TEAM WORK
PRODUCT DESIGN

THE WEIGHT OF TIME

Time is not measured but felt.
Children's time perception products

Weight and Shadow
Time Rhythm

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PRIMARY RESEARCH

RHYTHM OF TIME

> Temporal rhythm is an embodied agent's ability to perceive and organize periodic events, constructing temporal order through biological and environmental cues.

> Through its motor logic, **the body acts as a "temporal generator"**, segmenting time into rhythmic units. Neural entrainment allows for predicting external rhythms, enabling fluid perception-action cycles.

TIME PERCEPTION

Time perception is the intuition of sequence and duration. Children's deficient time concepts and inaccurate perceptions stem from immature neurocognitive structures (like the prefrontal cortex) and limited cognitive development.

Generally, children **aged 3-4** should grasp day, night, morning, and evening; **4-5 year-olds** should distinguish yesterday, today, and tomorrow; and **by 5-6**, they should understand specific times of day.

01 Subjectivity: Children perceive time through activities, not abstract units.

02 Present-oriented: Live in the "now" and struggle with waiting, often asking for time updates.

03 Gradual Development: Temporal awareness develops with age and cognitive maturation.

04 Experience-Based: Understood through daily routines and specific events, not clocks.

OPPORTUNITY

Smartwatches, Analog clocks, Hourglasses, Timers...

Limitations and Shortcomings

- **Screens:** Promote instant feedback habits.
- **Physical Timers:** Only demonstrate "countdown," lacking holistic time concept development.
- **Market Gap:** A lack of interactive products that let children experience the passage of time.

MY FOCUS

1. Do children understand what time is, and how do they perceive it ?
2. Do children of different ages differ in their ability to sync body rhythm and perceive time ?
3. Are children more accurate in estimating time duration during rhythmic body movements than when they are stationary ?

USER RESEARCH

We interviewed **10 parents and 10 children (ages 4-8)** to explore how children understand and express time. Using age-appropriate methods like games, we looked at **how they develop time concepts and how it relates to their cognitive growth**. The interviews were transcribed and analyzed by themes.

10 parents + 10 children aged 4-8 years → A parent-child pair. (special)

MAIN QUESTIONS

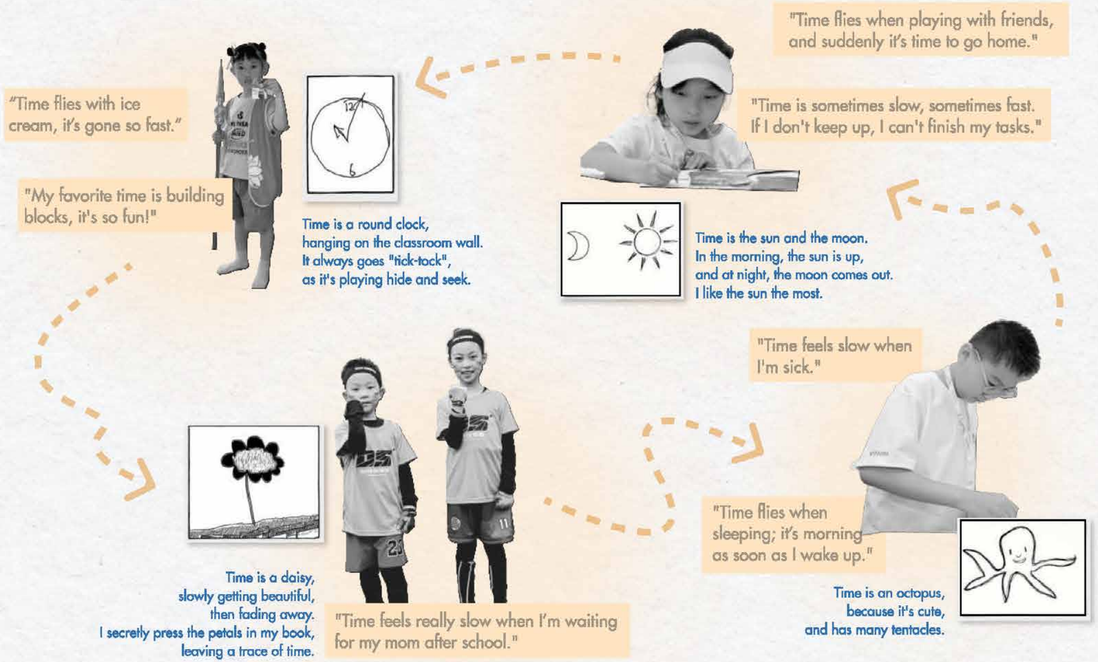
Interview subjects: Children

1. What's your favorite time of the day ? Why ?
2. When does time feel fastest ? How do you feel then ?
   When does time feel slowest ? How do you feel then ?
3. What is time to you ? Can you draw it ?

Interview subjects: Parents

1. Do you think your child can recognize different times of the day and the activities for each ?
2. Does your child talk about time (like today, tomorrow, soon) ? Do they understand these words ?
3. How does your child behave when they have to wait or be patient ?

INTERVIEW RESULTS



FINDINGS

Through Q&A with parents and children, we explored how children of different ages perceive time, their emotional responses, physical experiences, and understanding of rhythm. We also gathered parents' feedback, providing data for future time perception education, product design, or interactive plans.

1 Time perception characteristics: :

- **Visualizing time:** Hard to grasp abstract concepts like "5 minutes," but more aware of events like "sunset."
- **Emotional link:** Time feels like it "flies" during fun moments, but "stands still" when feeling bad, leading to distorted time perception.

2 Current educational practice:

- **Parent expectations vs methods:** Parents value time management but rely too much on rigid schedules, which limits kids' ability to manage time independently.
- **Traditional tools:** Hourglasses and timers lack long-term effectiveness and don't help develop kids' internal sense of time.

THINKING PROCESS

PERSON

Yu Xiaole
Kindergarten students

Habits:
- Rely on countdowns or reminders, but don't understand how long.
- Time feels short for fun, long for boring activities.
- Follow parents' schedules, rarely manage time.

Pain points:
- Can't estimate activity length, leading to distractions.
- Lack patience, feel anxious in waiting.
- Don't fully grasp time or feel it physically.

Expectations:
- Learn time through fun, hands-on experiences.
- Use body and senses to track time.

Zhou Qian
Student's parents

Habits:
- Use schedules, alarms, and reminders to manage kids' routines.
- Give verbal countdowns like "5 more minutes" to hurry kids up.
- Occasionally offer rewards to speed up progress.

Pain points:
- Kids don't understand time, leading to procrastination.
- Sensitive to changes in schedule, causing emotional reactions (resistance or anxiety).
- Parents need to constantly remind, creating tension.

Expectations:
- Kids manage their own time without constant reminders.
- Understand time through real experiences, not abstract clocks.
- Improve patience, self-regulation, and task efficiency.

INSIGHT + INSPIRATION

01 The relevance of key events shape intuitive time concepts:

Children understand time better through important or engaging events. Negative events disrupt their sense of time. Seeing changes in events helps them grasp time passing.

Use fun, engaging real-life scenarios and actions to naturally connect with time rhythm and progress.

02 Interest leads time rhythm perception:

Children feel time passes faster when they're interested and slower when they're bored. This can confuse them about actual time and lead to mistakes in judgment.

Through interest, children perceive the difference between subjective and objective time.

03 Disconnection between habit formation and event perception:

Daily habits help build a sense of time, but when disrupted, children struggle to estimate time for other tasks.

Habit formation is linear. Can we teach children to move beyond linear thinking and connect habits with time ?

04 Parental Instruction vs. Natural Perception

Children's current concept of time is formed through parents' constant external guidance, but it should ideally be built through a cycle of perception, action, and feedback.

Continuously enriching the experience of "time texture" makes time a tangible, measurable concept.

05 Natural sensory perception of time

Children primarily rely on visual and auditory senses to understand the concept of time, while tactile actions assist in the subconscious perception of the passage of time.

Assign time to objects, turning the abstract into the concrete, with cross-sensory experiences.

06 Children's time analogies

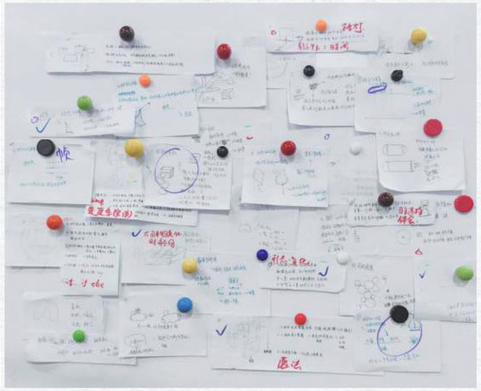
Children often imaginatively compare abstract time concepts to familiar everyday objects. These analogies reflect their intuitive sense of time's passage, speed, length.

Use analogies to help children understand the concept of time.

HOW MIGHT WE ...

How can we link the concept of time to fun key events in life, use natural rhythms to break linear time thinking, and strengthen children's embodied sense of time through the cycle of perception, action, and feedback ?

IDEATION



PRINCIPLE

1. From "abstract" to "concrete"

Turn abstract concepts into events or visuals kids can sense, using multiple senses to build understanding.

2. Allow "flexibility" and "tolerance"

Avoid rigid time rules. Use interactive design to convey flexibility, helping children understand that deviations are normal.

3. From passive to active

Encourage children to actively shape their time perception through engaging activities that boost motivation.

4. Enhance "process awareness"

Focus on the stages of an event (start, progress, turning point) instead of just the endpoint, to help children understand the continuity of time.

INITIAL IDEAS

IDEA 1 - Time Perception Hourglass

Users give events weight and color, which turn into sand. The flow of time speeds up or slows down based on the event's importance, showing time's texture.

Operability ★★★★☆
Solutionism ★★★★☆
Fun ★★☆☆☆

IDEA 2 - Time Loom

Users input events, and the system turns them into fabric strips with colors and lengths. These are woven into a pillow, and pressing it releases colors that recreate the time's experience.

Operability ★★☆☆☆
Solutionism ★★★☆☆
Fun ★★★★☆

IDEA 3 - Time Progress Ribbon

The ribbon has sensor lights that pulse with the child's heartbeat. As it moves, light flows. Touching the light makes it spread and speed up.

Operability ★☆☆☆☆
Solutionism ★★☆☆☆
Fun ★★★★☆

How heavy is time?

The hourglass is a traditional and effective way to feel time. People intuitively sense the weight and texture of sand.

Can we make weight the carrier of time, allowing children to feel its change with their hands?

How long is time?

By weaving length to record the time of an event, we can also intuitively feel the difference in the passage of time in our lives through the senses.

Can we also encourage children to explore the time differences in various life events on their own?

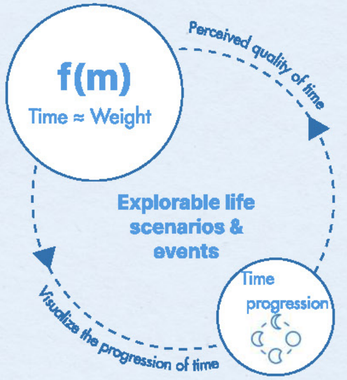
Time is like a progress bar

The progress of time is like a cartoon, where we can drag the timeline to see the change in each frame.

Can we show every "frame" of the time process?

DECISION MAKING

Use weight and shadow changes to help children sense time, **making it tangible and observable.** Through multisensory experiences, they can feel "fast" and "slow," "light" and "heavy," and understand time's flow. This design encourages them to explore different rhythms in life, helping them become more sensitive and curious about the passage of time.



DESIGN PROCESS

DEVELOPMENT

In our design, a light source moves uniformly around a disk, completing each rotation in a duration determined by the weight of objects placed on the disk. The height and distance of the light are adjustable, influencing the shadows cast by the objects.

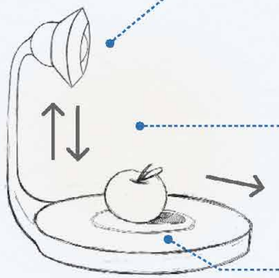
Cut paper of different radii, test the size of light and shadow.

Build a mock-up with the electronic scale and rotating device.

We conducted multiple sets of experiments for comparison regarding the position of the light source.

Adjust the angle | Adjust the height | Adjust the distance

Preliminary plan



Start and End:
A full rotation of the shadow represents the beginning and end of a time period.

Weight:
Weight reflects a child's subjective perception of time. Different objects correspond to different objective time lengths.

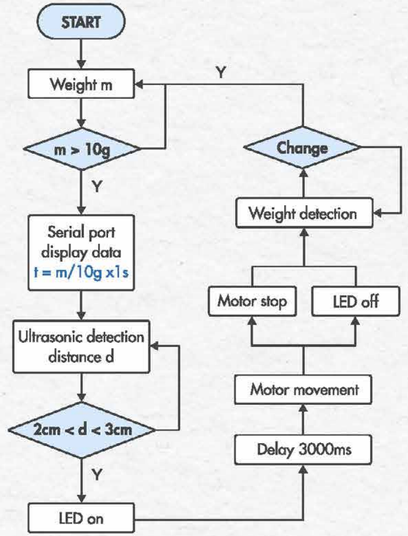
Shadow:
The shadow represents objective time, when changes in the lighting angle alter the shadow.

NEXT: We seek to determine optimal product dimensions through testing to improve children's interaction, and to prototype the concept technolo-gically. This approach will reveal limitations and guide subsequent iterations and refinements.

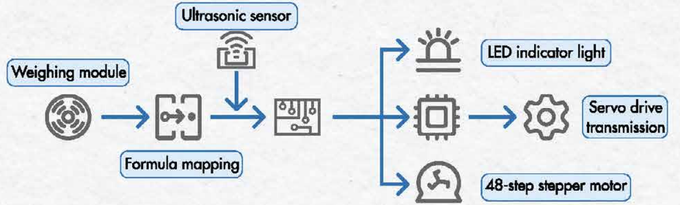
PROTOTYPE

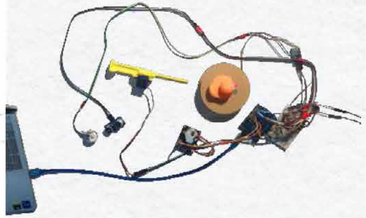
TECHNICAL REALIZATION

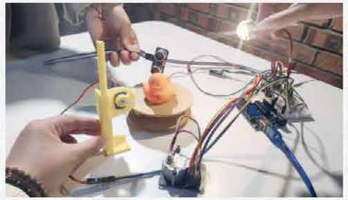
This intelligent control device operates on a closed-loop control mechanism following the sequence: **"Sensing → Analysis → Execution → Feedback".**



CIRCUIT DIAGRAM

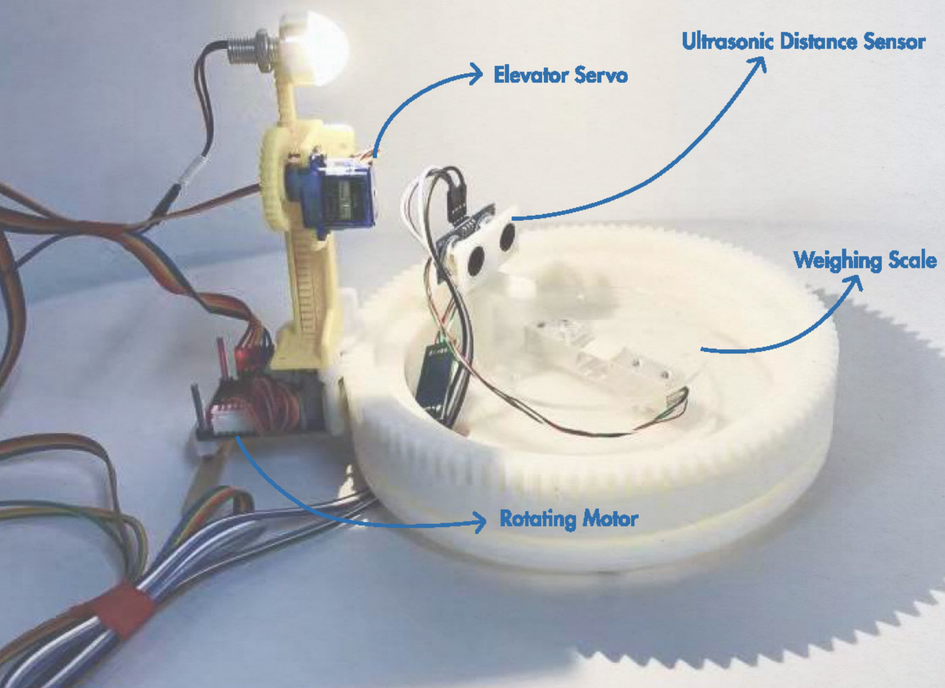






USER TESTING

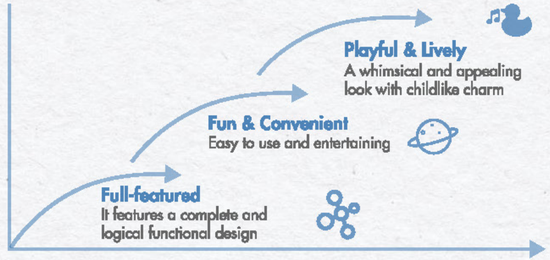
WORKING DEMO



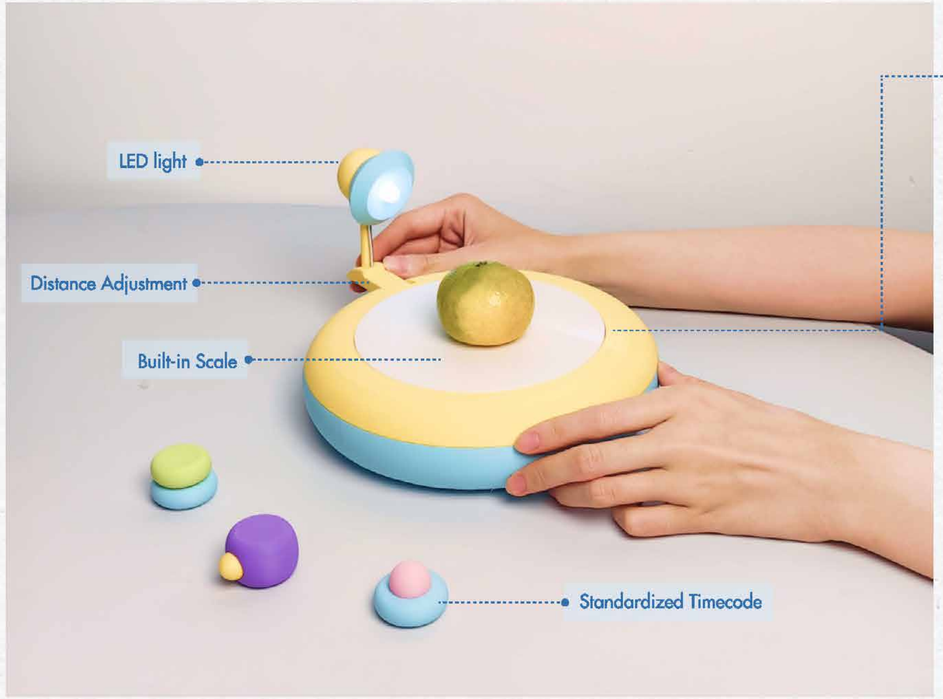
IMPROVEMENT

	Ultrasonic Sensor	Elevator Servo
Test Question	• The sensor has low reception sensitivity • It responds slowly • It's complicated to operate	• Servo overweight hinders rotation • Light height adjustment barely affects shadow
Solution	1. Remove the ultrasonic sensor 2. Manually adjust the light-to-object distance	Optimize the elevator servo by simplifying its functional design

EVOLUTION



OUTCOME



Bridges abstract thought with concrete perception :

The light moves steadily around the disk, and the object's shadow shifts slowly with it. Children can observe the changing position of the shadow, clearly sensing the passage of time. When time is up, the light stops, and the shadow freezes, providing a gentle yet clear reminder that "time's over."

Playful Control, Flexible Time

- Distance Rod Adjustment: Moving the light changes the shadow's size and shape, helping children perceive time intuitively—longer shadows feel slower, shorter ones faster.
- Standardized Time Tokens: Children use weighted toys to represent time values, learning through play how "weight equals time" and building awareness of standard units.

Rhythm & Senses: Builds Timing

- Haptic: Hold objects of different weights to feel how "lightness" and "heaviness" shape the sense of time.
- Visual: Watch the gradual shift of shadows to perceive the flow and rhythm of time.

Touch Time
Understand the duration of events through the weight of objects.

Observe Time
Watch time flow step by step through the movement of shadows.

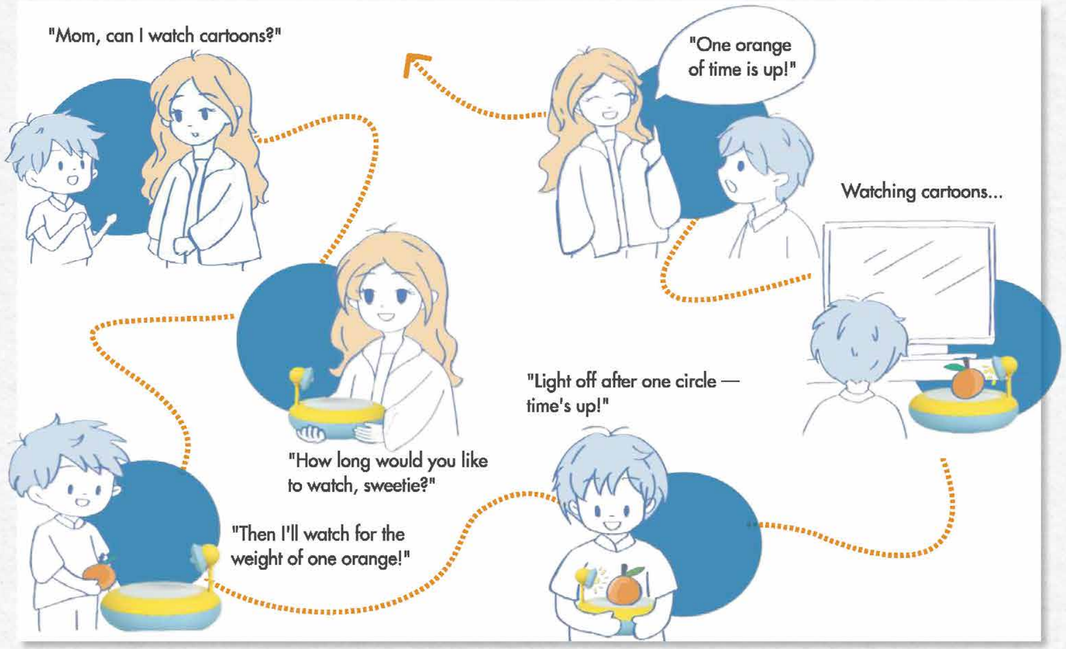
Adjust Time
Actively explore changes in rhythm and speed through interactive play.

Embodied Time Education

Light and shadow visualize time's flow, helping children intuitively grasp the cycle of start, wait, and end through interaction.

INTERACTION

STORYBOARD



USAGE STEPS

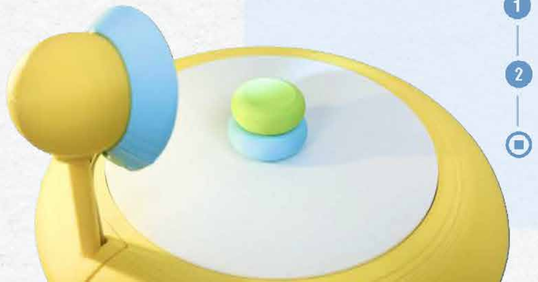
STEP 1 : Place Item

1. Children place chosen items (toys, apples, blocks) on a smart scale.
2. The system weighs items with precision sensors and converts the weight to a time duration (lighter = shorter time, heavier = longer time).

This tactile interaction helps children intuitively connect weight with time.

STEP 2 : Start "Time"

1. The ring light rotates steadily, casting a clear shadow of the object.
2. Adjusting the light distance alters the shadow: farther away makes it larger and slower, closer makes it smaller and faster.
3. The moving shadow acts as a constant "time pointer" on the disk.



STEP 3 : Fun Boost

1. Children can adjust the total duration by adding or removing items.
2. Standard time chips allow precise duration setting.

These interactions make learning standard time units both fun and intuitive.

STEP 4 : End "Time"

1. The light stops rotating at the set time, freezing the shadow in place.

This gentle, non-audio-visual cue:

- Visually signals "time's up" by freezing the shadow.
- Builds a clear time cycle concept.
- Feels less abrupt than traditional timers, better suited for children.

FEEDBACK

Feedbacker 1

- "I can control time!" — Kids love placing different weights on the scale, thrilled to command time itself.

Feedbacker 2

- "Which lasts longer?" — Kids love comparing time weights of different objects and can't get enough of the magnetic standardized time tokens.

Feedbacker 3

- "The shadow is magic!" — Kids love trying different combinations while adjusting the rod to stretch or shrink the shadow.

Deeply engaged, children discover time not as abstract numbers, but through visible light and shadow—naturally learning how weight shapes time and shadows show its flow.

→

This test proves that through multi-sensory interaction (touch + sight) and playful exploration (weight choices, shadow magic), children not only grasp time but enjoy "dialoguing" with it.

→

This design solves the abstraction of traditional time education while nurturing sensitivity to life's rhythm through joy — the core value of "Tangible Time".

CONCLUSION

Calibrated Time

The "time" we take for granted is often artificially segmented: seconds, clocks, calendars... These standardized tools create a universal scale, but also invisibly dissolve time's fluidity and elasticity.

Time Through Body

In this design, we move beyond rigid traditional time-teaching. Instead, children use weight and shifting light and shadow to physically feel time's heaviness and lightness, darkness and brightness.

Cultivating Inner Time Sense

This is not just an innovation in understanding time — it's a rediscovery of the body's natural rhythm. Instead of memorizing "5 minutes" vs. "10 minutes", children learn to sense the pulse of time through sensory flow, developing a personal tempo that harmonizes with life's cadence.

From Numbers to Life Wisdom

When time transforms from cold numbers into a tangible rhythm of life, children gain not just understanding, but wisdom — empowering them to find their own pace amid life's changing rhythms.