

Section 3: Understanding



Understanding Your Design

Now that you have a plan, you might not want to slow down to deeply think about your potential end-users. However, investing the effort to understand the market for your product now will save you time in the long run. Resist the urge to engineer in a vacuum. If you make too many assumptions about what people need or want you may end up with a product that no one ever uses. The tools in this section will help you avoid this outcome.

This section will guide you through three steps in the design thinking process: empathize, define, and ideate.

Keep in mind that this phase is meant to work in tandem with your project development. Keep up with your project plan but make adjustments where necessary.

Market Analysis



Your project will only be successful if someone uses what you create. Conducting a market analysis will help you determine whether your product is something people will eventually adopt. Even if you are creating something for educational use or open distribution, you will want to make sure that you are creating a viable, useful product.

Identify your target end user(s). Then, decide the best method for conducting market research about those users. Will you use observations, interviews, and/or online research to learn about your end users? Use the Build a Question Guide pages to help plan out your research tactics. Describe your plan.

See next page for response to this assignment prompt.

Estimate the size (# of users/customers) of your primary market. Where did you get this information?

From SleepFoundation.org:

- “Exact numbers of how many people have sleep bruxism are hard to come by because many people are not aware that they grind their teeth at night.”
- “Studies have found anywhere from around 6% to up to nearly 50% of children (Machado E., Dal-Fabbro C., Cunali P. A., Kaizer O. B. (2014). Prevalence of sleep bruxism in children: A systematic review. Dental Press Journal of Orthodontics. <https://pubmed.ncbi.nlm.nih.gov/25628080/>) experience nighttime teeth grinding. It can affect children as soon as teeth come in, so some infants and toddlers may grind their teeth.”
- “In adolescents, the prevalence of sleep bruxism is estimated to be around 15% (Prado I.M., Abreu L.G., Silveira K.S., Auad S.M., Paiva S.M., Manfredini D., Serra-Negra J.M. (2018). Study of associated factors with probable sleep bruxism among adolescents. Journal of Clinical Sleep Medicine, 14(8), 1369-1376. <https://pubmed.ncbi.nlm.nih.gov/30092895/>). The condition becomes less common with age, as around 8% of middle-aged adults and only 3% of older adults are believed to grind their teeth during sleep.”

From Coherent Market Insights:

- The global bruxism treatment market is robust and growing, with a market value estimated at approximately \$1.143 billion in 2022. It is forecasted to grow at a compound annual growth rate (CAGR) of 6.6%, reaching about \$1.905 billion by 2030. This growth is driven by increasing awareness of the condition and the availability of treatments
- <https://www.coherentmarketinsights.com/market-insight/bruxism-treatment-market-5197>



(continued from page 34, prompt #1)

Target End Users

1. Individuals suffering from bruxism who experience symptoms like teeth grinding or clenching.
2. Patients diagnosed with bruxism by healthcare professionals.
3. Individuals seeking preventative measures against bruxism due to risk factors such as stress or sleep disturbances.
4. Dental professionals who could use this technology to enhance patient care.
5. Research institutions and clinics involved in studying bruxism or similar conditions.

Market Research Plan

1. Observations:

- Objective:** To understand the environment and conditions in which potential users experience bruxism-related issues, especially during sleep.
- Method:** Traditionally, we would want to conduct site visits to sleep study centers where overnight observations of sleep patterns and disorders are conducted. There, we would observe the setup, patient comfort levels with existing solutions, and interactions with healthcare providers. That is **NOT** feasible within the project timeline and would require training and experience that is beyond the scope of this class. Instead, we will interview volunteers that will give their own observations about bruxism and their experience with it.
- Build a Question Guide - Observation:** Focus on patient behaviors, the comfort of the sleep environment, and current intervention methods for bruxism.

2. Interviews:

- Objective:** To gather detailed insights from both sufferers of bruxism and dental professionals about their experiences, needs, and expectations from a potential new solution.
- Method:** Conduct structured interviews with both groups. For bruxism patients, focus on their experiences with current treatments and their expectations from new technology. For dental professionals, focus on how they diagnose and manage bruxism and their openness to new technology.
- Build a Question Guide - Interview:** Start with specific questions about current challenges and frustrations with bruxism management, then explore broader questions about what they seek in an ideal solution.

3. Online Research:

- Objective:** To collect existing data on bruxism prevalence, current solutions, user satisfaction, and technological advancements.
- Method:** Perform extensive online research using academic databases, forums, and publications. Focus on patient advocacy groups, professional dental forums, and academic journals for the latest research on bruxism.
- Build a Question Guide - Online Research:** Identify the most informative sources and gather data on the effectiveness and user satisfaction of current bruxism treatments. Explore new trends and technologies in the field of dental health technology.

Resources Needed

- ~~Access to sleep study centers and dental clinics for observations.~~
- Contact information for potential interview candidates.
- Subscriptions or access rights to relevant academic journals and databases.
 - This is provided through the University of Washington library system*

Now that you've considered the user's needs and pain points through market research, use the information you have gathered to help you create a hypothetical user portrait. Give this person a name and then describe his/her history, hopes, fears, and feelings. This user portrait helps to make the idea of your users more personal. It helps to have an ideal end user in mind in order to create an authentic solution for their needs and desires. A user portrait will also become part of your marketing pitch.

User Portrait: Michael Thompson

History: Michael Thompson is a 42-year-old school teacher from Portland, Oregon. Over the years, Michael has developed a habit of grinding his teeth, particularly during his sleep—a condition known as nocturnal bruxism. This habit began subtly but has gradually become more pronounced, especially during periods of increased stress at work and home. Michael's dentist recently pointed out signs of enamel wear and recommended looking into treatment options to prevent further dental damage.

Hopes: Michael hopes to find a solution that can alleviate his bruxism without impacting his daily routine or sleep quality. He is particularly interested in a non-intrusive, tech-driven solution that could provide not just preventative care but also insights into stress management, possibly improving his overall wellbeing. Michael values solutions that could integrate easily into his lifestyle, perhaps through wearable technology that doesn't discomfort him during sleep.

Fears: One of Michael's primary fears is the long-term damage his bruxism could cause to his teeth, potentially leading to expensive and extensive dental work. He is also concerned about the impact of poor sleep quality on his health and his ability to perform his job well. Additionally, Michael is wary of solutions that might be cumbersome or uncomfortable, such as traditional mouthguards, which he has tried but found too intrusive to wear at night.

Feelings: Michael feels a bit frustrated with the limited options that have been presented to him so far, most of which have not alleviated his symptoms effectively. He is anxious about his deteriorating dental health and eager to find a more holistic approach that addresses the root causes of his stress-induced bruxism. Michael is optimistic about new technological innovations and feels hopeful about finding a smart device that could offer real-time feedback and intervention.

Are there modifications or additions that could make your product applicable to secondary and tertiary markets?
Describe these markets.

Secondary Market: Stress and Anxiety Management

Modifications/Additions:

- Stress Detection:** Incorporate sensors to monitor physiological indicators of stress, such as heart rate variability or skin conductance, which can provide data to help users manage their stress and anxiety levels more effectively.
- Biofeedback Features:** Integrate biofeedback techniques that train users to modify their body's responses to stress, potentially reducing bruxism induced by anxiety.

Market Description: This market includes individuals who might not suffer from bruxism but are looking for solutions to manage stress and anxiety. The product could appeal to a broader wellness-focused audience, including working professionals, students, or anyone undergoing stress.

Tertiary Market: Sleep Enhancement Tools

Modifications/Additions:

- Sleep Tracking:** Add features that analyze sleep patterns and cycles to enhance overall sleep quality. This data can be used to provide personalized recommendations for improving sleep hygiene.
- Smart Home Integration:** Enable the device to integrate with smart home systems to optimize the sleep environment, adjusting lighting, temperature, or playing soothing sounds automatically before bedtime.

Market Description: This market targets individuals interested in improving their sleep quality, which includes a large segment of the general population, particularly in urban settings or technology-savvy consumers. This also includes people with mild sleep disorders who are looking for non-pharmaceutical interventions.



Build a Question Guide: Interview



An interview allows you to pose specific questions of an end user or someone who can provide key insights for your project. Interviews allow you to learn about challenges, frustrations, motivations, and desires.

Before conducting an interview, it is important for your team to develop an interview protocol. It may be useful to review the “Business Modeling” sections on Customer Discovery as you prepare for the interviews. What do you hope to learn during this interview? To prepare for an interview, complete one of these pages for each interview and person. After you have developed a list of potential questions, organize them into themes, and determine an order that will feel natural and conversational. During each interview, take detailed notes or ask permission to audio record the interview, which allows you to write up your notes later. Be sure to attach your notes from each interview.

Interviewee Name:

Details:

Start Specific

What are some specific questions you can ask to open the conversation? What background do you need to understand this person and their insights?

1. Can you describe when you first noticed symptoms related to bruxism?
2. How has bruxism impacted your daily life or your patients' lives?
3. What treatments or interventions have you tried or prescribed, and how effective were they?

Go Broad

What are some questions that can help you understand this person's motivations desires, challenges, and frustrations?

1. What are the biggest challenges you face or observe in managing bruxism?
2. In your experience, what do you believe motivates a person to seek treatment for bruxism?
3. Can you share any frustrations with current bruxism treatments or devices?

Dig Deeper

What are some ways you might be able to dig deeper, to better understand this person's perspectives?

1. How do you think technology could improve the management of bruxism?
2. What are your thoughts on a device that could provide real-time feedback to mitigate bruxism symptoms?
3. Can you share a particular instance where current treatments fell short, and how you wish the outcome could have been different?

Text credit: Design Thinking for Educators, IDEO



Section 3: Understanding

Build a QuestionGuide: Observation



A site visit allows you to observe the setting in which your product might be used, or another setting that may provide key insights. It is a chance to look, listen, question, and think deeply about what is going on at the site.

Before conducting an observation, it is important for your team to make a plan for your site visit.

What do you hope to learn during this observation?

What questions do you have? To prepare for an observation, complete one of these pages for each observation and site. For each observation, take

detailed notes and draw maps and sketches. Be sure to attach your notes from each observation.

Traditionally, we would want to conduct site visits to sleep study centers where overnight observations of sleep patterns and disorders are conducted. There, we would observe the setup, patient comfort levels with existing solutions, and interactions with healthcare providers.

That is **NOT** feasible within the project timeline and would require training and experience that is beyond the scope of this class. Instead, we will interview volunteers that will give their own observations about bruxism and their experience with it.

Text credit: Design Thinking for Educators, IDEO



Section 3: Understanding

Build a Question Guide: Online Research



One of the advantages of conducting online research is that you can look at the problem from multiple perspectives. It is important to be intentional in choosing sources of information that will provide diverse perspectives. What are you hoping to learn from your online research? What sources will tell you the most about your user population? For example, you might consider patient advocacy groups, patient support groups, online user groups, and academic journals.

Sources of Information

Keeping in mind your potential end users, what online sources will help you understand their perspectives, needs, and concerns?

- **Patient Advocacy Groups and Support Groups:** These can provide insights into the daily challenges faced by individuals with bruxism, as well as their experiences with existing treatments.
- **Online User Groups and Forums:** Platforms like Reddit, HealthUnlocked, or specialized bruxism forums where users share personal stories and treatment feedback.
- **Academic Journals and Research Papers:** Sources like PubMed or Google Scholar for scientific studies on the causes, effects, and treatments of bruxism.

Types of Information Available from these Sources

What do you hope to learn from these sources? What type and quality of information will each source provide?

- **User Testimonials and Case Studies:** Real-life accounts of how bruxism affects daily life and how effective current treatments are.
- **Research Findings:** Data on the efficacy of various treatments, new research on the physiological or psychological causes of bruxism, and any potential side effects or risks associated with existing treatments.
- **Product Reviews:** Feedback on usability, effectiveness, comfort, and overall satisfaction with current market solutions.

Tips for Effective Online Searches

- Mine the reference lists in academic papers.
- Find out who the big names are in this field. Visit their websites or Google Scholar profiles.
- Determine the buzz words in this field. Try them as search terms.
- Keep track of the search terms you use. Try variations of these terms.



Ethical Considerations



Every engineered product will have ethical implications for people who use it and sometimes even for people who do not use it. It is important to consider potential ethical implications in advance.

What ethical concerns could be raised by your completed project? Think broadly about this question. Consider concerns related to safety, privacy, identity, cost, and equitable access.

Safety

- Biocompatibility and Long-Term Effects:** Ensuring that all materials used in the device are safe for continuous contact with the body and do not cause adverse reactions such as allergies, infections, or other health issues.
- Device Malfunction:** Addressing risks related to device malfunction, which could potentially worsen the user's condition or cause new health issues, is essential. Regular safety audits and compliance with health and safety standards are necessary to mitigate these risks.

Privacy

- Data Security:** The device will likely collect sensitive health data, including sleep patterns and possibly stress levels. Ensuring that this data is securely stored, processed, and transmitted is crucial to protect users' privacy.
- Consent and Transparency:** Users must be fully informed about what data is

collected, how it is used, and with whom it is shared. Obtaining explicit consent and providing easy-to-understand privacy policies are ethical necessities.

Cost and Equitable Access

- Affordability:** If the device is priced too high, it might only be accessible to the wealthier segments of the population, thereby exacerbating health inequalities.
- Global Access:** Consideration needs to be given to how the device can be made available in low-resource settings or in different countries, taking into account different healthcare systems and economic conditions.

Legal Compliance

- Regulatory Approvals:** Compliance with medical device regulations in all operating markets is not just a legal requirement but an ethical obligation to ensure the device's safety and efficacy.

How might you mitigate some of these concerns?

Safety

- Testing and Certification:** Conduct thorough testing including clinical trials to ensure safety and efficacy. Obtain certifications from relevant health and safety authorities like the FDA (U.S. Food and Drug Administration) or CE marking in Europe, which also helps in enhancing user trust.
- Quality Control:** Establish strict quality control measures during manufacturing to ensure that every unit meets safety standards. Implement a robust quality management system to continuously monitor and address potential safety issues.

Privacy

- Data Encryption:** Use strong encryption methods for storing and transmitting user data to protect against unauthorized access and data breaches.
- Privacy by Design:** Integrate privacy into the development process from the outset. This includes minimizing data collection to only what is necessary, securing data storage and transmission, and providing users with control over their data.
- Regular Audits:** Conduct regular security audits and update security measures in response to new threats. Compliance with regulations such as GDPR (General Data Protection Regulation) or HIPAA (Health Insurance Portability and Accountability Act) can guide these practices.

Cost and Equitable Access

- Pricing Strategy:** Develop a pricing strategy that balances cost recovery and profit margins with affordability for a broader range of users. Consider tiered pricing models or subsidized rates for low-income users.
- Partnerships:** Partner with healthcare providers, non-profits, or government programs that can help subsidize the cost or distribute the device to underserved populations.
- Global Market Considerations:** Adapt the product to different markets, taking into account local economic conditions and healthcare systems to make the device accessible and functional worldwide.

Legal Compliance

- Regulatory Navigation:** Stay informed about and comply with medical device regulations in each market where the device will be sold. This might involve different documentation, testing, and approval processes depending on local laws.
- Ethical Reviews:** Establish an ethics board or committee to oversee development and marketing practices, ensuring they meet legal and ethical standards.
- Transparency:** Maintain transparency with regulatory bodies by regularly reporting on product safety, efficacy, and any adverse events.



Refined Value Proposition and Revised Project Plan



Now that you have more information on your market, you should update your value proposition to incorporate your new knowledge. How will your product add value for your target population(s)? How will you address potential ethical issues?

Our Closed-Loop Bruxism Management System uniquely addresses the prevalent and often overlooked issue of bruxism, offering a proactive and personalized solution that empowers individuals to manage their condition effectively. Leveraging advanced sensor technologies and real-time data analytics, our system not only detects episodes of teeth grinding but also analyzes behavioral and physiological triggers, providing users with actionable insights and personalized feedback to prevent future occurrences.

Value for Target Populations:

- 1.Bruxism Sufferers:** Offers relief and prevention by training users to modify their behavior through gentle interventions, reducing the frequency and severity of bruxism episodes.
- 2.Dental Professionals:** Provides a tool that enhances patient care through detailed data insights, allowing for better diagnosis and tailored treatment plans.
- 3.Healthcare Researchers:** Facilitates the study of bruxism's underlying causes and the effectiveness of interventions, contributing to the broader field of dental health research.

Addressing Ethical Concerns:

- Safety:** Ensures the highest standards of biocompatibility and robustness through rigorous testing and adherence to global safety regulations. Each device undergoes stringent quality control measures to prevent any adverse effects.
- Privacy:** Prioritizes user privacy with state-of-the-art data encryption and adherence to GDPR and HIPAA standards. We implement privacy by design, ensuring that all data collected is essential and securely handled.
- Cost and Equitable Access:** Commits to affordability and accessibility through a tiered pricing model and partnerships with healthcare organizations to reach underserved communities, ensuring that our solution is accessible to those who need it most.
- Legal Compliance:** Maintains strict compliance with all regulatory requirements in each market, with ongoing monitoring and updates to our practices to stay ahead of legal and ethical obligations.

By focusing on these key areas, our product not only meets the immediate needs of individuals suffering from bruxism but also addresses broader market and ethical considerations, ensuring its viability and desirability in a competitive healthcare market. This approach positions the Closed-Loop Bruxism Management System as a leader in holistic, tech-driven health management solutions.



Sketch Your Concept



What your product looks like and feels like will determine the way that people use and interact with it. Therefore, it is important to have a plan for the physical product or interface. You will share this sketch or diagram for peer feedback during a Gallery Walk exercise.

Imagine what you believe your final project will look like. Be ambitiously realistic. Draw by hand below or with computer software and attach a diagram of your project. Label the different parts and features and include brief explanatory text where useful and appropriate.

