

APPENDIX B: BACKGROUND RESEARCH

Introduction

The project involves designing an age-appropriate sensory item which will stimulate the senses and cognitive interests of the residents of Misericordia, a community of care for persons with mild to profound intellectual and developmental disabilities (IDD). The final product design must meet safety standards by not being a choking hazard, avoids drawing unwanted attention, and preserves the residents' sense of dignity. Background research revealed (1) basic information on intellectual and developmental disabilities; (2) safe fragrances to consume; (3) sanitation of sensory toys; (4) choking hazard safety regulations; and (5) existing products in aiding sensory stimulation for adults with IDD.

Information on intellectual and developmental disabilities

People with IDD encompass hundreds of diagnoses, including autism, cerebral palsy, and Down syndrome. There are four levels of IDD (Figure 1).

Levels of Intellectual Disability					
Level	IQ Range	Ability at Preschool Age (Birth to 6 Years)	Adaptive Skills at School Age (6 to 20 Years)	Support Required at Adult Age (21 Years and Older)	
Mild	IQ 52–69	Often presents as speech-language delay Often not diagnosed until later age Can develop social and communication skills	Some difficulty learning reading, writing, and math, but can learn up to about the 6th-grade level by late adolescence Challenges making plans and managing money Socially immature but can be expected to learn appropriate social skills Some limitation of judgment and understanding of risk—more easily manipulated by others	Needs guidance and assistance in complex tasks (such as health care and legal decisions) and during times of unusual social or economic stress Can usually achieve enough social and vocational skills for self-support	
Moderate	IQ 36–51	Poor social awareness Can profit from training in self-help Can talk or learn to communicate	With support, can progress to elementary school level in schoolwork May learn to travel alone in familiar places Social judgment and understanding limited but can learn some social and occupational skills May have successful friendships and romantic relationships	Cares for simple personal and household needs after extended guidance Needs supervision and guidance managing money, scheduling, and all but simplest daily tasks May achieve self-support by doing unskilled or semiskilled work in a supportive environment	
Severe	IQ 20–35	Able to learn some self-help skills Has limited speech skills Can say a few words	Can talk or learn to communicate about simple, everyday events and learn simple health habits Little understanding of written language, numbers, time, or money Benefits from habit training Usually successful relationships with family members and familiar others Sometimes maladaptive behavior (including self-injury)	Can develop some useful self-protection skills in controlled environments Requires support for all daily tasks but may contribute partially to self-care under complete supervision	
Profound	IQ 19 or below	May need nursing care due to limited self-care skills Extreme cognitive limitation Often sensory and/or physical impairments	Limited understanding of speech or gestures; communicates mainly nonverbally Enjoys company of well-known family and caretakers, but sensory and physical impairments often limit social activities	Often needs nursing care May have very limited participation in self-care	

Figure 1: Levels of Intellectual Disability (Source: Merck Manual)
(<https://www.merckmanuals.com/home/multimedia/table/levels-of-intellectual-disability>)

Autistic and pica behaviors are common among the residents of Misericordia.

Autism

A neurodevelopmental condition of variable severity characterized by 1) poorly developed social skills, 2) difficulty with expressive and receptive communication, and 3) the presence of restrictive and repetitive behaviors.¹⁸

Pica

Pica is one of the most common eating disorders among individuals with autistic spectrum disorder and intellectual disabilities. The illness is characterized by a pattern (more than once per month) of ingesting (eating vs mouthing) inedible materials, often rocks, rubber gloves, hair, etc. For people with intellectual disabilities, swallowing or chewing feels good and provides sensory stimulation. Sometimes they are imitating observed behavior, relieving boredom, seeking attention, or are not capable of discriminating between food and non-food due to their intellectual disability or developmental level.¹⁹

Consumable fragrances

Fragrances are a type of sensory stimulation that many people enjoy. The aromas must be pleasant, yet safe to consume should the user put the sensory toy in their mouth. Vanilla extract is well-liked and can be consumed. However, it does contain a varying concentration of alcohol, so it is important to use a small quantity. Vanilla extract is recommended for amounts found in cooking recipes or it can simply be diluted with water.²⁰

For people seeking a more natural scent, green tea leaves may be more appropriate. Green tea leaves are safe to consume by themselves, but they do contain caffeine. The caffeine likely would not be an issue as the user would have to consume excessive tea leaves to experience the effects of caffeine, whereas only a small amount would be applied to create the smell.²¹

Cocoa powder can create a scent that may also provide olfactory and gustatory stimulation. It is safe to consume in its raw unsweetened form on a daily basis. It even has potential health

¹⁸ "What is Autism," Autism Speaks. Web. <https://www.autismspeaks.org/what-autism>

¹⁹ Pagoria, N., "Pica - The Basics for Caregivers," *Advocate Health Care*, <https://www.advocatehealth.com/assets/documents/subsites/luth/downsyndrome/pica.pdf>

²⁰ Boldt, A., "What Are the Health Benefits of Vanilla Extract?," LIVESTRONG.COM, <https://www.livestrong.com/article/298410-what-are-the-health-benefits-of-vanilla-extract/>

²¹ Nishida, K., "Is it Safe to Eat Green Tea Leaves?," Japanese Green Tea Co., <https://www.japanesegreenteain.com/blogs/green-tea-and-health/is-it-safe-to-eat-green-tea-leaves>

benefits when incorporated into one's diet. However, the main concern of using cocoa powder, like utilizing green tea leaves, is the caffeine present.²²

Methods of keeping sensory toys sanitary

The sensory toy needs to have proper methods of sanitization in case the user puts the item in their mouth. In the event this does occur, various approaches can be used to clean the sensory item. For instance, boiling water is highly effective at killing all harmful organisms.²³

In addition to boiling, white vinegar can be used as a cleaner and is considered a safe method of cleansing pacifiers for babies. Vinegar is a much safer alternative to harsh cleaning products such as bleach. To properly clean a sensory toy, it can be soaked in a cup of 50/50 white vinegar and water solution and then can be rinsed afterwards.²⁴ Lastly, perhaps the simplest method of sanitizing is using soap and water. Soap and water can be used to effectively clean pacifiers. It is important to fully rinse the soap so it does not get consumed.²⁵

Choking hazard safety regulations

The Consumer Product Safety Commission indicates that if a toy can fit in a specialized cylinder container with the dimensions of 2.25 inches wide by 1.25, it is considered a choking hazard.²⁶ This standard is based upon the fully expanded size of a three-year-old's throat, but it has proven to fall short of perfectly effective.²⁷ Additionally, because the average adult throat is larger than a child's, and we are designing for adults, any verification of what is or is not a choking hazard will have to be scaled accordingly.²⁸ The FDA indicates that it is also necessary to consider the materials used and methods by which the product is manufactured so that there is no potential for accidental ingestion of harmful materials like plastics, metals, and glass.²⁹

²² Shah, M., "Cocoa Powder: Health Benefits, Nutritional Facts & Recipes," HealthifyMe, <https://www.healthifyme.com/blog/cocoa-powder/#:~:text=Yes%20you%20can%20eat%20raw,moderately%20in%20its%20raw%20form>

²³ "Boil Water Response - Information for the Public Health Professional," Department of Health, https://www.health.ny.gov/environmental/water/drinking/boilwater/response_information_public_health_professional.htm

²⁴ Fazio, E., "How to Clean and Sanitize a Pacifier 3 Ways," HGTV, <https://www.hgtv.com/lifestyle/clean-and-organize/how-to-clean-a-pacifier>

²⁵ Ibid.

²⁶ "Small Parts for Toys and Children's Products Business Guidance." United States Consumer Product Safety Commission. <https://www.cpsc.gov/Business--Manufacturing/Business-Education/Business-Guidance/>

²⁷ Neofotistos, A., N. Cowles, and R. Sharma, "Choking Hazards: Are Current Product Testing Methods for Small Parts Adequate?," *Int J Pediatr*, vol. 2017, p. 4705618, 2017, doi: 10.1155/2017/4705618. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5467345/>

²⁸ Breathnach, E., G. C. Abbott, and R. G. Fraser, "Dimensions of the Normal Human Trachea," *AJR Am J Roentgenol*, vol. 142, no. 5, pp. 903–906, May 1984, doi: 10.2214/ajr.142.5.903

²⁹ "Hazard Analysis and Risk-Based Preventive Controls for Human Food - Chapter 3". FDA. <https://www.fda.gov/media/99558/download>

Existing products on the market

Quiet sensory fidget toys target reducing stress and keeping focus for adults with ADHD, autism or high anxiety. An advantage to these products is they can easily fit into a pocket or bag. Fidget toys are available in bright colors and are made out of a high quality acrylonitrile butadiene styrene (ABS) plastic material which is non-toxic, durable, and washable. Some fidget toys provide different experiences on every side. See Figure 2.



Figure 2. Examples of fidget sensory toys, including multiple sided cubes

Tangle toys are another type of fidget toy which changes shape. See Figure 3.



Figure 3. Tangle toys

Stress balls or dough balls are often made of silicone and easily fit into the palm of an adult hand. Squeezing the ball or simply feeling the soft silicone between fingers can help adults with disabilities relax. Many balls stimulate the touch sense with bumps or other textures and are visually appealing with an interesting combination of colors. See Figure 4.



Figure 4. Silicone stress balls or ropes

Liquid motion bubbler toys contain colorful mineral oil and water. When inverted, the colored mineral oil inside falls to the button like water droplets, creating a calm landscape. See Figure 5.



Figure 5. Motion bubbler toys

Games are another toy product which people with IDD often enjoy, many of which have an educational learning component. The perpetually moving 3D puzzle balls, shape sorting toys, or soft pillows to practice zippers, buckles, or shoelaces are some examples. See Figure 6.





Figure 6. Games and educational toys

The LED light-up tambourine features three brightly colored light settings (fast flashing, slow flashing, and alternate flashing) along with sound which engages those people with IDD who want more stimulation. See Figure 7.



Figure 7. Toys with flashing lights and sounds

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