Our Objectives

How much sleep do we need?
–
How can we get quality sleep?
-
How does poor sleep affect us during the day?

Learning Outcomes

- Pre-sleep behaviors and bedroom ambient environment play a significant role in sleep quality
  - Light
  - Ambient noise
  - Ideal temperature for sleeping
  - Use of electronic devices
- Recommended sleep duration varies across the lifespan
- Poor sleep quality and insufficient sleep quantity can negatively affect our bodies
  - Mood
  - Attention & Task Performance
  - Physical fitness & Coordination
  - Energy/Fatigue
- Science process skills targeted: Inference, prediction, observing differences

Exhibit Design

- Support parent-child and child-child scaffolding
- Encourage guessing/prediction of outcomes
- Support repeated interaction, observation, and co-play through timed/"gamified" elements

On Facilitation

The procedures described on the previous pages reflect the facilitation we offered visitors during multiple testing sessions, but we do not believe that a more robust prototype will necessarily require facilitation to the same degree.

The final iteration of our labels (samples on following pages) include simple instructions that parents/guardians or reading children can use to navigate the exhibit with considerable independence.

At three points, however, the exhibit design will need to be modified to permit fully unfacilitated exploration:

- The sleep quality visualization in Station 1 currently requires the facilitator to toggle the four sleep environment parameters and display the animation on a tablet or laptop screen. If a future design retains a built-in display of this type,, we may need to include instructions showing visitors how to toggle these parameters themselves, using a either a touchscreen or manual controls.

- Facilitators currently provide explanatory content throughout activities at each of the three stations. This content will need to be incorporated onto labels/exhibit components in the absence of facilitator support.

- Facilitators are currently responsible for resetting the manually controlled elements of the diorama to their default status for each new visitor. Redesigning these elements – or switching to levers/controls adjacent to the diorama – may be required for a fully unfacilitated exhibit.

We note some additional benefits of facilitation in our observations later in this guide – especially regarding flexibility of timing and free-play. If such flexibility is desired, some exhibits procedures or instructions may need to change.

Evolution of prototype

Initial prototype

Station 1 only (Bedroom diorama)

Fully facilitated

Hand puppet dramatization for task and evaluation

Second iteration

Added visual search task (Where's Waldo, wearing blurry glasses)

First test of signage (poster-sized)

Digital results display

Lilypads

Third Iteration

Removed one wall of diorama to aid physical and visual access

Added 'beat the clock' timing to diorama station

Modified visual search task (hidden pictures, timed)

Added mood board station

Added sleep quantity x age station, with tokens

Smaller and more distributed labels

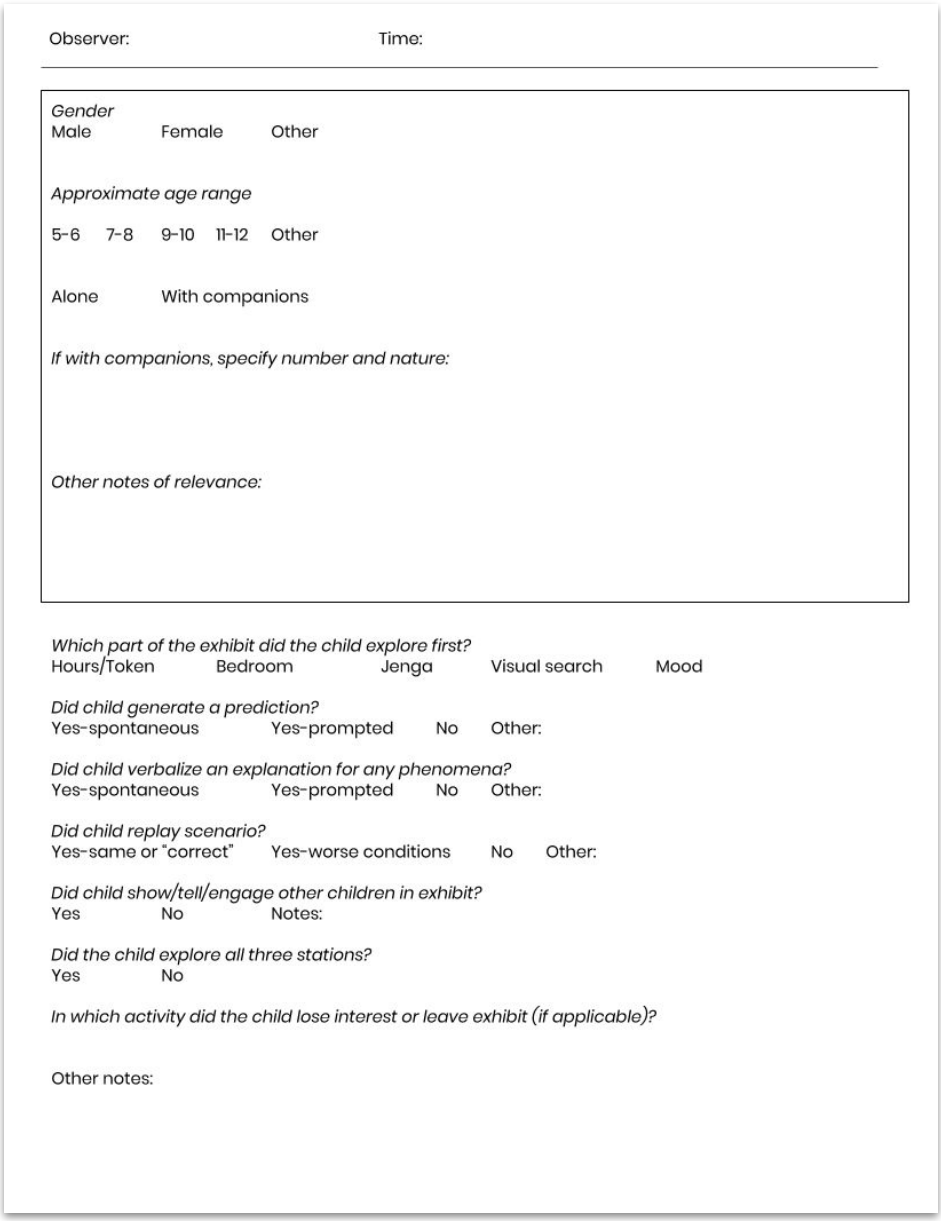
Evaluation

Unstructured Observation

Observations of visitor interaction with exhibit at multiple stages of prototyping at the Sciencenter

Structured Observation

One bservation session with final prototype, using sheet below. Visitors chosen at random and followed through each stage of the exhibit.



Observer: Time:

Gender
Male Female Other

Approximate age range

5-6 7-8 9-10 11-12 Other

Alone With companions

If with companions, specify number and nature:

Other notes of relevance:

Which part of the exhibit did the child explore first?
Hours/Token Bedroom Jenga Visual search Mood

Did child generate a prediction?
Yes-spontaneous Yes-prompted No Other:

Did child verbalize an explanation for any phenomena?
Yes-spontaneous Yes-prompted No Other:

Did child replay scenario?
Yes-same or "correct" Yes-worse conditions No Other:

Did child show/tell/engage other children in exhibit?
Yes No Notes:

Did the child explore all three stations?
Yes No

In which activity did the child lose interest or leave exhibit (if applicable)?

Other notes:

What we Observed

Tactile-first

Our initial design featured “dummy” controls for the environmental factors included in the exhibit: an adjustable thermometer, a quiet-loud slider, and an on/off wheel for use of e-devices. Visitors would manipulate these controls and the facilitator would then make the corresponding changes in the diorama. While this procedure was ultimately changed in favor of more direct visitor interaction with the bedroom environment (manipulating items in the diorama itself), we did observe some promising features of these controls.

The large size of the controls made it easy for children to manipulate them, and their placement (low and in front of the exhibit) meant they were often the first component visitors interacted with. This “touch-first” quality drew in visitors and afforded an initial interaction that wasn't facilitated/mediated by our team, which seemed to help younger/shyer visitors engage. Older children were also curious about the construction of the mechanisms themselves. Our lilypad trail on the floor appeared to provide similar benefits, encouraging visitors to make their way to the exhibit and offering them the chance to engage physically before viewing the rest of the content.

We recommend including versions of these controls – gear-turning, dial-sliding, or similar – in subsequent iterations of the exhibit, especially if they can be made fully functional rather than mere visualizations of settings.

Early-stage prototype development

What we Observed

How much structure is enough?
Our first two prototypes relied more heavily on facilitators to initiate and sustain activity during the exhibit, allowing us to set the pace and modify elements as required by the age and interests of visitors. Our final iteration–with instructional signage and the addition of timed elements–offered greater structure and required much less facilitation.

Our observations revealed some critical tradeoffs resulting from the addition of a timing/gamified component. The challenge of working to beat the clock at both the diorama and visual search stations dramatically improved the exhibit's appeal to older children (7+), increased dwell time and repeat play, encouraged onlookers, and fostered shared/team participation. These benefits lead us to suggest including a timed or competitive element in any future design.

Yet the untimed, less structured earlier exhibit format allowed visitors to explore the miniature bedroom at their leisure and engage in narrative play (e.g. reading the frog a bedtime story), which seemed to be popular with younger children. Facilitators also appreciated the ability to adjust timing and procedures for tasks based on visitor age and engagement style to support greater interaction and learning.

We also observed more self-talk and verbal reasoning from children when timed/gamified components were absent.

What we Observed

Visualizing results

Transitioning from the interactive “nighttime” portion of the diorama station (where children make adjustments to the sleep environment) to the “daytime” portion (where visitors discover whether the frog slept well) proved challenging.

Our first prototype functioned more like a stage-show, where facilitators used the hand-puppet to play out a narrative explanation of sleep quality. After manipulating the puppets bedroom, the puppet is taken out of the room in transition from “night” to “day” and used as a puppet through a covered hole in the bedroom wall. This offered us the chance to explain the importance of environmental features in a playful and silly way, which seemed to engage younger visitors more than older children, some of whom we observed leaving the exhibit at this point. The puppet scripts also allowed for explanations of why sleep elements made a difference in sleep quality.

Our second prototype employed an animated visual display of sleep quality results, which we hoped would be more attractive to older children. This option was a more efficient way of displaying results–good sleep or poor sleep–but did not provide much room for further explanation. We also noted that the display may carry an unintended effect of grading/scoring; one visitor was observed leaving the exhibit after seeing lower results than her peers had received; one similar interaction was also observed with the hidden-pictures task and scoreboard.

For future designs, we recommend including a visual representation of sleep quality, but perhaps one that is either mechanical or digitally animated (e.g. a frog character falling asleep at its desk) that does not rely on quantitative scoring. We also recommend including explanatory material within physical exhibit components (e.g. slide-to-reveal).

Small scale

The scale of our diorama seemed to attract visitors; many first interactions involved exploring the various functional and decorative features of the miniature bedroom environment, including playing with the closet coat hangers, discovering earplugs in a desk drawer, and marveling at the tiny electronics. The small size of the exhibit did, however, limit the number of children who could engage (as participants or observers) at any given time; for our final prototype, we removed one wall of the exhibit’s bedroom in order to improve visibility and provide more space for movement and observing.

For a future design, we suggest playing with scale further by placing both the miniature bedroom and human-scale mood/visual search/sleep quality stations underneath a partial roof or tent structure.

What we Observed

Expanding beyond sleep hygiene

Our initial prototype focused only on one topic: the environmental factors that can support or hinder quality sleep. Our early observations – which revealed that this content was fairly intuitive/easy to grasp – encouraged us to add additional content exploring a)sleep needs throughout the lifespan and b)the physical and mental effects of poor sleep.

Adding content about sleep needs was rather straightforward; we asked visitors to indicate how much they had slept the night prior (choosing one of four colored tokens) and place it in a bin corresponding to their age (one of four age groups). Visitors were then presented with recommended sleep times by age, and asked to compare both their response and the responses of prior visitors to these recommended amounts.

Demonstrating the mental and physical effects of poor sleep proved more of a challenge. Our first trial asked visitors to complete a visual search task (Where's Waldo, printed on a large poster) while wearing lab goggles blurred by petroleum jelly; we hoped this would illustrate how poor sleep quality can impair attention. This activity proved to be too difficult for many children, and the abstract connection between impaired vision and impaired mental performance was confusing.

For our final iteration, we replaced Where's Waldo with a timed task using a smaller and simpler hidden-picture book, and added a mood station where visitors could draw their current mood on a sticker corresponding to the number of hours of sleep they received the night before. These stickers were then placed on a board alongside previous visitors' to help visualize the connection between sleep and mood. Visitors enjoyed this activity and wanted to draw faces on other stickers used on the visual-search task scoreboard.

We believe that any future design should focus heavily on adding to or improving these components to offer a more in-the-body experience – something less abstract. Ideas to consider:

- a balance board or a jenga-like-game while wearing gloves to highlight effects on coordination
- A viewmaster or shoebox-diorama-type object which visitors can peer in to and observe differences in light temperature/color
- Heart-rate monitor with visual display + sudden loud noise to illustrate how sound can affect us physiologically (even in sleep!)