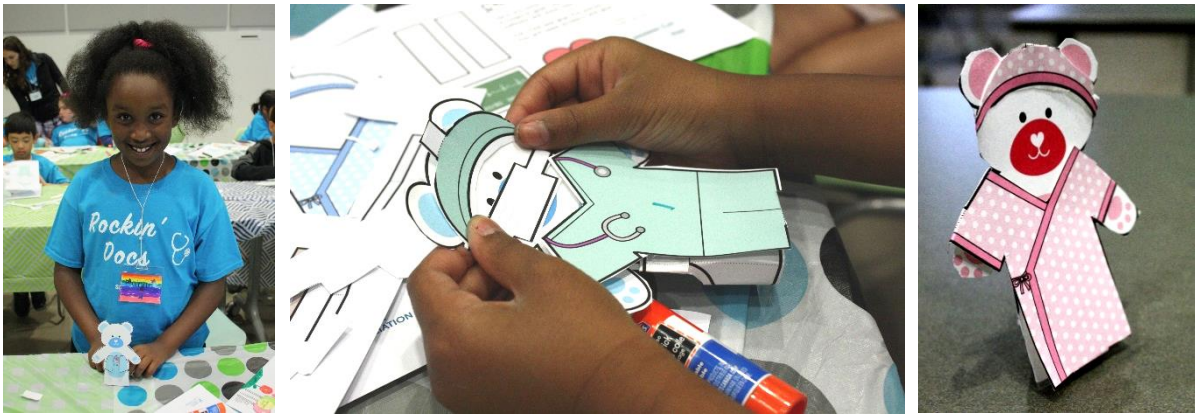


Figure 6: Rockin Docs Sternotomy Bear Workshop, 2017

Value of the Sternotomy Bear (Personal Reflection)

As a resident in cardiac surgery, it was rewarding to see how much the children learned through playing with the sternotomy bear. It was also fascinating to listen to their questions – "Why do you use a sternotomy? Can't you access the heart through the belly rather than going through the bone?"

The sternotomy bear has significant potential as an educational resource in cardiac surgery. The concept also has potential for application in other medical and surgical fields. The design can be easily adapted to show other surgical anatomy, such as the gastrostomy bear [2].

Project 3: Doctors Against Tragedies

Anecdote

"As a resident doctor in cardiac surgery, I participate in both heart and lung transplants. The process of harvesting organs is always an emotional experience, but one of the most difficult cases I have seen was the harvesting of organs from a young teenager who died as a result of fentanyl overdose. As health care workers, nothing can prepare us for a tragedy such as this. I cannot describe how emotionally challenging it is to harvest the organs of a perfectly healthy child who died from one mistake, a death that should not have occurred, a death that was preventable. As members of the transplant team, we have witnessed many tragic losses like this case and sadly, the number continues to rise." – *Dr. Michiko Maruyama*

Introduction: The Fentanyl Crisis

Fentanyl is a powerful synthetic pain medication similar to morphine, but it is 50 to 100 times more potent. It is classified as an opioid, a group of medications that act on pain receptors in the peripheral and central nervous systems as well as the gastrointestinal tract. Fentanyl is used in the management of chronic pain, including cancer pain, as well as an adjunct to general anesthesia. It comes in a variety of forms, including: lozenge, lollipop, spray, dissolving strip, tablet, patch or as an injectable solution. Fentanyl has multiple side effects. The most serious adverse reactions include respiratory distress, loss of consciousness, seizures and death [21].

Unfortunately, fentanyl is being misused for recreational purposes. The majority of "street fentanyl" is produced in China, exported to Canada and distributed and sold across the country by drug dealers [22]. Since fentanyl is cheap to produce, drug dealers are adding it to other street drugs to increase potency and to create addiction. Since the dose of the fentanyl is unknown, there has been a rapid increase in overdoses costing thousands of lives.

Many locations across North America have declared a state of public health emergency due to this "Fentanyl Crisis." As a result of the increasing mortality of young individuals, there has been a call for action to initiate social change in order to stop the Fentanyl Crisis.

In response to the call for action, a group of physicians at the University of Alberta teamed together to develop a unique fentanyl awareness campaign. Background research was conducted on the current fentanyl awareness

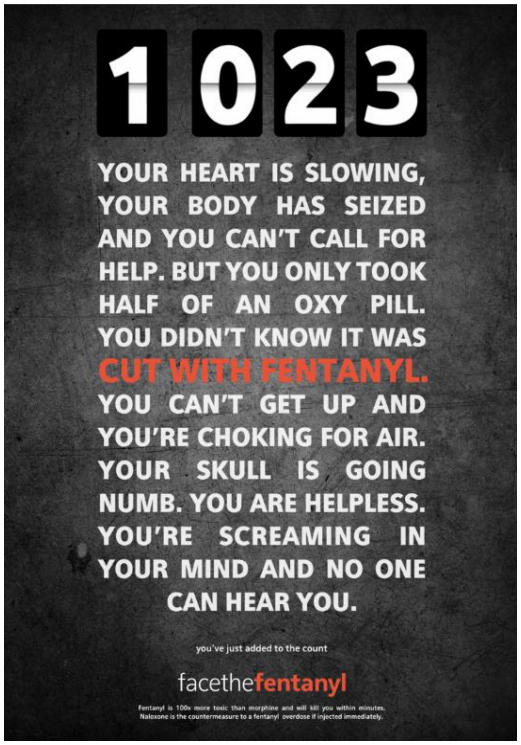
campaigns in order to analyze the different approaches and to develop a sense of what strategies have already been attempted.

Battling the Fentanyl Crisis: Fentanyl Awareness Campaigns

Initial background research revealed that the majority of fentanyl awareness campaigns rely on fear tactics. Images of dead bodies, morgues and family members crying are used repetitively as visuals to abstain from fentanyl use. According to an article released by Public Safety Canada, this "fear tactic" is found to be ineffective compared to educating the target audience and providing the tools to make informed decisions. In addition, it may also have damaging effects [23]. Physicians are already noticing the development of a culture of fear over the use of fentanyl and other opioids in hospital settings. Noticing the hesitation and negative associations from patients, many health care professionals feel it is important to discuss both the negative as well as the positive aspects of fentanyl use.

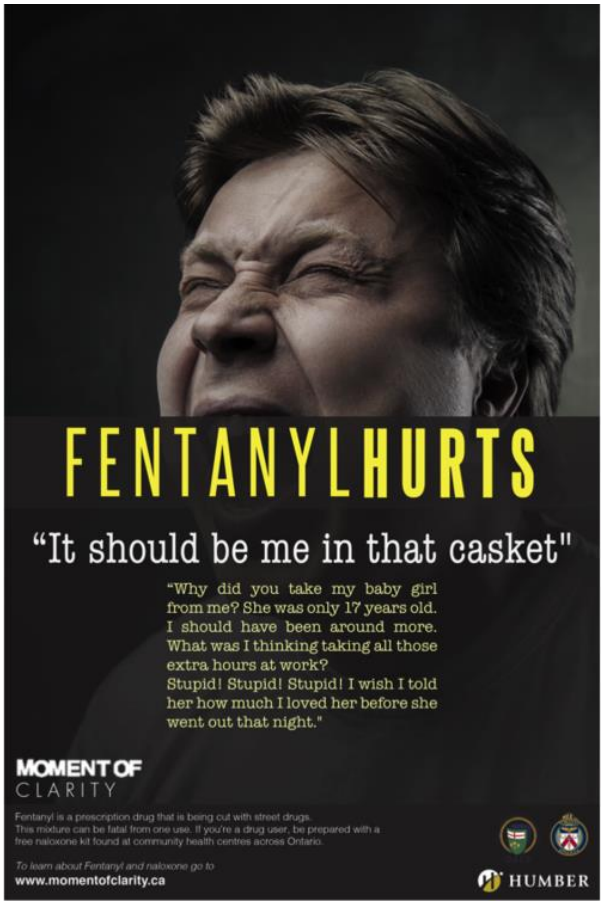
Figure 7: Above and below – Examples of current Fentanyl Awareness Campaigns

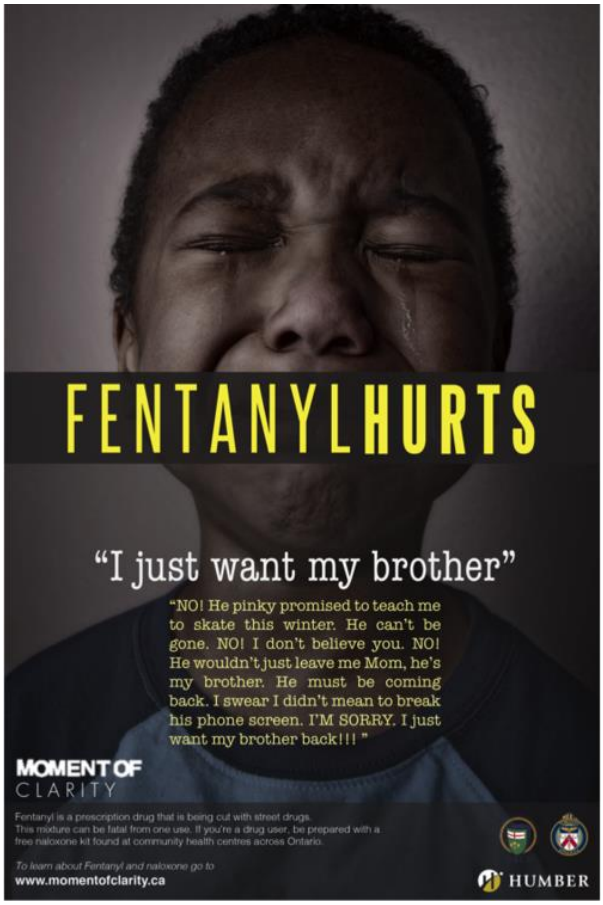

facethefentanyl
when fentanyl is cut into drugs you can't
SEE, SMELL
OR TASTE IT
[fen-tuh-nil]
a synthetic, short-acting narcotic analgesic and sedative
unless counteracted with naloxone
fentanyl will kill you in
MINUTES
577
fentanyl related deaths
in Ontario since 2010


1023
YOUR HEART IS SLOWING, YOUR BODY HAS SEIZED AND YOU CAN'T CALL FOR HELP. BUT YOU ONLY TOOK HALF OF AN OXY PILL. YOU DIDN'T KNOW IT WAS CUT WITH FENTANYL. YOU CAN'T GET UP AND YOU'RE CHOKING FOR AIR. YOUR SKULL IS GOING NUMB. YOU ARE HELPLESS. YOU'RE SCREAMING IN YOUR MIND AND NO ONE CAN HEAR YOU.
you've just added to the count
facethefentanyl
Fentanyl is 100x more toxic than morphine and will kill you within minutes. Naloxone is the countermeasure to a fentanyl overdose if injected immediately.


Fentanyl
"Russian Roulette in the worst degree."
street drug user
WARNING
street drugs kill


A recipe for disaster.
Fentanyl
$C_{22}H_{28}N_2O$
WARNING
street drugs kill


FENTANYLHURTS
"It should be me in that casket"
"Why did you take my baby girl from me? She was only 17 years old. I should have been around more. What was I thinking taking all those extra hours at work?
Stupid! Stupid! Stupid! I wish I told her how much I loved her before she went out that night."
MOMENT OF CLARITY
Fentanyl is a prescription drug that is being cut with street drugs. This mixture can be fatal from one use. If you're a drug user, be prepared with a free naloxone kit found at community health centres across Ontario.
To learn about Fentanyl and naloxone go to
www.momentofclarity.ca
HUMBER


FENTANYLHURTS
"I just want my brother"
"NO! He pinky promised to teach me to skate this winter. He can't be gone. NO! I don't believe you. NO! He wouldn't just leave me Mom, he's my brother. He must be coming back. I swear I didn't mean to break his phone screen. I'M SORRY. I just want my brother back!!! "
MOMENT OF CLARITY
Fentanyl is a prescription drug that is being cut with street drugs. This mixture can be fatal from one use. If you're a drug user, be prepared with a free naloxone kit found at community health centres across Ontario.
To learn about Fentanyl and naloxone go to
www.momentofclarity.ca
HUMBER

Project Objectives

1. To develop a creative social awareness campaign about fentanyl use targeted at Edmonton elementary, high school and university students.
2. To educate the target group about both the negative and positives of fentanyl use.
3. To create a social competency promotion campaign that includes resistance-skills training. This involves integrating cognitive behavioral training methods such as feedback, reinforcement, and behavioral rehearsal into the design of the educational games.
4. To teach the target group how to recognize fentanyl overdose and how to properly manage until medical personnel arrive. This includes educating the target group about the naloxone kit and how to administer the drug.

The Target Audience

The target group includes individuals ranging from age 12 to 25, including middle school, high school and university students as well as individuals who are not enrolled in the educational system. The primary target group includes adolescence and young adults who are at high risk of becoming recreational drug users.

A great deal of research effort has been devoted to understanding the etiology of drug use during the teenage years. Numerous factors have been implicated in the initiation and maintenance of adolescent drug use including parent drug use, perceived adult drug use, peer use, poor grades in school, poor relationship with parents, low self esteem, depression, and psychological distress, unconventionality and tolerance for deviance, sensation seeking and the desire for novel and unusual experiences, low sense of social responsibility, a lack of religious commitment, a lack of purpose in life, disruptive life events, and early use of alcohol [24].

Design Methodology

Traditional campaigning methods includes massive bill-boards, online ads, posters and pamphlets. Unfortunately, these methods can be very expensive. Since funding is limited, a different campaigning strategy was used, called "guerrilla campaigning." This strategy involves interacting directly with members of the target group [25]. In addition to the low cost, interacting directly with the target audience allows team members to openly discuss the topic of fentanyl use, answer any questions and create lasting memories versus reading a static billboard or poster.

The research started with brainstorming ideas about different ways to engage the target audience. In addition, further research was conducted based on the target audience's likes and dislikes. One game that was popular with the target audience is "Cards Against Humanity", which is known for its dark humor. As described on its website "Cards Against Humanity is a party game for horrible people. Unlike most of the party games you've played before, Cards Against Humanity is as despicable and awkward as you and your friends" [26].

Initially, the fentanyl awareness team wanted to create a series of online modules or information pamphlets. However, as a designer, I strongly felt that a different approach was required because at-risk youth would not want to sit through an online module or read an information pamphlet. Instead, we needed something edgy to catch their attention.

My idea was to create an edgy, yet educational game based on Cards Against Humanity called "Doctors Against Tragedies" (DAT). Prior to proceeding any further with my idea, I contacted the makers of Cards Against Humanity through email and we received their written permission to proceed with our idea. To note, Cards Against Humanity is open source and the creators welcome others to modify and distribute different versions of their game. Cards Against Humanity is distributed under a Creative Commons BY-NC-SA 2.0 license which means "You can use and remix the game for free, but you can't sell it without our (CAH) permission" [26].

DAT plays like Cards Against Humanity, where "each round, one player asks a question from a black card, and everyone else answers with their funniest white card" [26]. The winner is the person who wins the most rounds.

After proposing my DAT idea to the team, a few physicians were uncomfortable with the coarse language and decided to leave the group. The four remaining team members who subsequently became the DAT Team Leaders, included: Dr. Michiko Maruyama, Dr. Cheryl Mack, Dr. Vivian Ip and Dr. Ferrante Gragasin.

Trivia Version

The trivia version of Doctors Against Tragedies included peer reviewed questions in the form of true or false, multiple choice and short answers. The questions are designed to teach fentanyl facts, the methods of resuscitation and the plan of action should someone be suspected of fentanyl overdose. Also included were facts about addiction and dependence, as well as treatment options for addiction. The initial prototypes of the game underwent focus group testing to determine level of difficulty, knowledge translation and enjoyment.

The Trivia Version is for ages 12 and older based on level of reading and there is no use of inappropriate language. It is designed to be used in schools and to be distributed in coffeeshops and restaurants around Edmonton.

Figure 8: Doctors Against Tragedies Trivia Version
Free downloadable copies available at www.doctorsagainsttragedies.com

Peer-Reviewed Questions

For the trivia version of Doctors Against Tragedies, the team created approximately seventy-five multiple choice, true or false and short answer questions. These questions were reviewed by over two hundred physicians Canada-wide. We also reached out to members of the target audience to review the "playability" of the game. This involved distributing downloadable prototypes of the game and collecting feedback. The feedback collected was not for the purpose of data analysis. We received feedback from pain specialists, palliative care, addiction medicine specialists, Fentanyl Crisis team members, family physicians and members of the target audience.

The Horrible Version

The "Horrible Version" is played similar to Cards Against Humanity. Black cards contain a question or statement and white cards are used to answer the black cards. The person who peed last goes first by reading a black card out loud and collecting, face down, all the white cards. The person who read out the black card chooses the 'best' answer and whoever submitted it, gets to keep the black card. Whoever gets 5 black cards first wins.

Figure 9: An example of one round of the Horrible Version

There are five different categories of white cards: Facts, Resources, Risk Factors, Social Change and Filler Cards. Every card in the deck can be organized into one or more of these categories.

THE FACTS: Facts about fentanyl and opioids are written in red text.

Figure 10: A collection of different Fact Cards

RESOURCE CARDS: Information about what to do in the event of a drug overdose, contact information for Addiction Helpline and other resources in Alberta (below).

Figure 11: An example of some Resource Cards. The text in red can be changed to provide phone numbers or website addresses for a given location

RISK FACTOR CARDS: Highlight risk factors for recreational drug use.

Figure 12: An example of a few Risk Factor Cards

SOCIAL CHANGE: These cards *poke fun* at the culture surrounding recreational drug use.

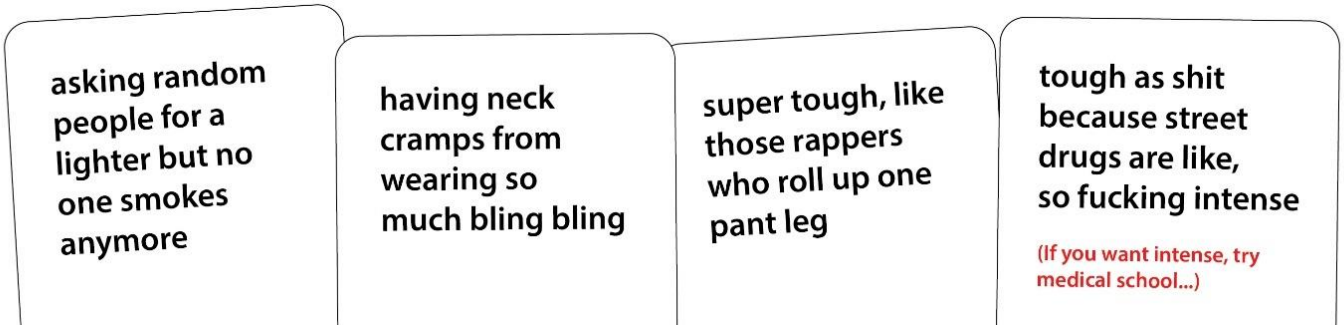


Figure 13: A sample of a few Social Change cards.

FILLER CARDS: These cards have nothing to do with fentanyl, opioids or drugs. The main purpose of filler cards is to make the game more fun and provide variety or shock value.

Professionalism

When we first introduced the concept of Doctors Against Tragedies to other physicians, there was some concern expressed regarding the coarse language and that it may be seen as 'unprofessional'; however, we argue that our design uses a user-centered-design approach which is similar to patient-centered-care. In fact, an act of unprofessionalism would be to use medical terminology and jargon that the user would not understand. We emphasize that we are not designing a fentanyl awareness campaign directed towards physicians or healthcare workers. Instead, we are designing a campaign for at risk youth and young adults. We selected our language to resonate with our target audience. One of the reasons why social awareness campaigns are not successful is because the people who are creating the campaigns are designing it for themselves and not the target audience.

Since the concern regarding language was expressed, we created the Trivia Version which does not contain any coarse language and is suitable for public setting use, such as hospitals or schools.

Prototypes and Initial Testing

Both versions underwent several prototype testing sessions with high school, university students and at-risk-youth. The Trivia version underwent additional testing with elementary school children. Feedback showed that the horrible version of the game is both fun and serves as a knowledge translation tool to the target population. The game was well received and considered a positive approach to fentanyl education and did not rely on scare tactics. Constructive feedback included rephrasing some of the questions for ease of readability purposes and including non-educational game cards (filler cards) to make the game more dynamic.

For the Trivia Version, the level of difficulty was considered appropriate with a good variety of both easy and challenging questions. In addition, the detailed answers were appreciated as they provided an explanation and additional information which added to the education of the users. Not surprisingly, the trivia version tested horribly with the target audience. Youth at risk had no interest or will to play a 'game' that resembled writing a test.

As part of the initial testing phase, we asked the users, "What did you learn?" Here are some of their responses:

- "Fentanyl is 50-100 times more powerful than morphine"
- "Fentanyl is cheap and being laced into other drugs"
- "Fentanyl can come in the form of lollipop"
- "When to use recovery position"
- "Constipation is a side effect of opioids"
- "I never really knew what opioids were until now"
- "Naloxone can be used for fentanyl overdose"
- "Difference between addiction and dependence"
- "A small amount can cause an overdose"
- "Fentanyl is used in the hospital"
- "Fentanyl is an opioid"
- "It is called 'green apples', 'China White' and has other names"

DAT Website Launch

The Doctors Against Tragedies website was launched on January 12, 2018. The website includes information about DAT, biographies of team leaders, online resources, upcoming events, free game downloads and contact information. The website acts as a supplementary source of information as well as a method to distribute electronic copies of the game.

Figure 14: Website Launch Announcement

Workshops

The first Doctors Against Tragedies workshop was held during the University of Alberta's International Week on January 30 and 31, 2018. The workshop took place in a high traffic hallway in the Student's Union Building. It involved an information booth with four tables where volunteers sat down and played the game with students. The workshop was well received, and many students signed up to become members of the DAT Team and participate in future workshops.

Figure 15: Doctors Against Tragedies Team photo at the University of Alberta International Week Workshop

Doctors Against Tragedies Team

Since its launch in January 2018, Doctors Against Tragedies has become more than just a card game. It is now a team of physicians, medical students, university students and community members who have come together to address the fentanyl crisis.

We now have over 150 volunteers in Edmonton and we are building DAT Teams in cities across Canada. Our games are being used across the world and it has been adapted for different cultures and is currently being translated to different languages. We are also starting to create games for other topics, such as sexual health, online safety, physician wellness, infectious diseases and many more.

Word on the Street

Since its launch in January of 2018, DAT has been featured on the news, radio, social media and online forums which has helped spread the word about who we are and what we are doing.

A collection of comments and feedback:

"Entertaining yet dreadfully educational" – Reddit User

"We wish you the best of luck. Sounds like you're doing a really great thing to keep kids from a really dumb drug" – Cards Against Humanity

> *DAT – "Thank you Cards Against Humanity. It is certainly a terrible drug when used inappropriately."*

"Thank you for taking the time to develop an educational tool around such an important, life-threatening issue." – Dr Zoë Ayling, Emergency Physician, BC

"I have respect for their creativity, but I know what teenagers are like and this is a terrible idea!" – Anonymous Facebook User

> *DAT – "If it saves one life, it is worth it. There is a trivia version if you are uncomfortable by the one inspired by Cards Against Humanity.*

"The actual cards are perfect, these docs understand addiction and humour!" – Facebook User

"Just wondering who would buy this – people who are already aware of the dangers probably wouldn't and druggies can't afford it or don't care to." – Facebook User

> *DAT – "Our games are completely free. Click here to download your own copy! Printed versions of the game will also be made available in pubs, cafes, restaurants, etc. People who are already aware of the dangers of fentanyl will kick a$$ in the Trivia*

version, plus, there are a variety of easy and challenging cards to pay. Also, we don't make assumptions about the 'druggies' nor do we use that label. People who use recreational drugs might get a kick out of our games too. Plus, there's lots of people who don't know about fentanyl and who don't use recreational drugs, but they might get exposed to it along the way. Regardless, it's worth a shot to save a life."

"Brilliant!" – Facebook User

"The opioid epidemic has become a global crisis. People are dying of overdoses daily and Canada has also seen their share of these tragic deaths due to Fentanyl laced drugs. Unfortunately, many people are still unaware of the dangers of taking illicit opiates. Many young adults are exposed to recreational use of opioids, including heroin or they might have been prescribed for legitimate pain. We often treat Canadian patients who have become addicted to opioids. Many were unaware of what they are really taking and often see the dangerous results of these powerful opioids. It has always been challenging to educate adolescents in a way that they will understand, without simply scaring them. It's great that these Alberta physicians have come up with an alternative method for educating their young citizens. Let's continue to find new and innovative ways of spreading awareness to decrease future overdoses." – Comment from The Fix

Funding

Doctors Against Tragedies (DAT) is completely non-profit. It relies on volunteers to keep the campaign going and since its launch in January of 2018, the number of volunteers continues to grow. DAT started in Edmonton, but it has now spread across Canada, the United States, New Zealand, Australia and Ireland.

To help offset the costs of printing decks for free distribution, DAT has received grants from the Alberta Medical Association and the Canadian Medical Association in the form of an "Emerging Leaders in Health Promotion Grant" from the Alberta Medical Association and the Canadian Medical Association to help pay for prototypes and website. In addition, DAT has received funding from the Edmonton Community Foundation Grant to produce more public decks, volunteer t-shirts and to cover costs of workshops.

To make the DAT initiative sustainable, we have created electronic versions of all our games and educational resources. In the event we are not able to find additional funding, all the resources will be available online for free download.

Significance of Doctors Against Tragedies (Personal Reflection)

Doctors Against Tragedies started as an idea for a campaign that I created for my Master of Design thesis work to address the question, “What can we do, as physicians and health care workers, about the fentanyl crisis?”. It has now developed into a Canada-Wide, multi-national effort to address not only the fentanyl crisis but also, many other topics concerning public health. I never imagined it would become this big.

Since the research focuses on the industrial design process of taking an idea and turning it into reality rather than the impact it created, it is difficult to quantify the significance of Doctors Against Tragedies. Informally, through surveys, facebook comments, instragram, twitter, emails and more, we have received excellent feedback on the games we have created. We continuously have people signing up to volunteer and new ideas for other public health topics, such as sexual health, social media safety, infectious diseases and much more.

I absolutely love volunteering for DAT workshops. I enjoy interacting with people one-on-one, answering questions and providing further resources. It is amazing to see how a game can become an icebreaker to encourage people to talk about subjects that are “taboo” or generally uncomfortable to talk about. We even created a version of the game to address opioid addiction amongst doctors.

We have incorporated Doctors Against Tragedies into academic half days to encourage residents as well as attending physicians to get out of the hospital and become involved in the community. It is also an opportunity for mentorship between staff, residents, medical students and pre-meds and to connect healthcare workers, community volunteers and the general public.

Project 4: MEDCRAFT

Project Objectives

1. Develop a creative social awareness campaign on fentanyl use targeted to preschool and elementary school children.
2. Address other areas of general safety, including smoking, alcohol, bullying, internet safety, etc.
3. Create a social competency campaign that includes resistance-skills training.
4. Emphasize the importance of positive role models.
5. Provide workshops and presentations about various health topics around the city.
6. Continue to build our multidisciplinary team of passionate and dedicated people.

Background Research

Initial background research using social media and informal target audience surveying revealed that one of the most popular games among elementary school aged children is Minecraft, a pixelated computer game based on building environments with blocks.

From Minecraft to MEDCRAFT

To catch the attention of the target audience, a series of educational resources inspired by Minecraft were created. Prior to moving forward with the design process, research was conducted to ensure that our design solution would not infringe on Minecraft copyright laws or intellectual property. An effort was made to contact Minecraft directly to discuss the research project; however, after corresponding through several emails, we were referred to the official Minecraft website for further information. The website states that Minecraft is licensed under creative commons terms allowing others to remix, transform, and build upon their material [27]. One condition is that profit cannot be made from selling of any rendition or material that built upon their material. To note, the purpose of the research is for educational purposes only and no profit will be made. Given this, the research follows Minecraft's creative common terms.

To harness the popularity power of Minecraft, the team leaders were turned into pixelated "MEDCRAFT" characters. Other role models, including a police officer, nurse and teacher, were turned into pixelated characters. In addition, a blank character template that children can use to turn

themselves into a MEDCRAFT character was also created to make the game more engaging and interactive.

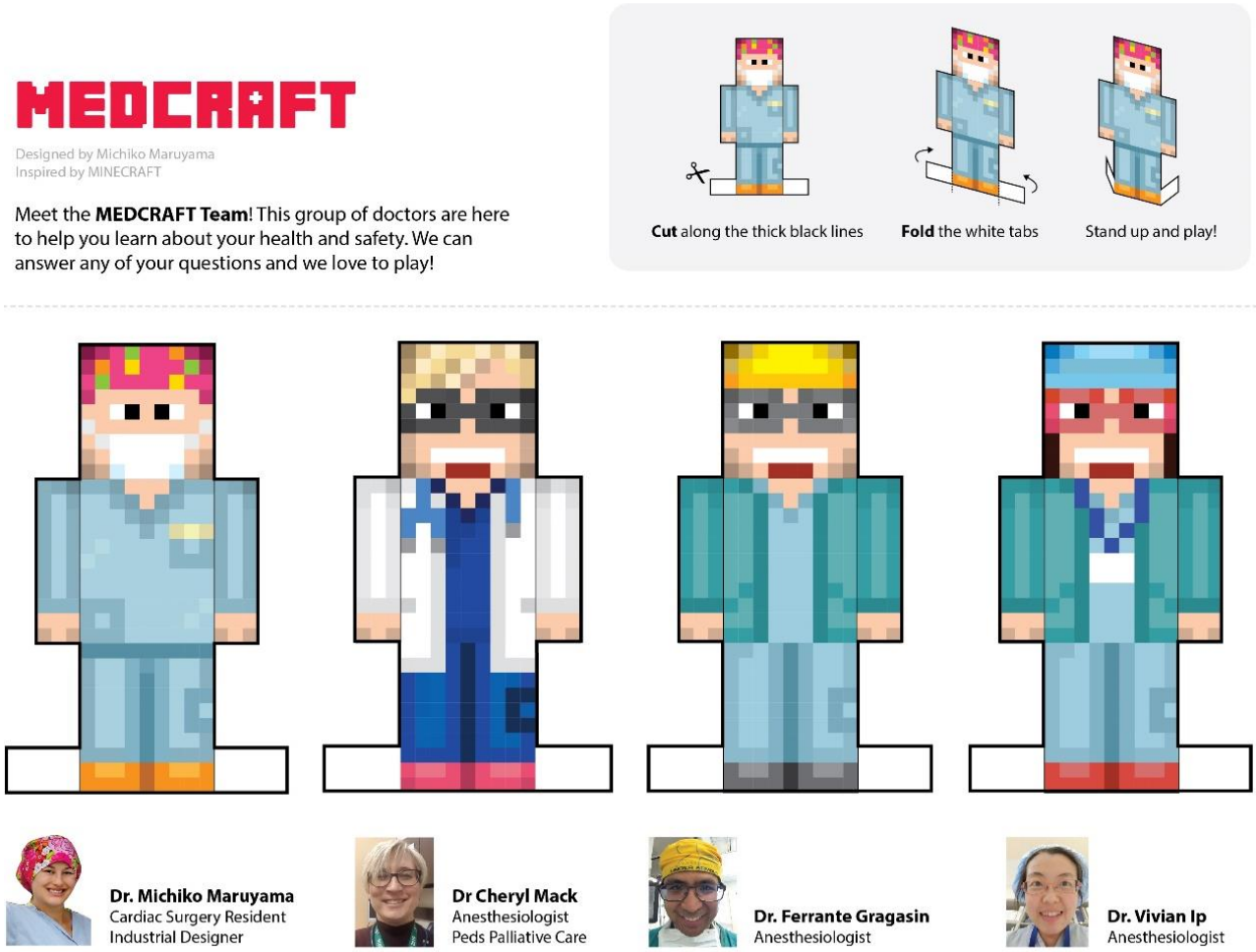


Figure 16: MEDCRAFT Team Leader Characters

More than Just a Game

In addition to creating toys and games available for free download on our website, the MEDCRAFT team plan to host workshops and presentations across the city. During these workshops, members of the team will play the MEDCRAFT games with the children. Through playing games, the children will have the opportunity to ask questions in a safe and fun learning environment. This interaction is important for establishing trust with doctors, nurses, police officers, etc, which is key to developing long-term healthy relationships. To increase the hype and excitement, the team want

to build cardboard pixelated mascots of the MEDCRAFT characters for event rallies and work-shops.

Since pre-school to elementary spans a large range of ages, we have created multiple versions of the toys, games and colouring books depending on reading level and manual dexterity (the majority of the games involve assembling the toys out of paper using scissors and glue).

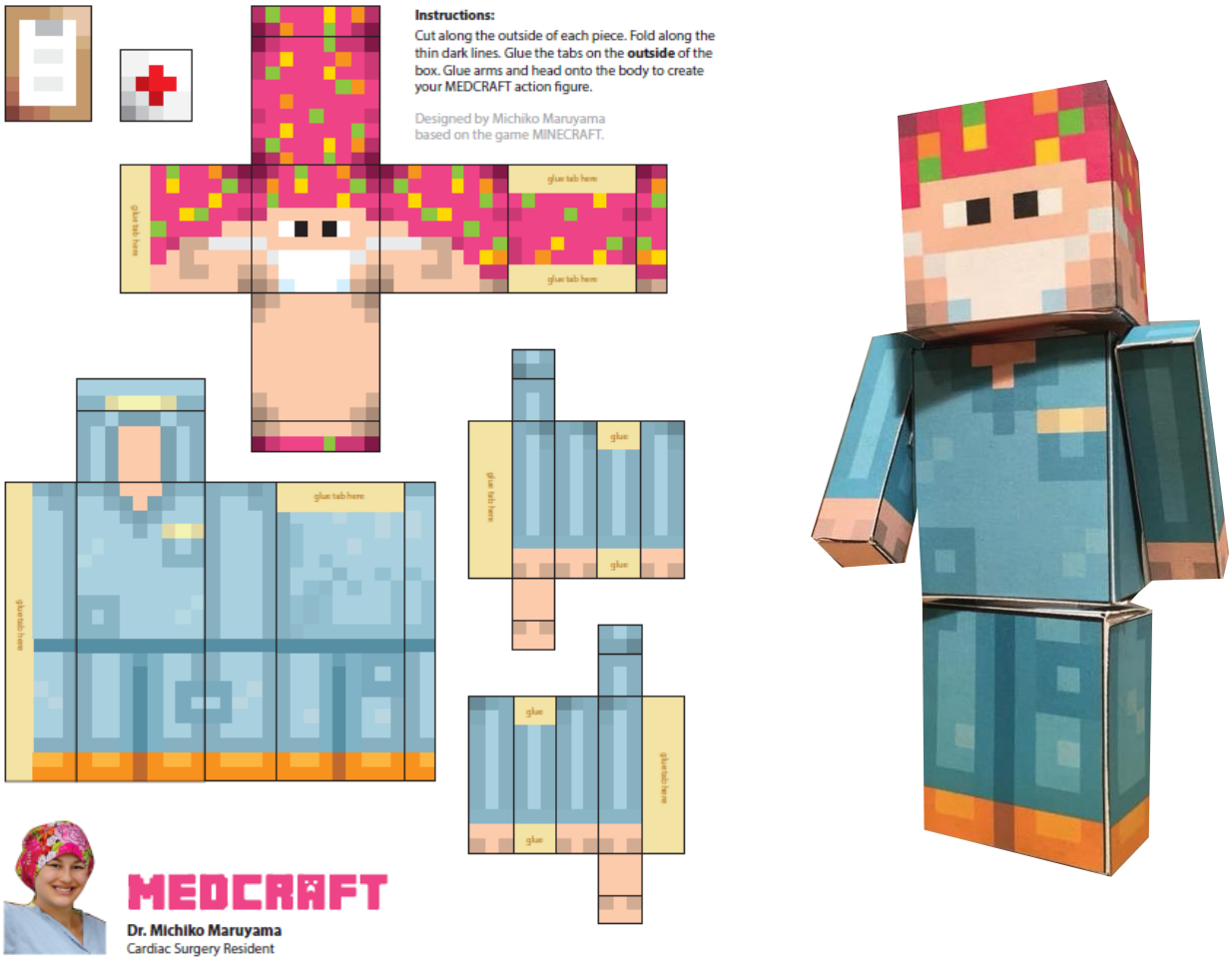


Figure 17: Turning myself into a 3D MEDCRAFT character

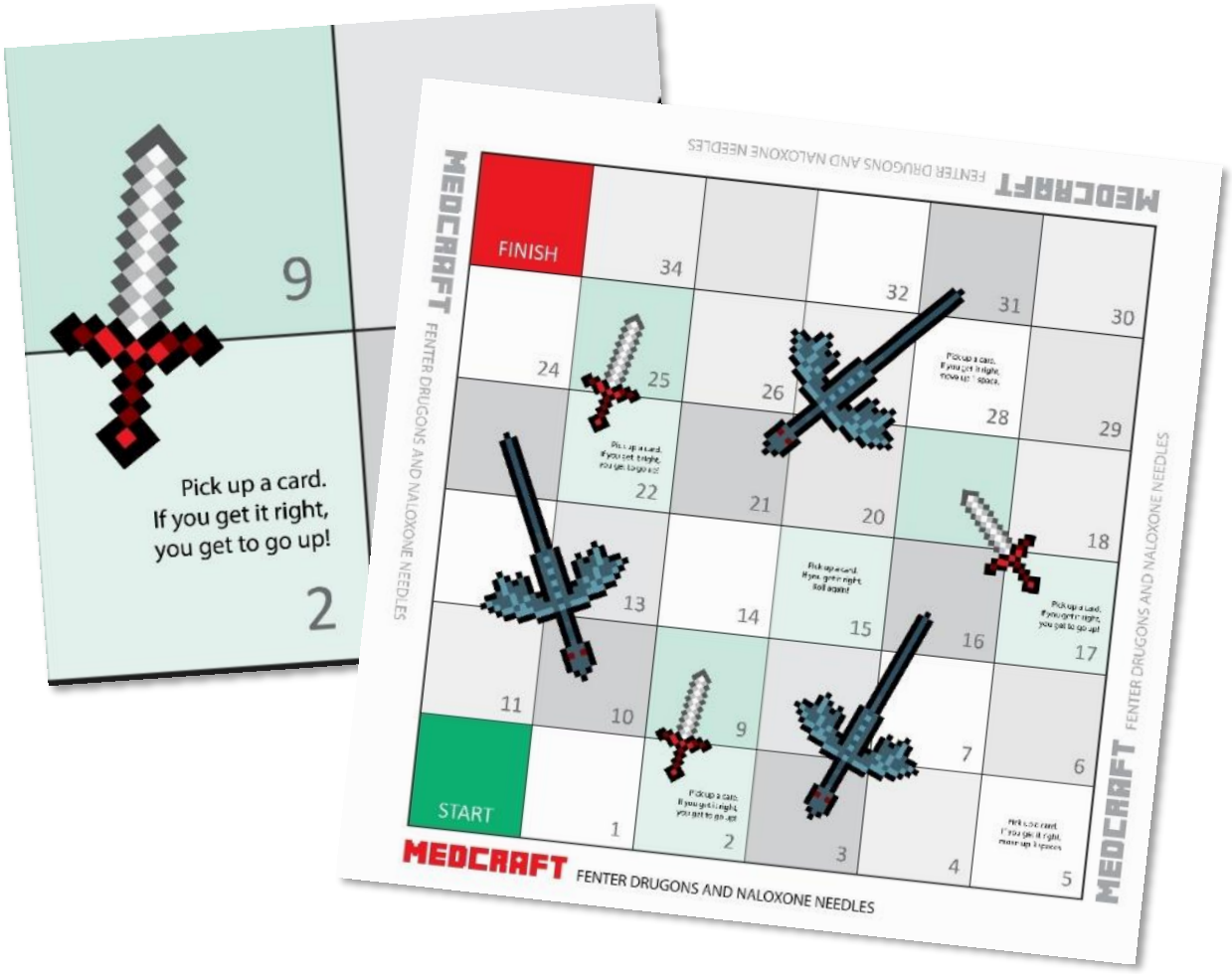


Figure 18: MEDCRAFT game board “Naloxone Swords and Fenter Dragons”

Team You!

An important concept of our toys is “Team You”, a sheet of blank characters where the child forms a team of their own positive role models, such as parents, guardians, siblings, friends, professional athletes, etc. Each member of Team You is someone who encourages, supports or inspires the child. By establishing their role models, children will learn to develop a positive support system. We also have ‘negative’ characters, such as a drug dealer and the Fenter Dragon (a mock of the Minecraft arch enemy, Enter Dragon). Through story-based games and colouring books, these pixelated characters will be used to teach children about safety, drug awareness, bullying and various medical topics, such as mental health, vaccinations, nutrition, etc.

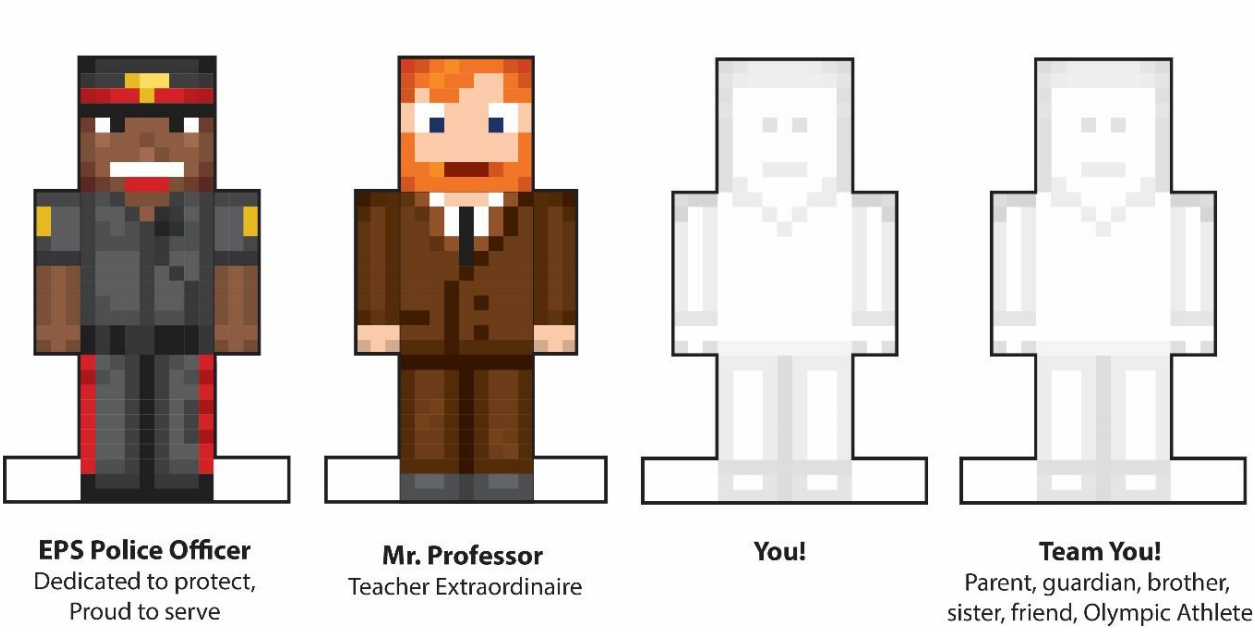


Figure 19: Examples of Team You! And Team You blank sheets

MEDCRAFT Launch

Figure 20: Photograph of MEDCRAFT Launch at a local elementary school

MEDCRAFT was launched in the summer of 2018. Although it was a success and the elementary school children enjoyed the workshops, the majority of the hand made game boards that were constructed out of foamboard did not survive and were not able to be used for future workshops.

Summary of Project

MEDCRAFT is a creative medical education tool and social awareness initiative geared towards pre-school and elementary school children. MEDCRAFT is dedicated to early safety training, drug awareness and medical education through creativity, innovation and fun. We believe that early initiatives will provide children with the tools and resources to make positive, safe and healthy decisions.

Although MEDCRAFT has great potential, the cost of this project is not sustainable. Each game board was handmade and unfortunately does not tolerate multiple workshops. We were unable to find a cost efficient method of creating durable game boards and game pieces. In order to pursue MEDCRAFT further, a larger source of funding is required.

Project 5: Doctors Against Tragedies Junior Edition

Introduction

Doctors Against Tragedies started as a mini-project and it has since grown into an interdisciplinary team of physicians, nurses, university students, teachers and members of the community who are dedicated to addressing the Fentanyl Crisis and other public health concerns. Feedback from the mini-project revealed that earlier methods of public education directed towards elementary school children were needed.

After the team faced several challenges with the development of MEDCRAFT, including affordability and sustainability, a new solution to the design problem was created using a similar process as the initial Doctors Against Tragedies game.

One of the first steps of the research was to recruit members of the new design team that reflected the target audience. We welcomed three children to the team, ranging from elementary to junior-high school. This "Junior Team" is an extension of the DAT team and consists of Edmonton youth, from elementary to junior high-school, who are using creativity and innovation to promote safety, health and wellness to their peers.

Project Objectives

1. Develop a creative social awareness campaign on fentanyl use targeted to Edmonton's preschool and elementary school children. This includes creating a series of age appropriate games that will teach the target group about fentanyl, other drugs, smoking, alcohol, bullying, internet safety, etc., through play.
2. Create a social competency promotion campaign that includes resistance-skills training. This involves integrating cognitive behavioral training methods such as feedback, reinforcement, and behavioral rehearsal into the design of the educational games.
3. Emphasize the importance of positive role models.
4. Provide workshops and presentations about various health topics around the city.
5. Continue to build our multidisciplinary team of passionate and dedicated people.

Why is this important?

Recently, in Alberta, 12 youths have died due to misuse of opioids, and the province is looking to create a youth-specific response to the fentanyl crisis [28]. The Doctors Against Tragedies Junior Team, is dedicated to creating a response to this crisis through creativity and innovation. Making positive choices starts with early initiatives that will provide children with the tools and resources to make positive, safe and healthy decisions.

Unlike the majority of the fentanyl and opioid awareness campaigns that target adults, we designed educational resources for children. We strongly believe that drug awareness and safety education need to start early, before it is too late. Since children learn through play, our team decided to create medical educational resources in the form of toys. Since DAT for teenagers and adults was a success, we decided to pursue a similar game, minus the coarse language.

Doctors Against Tragedies Junior Edition was designed by kids for kids, with my help as a designer to turn their ideas into reality. The predicted outcome is increased knowledge about not only opioids, but also other street drugs, general safety (such as wearing a helmet) and social media safety. We will provide children not only with knowledge about health and safety, but also the skills and tools needed to make positive decisions. DAT Junior Edition encourages children to speak with their parent or guardian first and what to do with regard to social media safety such as never giving out personal information and not to read messages from unknown senders without permission.

We have currently teamed up with an after-school program to test our resources and games and we have received positive feedback. Parents and teachers are very excited about our educational-but-fun card games!

Figure 21: Examples of Doctors Against Tragedies Junior Edition red and white cards

Figure 22: Doctors Against Tragedies Junior Edition Team Photograph

Research Reflection

The Significance of it All

As I am watching the news, I cannot help but wonder, what is the world coming to? Kids are eating Tide Pods, which are small packs of laundry detergent, as part of a horrible social media challenge. Teenagers and young adults are overdosing on fentanyl without even knowing. Doctors are committing suicide as a result of burn out. And even in todays society, inequalities based on gender and race still exist. When I hear about these events, I cannot help but wonder… What can I do? How can I change the world and make a positive impact? Where do I even begin?

I started by dividing my Master of Industrial Design thesis into several mini projects, each with the goal of integrating toy design and medicine. Why toy design? Because, children learn through play. As a toy designer, I have always been interested in the educational role of toys and their potential to create social change.

Inspired by the Japanese art of folding paper, my first mini project involved creating affordable anatomical models to help children and medical students learn about the cardiovascular system. As a medical student, I used anatomical models to help me study and understand the human body. Unfortunately, anatomical models are extremely expensive. Through the mini project, Organami, I created low cost anatomical models of the heart for both children and adults. The positive feedback I have received from these models and how they have aided in the understanding of cardiac anatomy or as a communication tool with patients is rewarding both as a designer and a physician.

I did not expect Doctors Against Tragedies, a rather edgy yet educational card game designed to address the fentanyl crisis, to take off as it did. Since it's launch this January, Doctors Against Tragedies has spread across Canada, the United States and even internationally. From starting off as a game, it has now turned into a multidisciplinary team of people, around the world, joining together to overcome not only the fentanyl crisis, but other public health concerns. As a team, we are now in the process of creating extension packs to cover other topics including social media safety, such as online challenges, sexual health, physician wellness and much more.

For each mini project, my aim was to create educational resources that are creative, inspirational, fun and free. As a designer, I believe that education should be available to everyone, which is why I made all my designs open source and available online for free download.

Future Research

"Integrating Industrial Design and Cardiac Surgery: Changing the World One Toy at a Time" explores the design process of integrating two unlikely fields. The research provided an exploration of the step by step process used to create a variety of final products all with the goal of integrating toy design and cardiac surgery.

With regard to future research topics, this research opens up the door to creating educational resources for other fields of medicine, from general surgery to infectious diseases, the potential is endless. Other topics not relating to medicine could also be explored.

In addition to creating more educational resources using toy design, an area of future research includes quantifying the impact of the designs already created. Different parameters can be set to define 'impact' such as knowledge translation, knowledge retention, harm reduction, etc. The Doctors Against Tragedies Team in Halifax is currently developing a research study to evaluate the effectiveness of the 'Horrible Version' of the card games in the community.

In Closing

My long-time mentor, Dr. Shaun Robinson, a retired surgeon and designer, always reminds me "If you can think it, you can draw it. If you can draw it, you can build it. If you build it, you will change the world." Some people might view this project as simply "toy design"; however, if we create toys that teach children valuable information, then we give them the tools and knowledge to succeed.

As an industrial designer in the field of medicine, my goal is to think differently and to create creative solutions to advance the medical field – one toy at a time.

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