
MindRemind

Exploring Assistive Technology for Learning Disabilities



Project 2

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Interaction Design

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Image credit: http://www.coroflot.com/public/image_file.asp?port_id=308798&individual_id=137025&s=0&v=4&a=5&t=0

Exploring Assistive Technology for Learning Disabilities



Tool : Any device, program or system that helps eliminate, bypass or compensate for an individuals specific learning deficit.

Scope : Developing a learning aid tuned to the students' disability

Bringing independency, spontaneity and enabling smooth learning to those with learning disabilities such as dyslexia or other related conditions such as ADHD

Image credit: http://www.coroflot.com/public/image_file.asp?port_id=308798&individual_id=137025&s=0&v=4&a=5&t=0

Process

1. Research

Literature study

Study of existing tools

User research and interaction

2. Analysis

Identifying concerns and problems

Generating key insights

Project direction

3. Ideation

Brainstorming

Initial testing of ideas

Identification of drawbacks

Concept generation

User testing

4. Prototyping

Concept detailing

Detailing of interaction flow

High-fidelity screenshots

Fully functional prototype

5. User Testing

Concept evaluation

Performance mapping

Concept and UI modifications

1. Research



Method : Personal interviews with teachers, volunteers and physiologists | User interaction | Shadowing classroom activities | Observations for instruction methods | Study of various training material and aids available in the school and otherwise

Objective :

1. Understand the term Learning Disability in all its aspects and study how a disability affects learning

2. Identify obstacles faced by the students with respect to current teaching methodologies

3. Explore the role of technology in maximizing the students' potential and making them more productive and independent

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A hidden handicap

Learning disability is an information processing impairment which refers to a variety of disorders that affect the acquisition, retention, understanding, organization or use of verbal and/or non-verbal information.

Interferes with the acquisition and use of one or more of important skills like:

Oral language	(listening, speaking, understanding)
Reading	(decoding, comprehension)
Written language	(spelling, written expression)
Mathematics	(logic, problem solving)

Organizational skills / memory / social interaction

Learning Disabilities Resourse Community. (2002). (A. T. Center, Producer) http://www.ldrc.ca/

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A hidden handicap

Co-exist with other conditions, including attention related, behavioural or emotional disorders, sensory impairments or other medical conditions.

A person can be of average or above-average intelligence, not have any major sensory problems (like blindness or hearing impairment), and yet struggle to keep up with peers in their ability to learn.

'These disabilities often tend to be misunderstood even by parents and hence their impact is underestimated...'

'Our students are not "lazy" or "dumb." In fact, they usually have average or above average intelligence. They just process information differently.'

Learning Disabilities Resourse Community. (2002). (A. T. Center, Producer) http://www.ldrc.ca/

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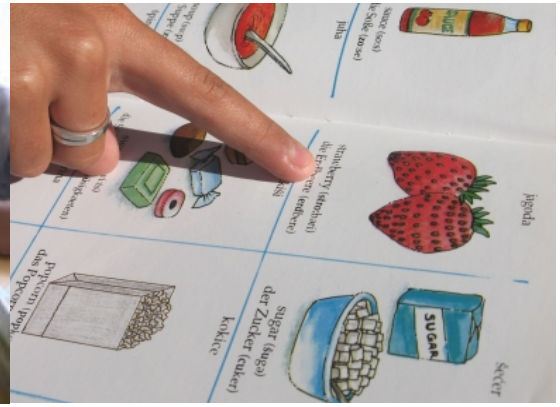

Academic structure

Although learning disabilities can occur in very young children, the disorders are not usually identified until problems are recognized at school.

SCHOOL	:	6 to 12 yrs	(Grades 1, 2, 3 and 4)
PRE VOCATION PROGRAM	:	12 to 16 yrs	
VOCATIONAL PROGRAM	:	16 to 25 yrs	

Intensive Therapy Unit (ITU)

Skills Enhancement Class

Courses : Creative Visual Arts, Office Procedures, Hospitality and Catering

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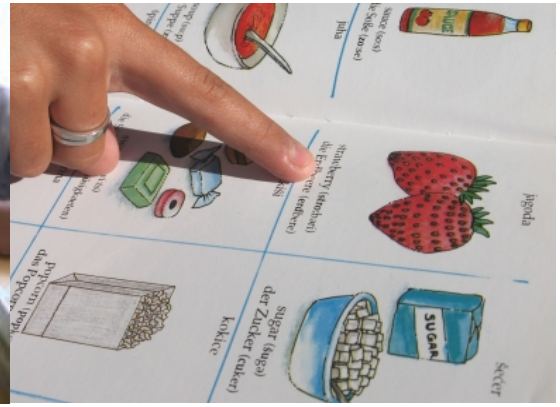

Academic structure

Individual Student Design

- Inputs : Evaluation of the child, family and medical history, education level and past performance
- Outputs: Academic Placement, Therapy recommended, Focus areas

Departmental Design

- Inputs : Student's current level – academic, physical and behavioural, data from students previous records or assessments, appropriate equipment and teaching aids
- Outputs: Enhancement of students' abilities – progress of the student

Therapeutic Design

- Inputs : Interpretation of the students behaviour by the parents and teachers, learning skills, communication skills, emotional state
- Outputs: Better and cohesive understanding of the student's behaviour

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Teaching strategies

Key Observations

- Classes are divided according to the severity of the development disability of the students.
- Activity based training structure – All teaching material is made relatable to the child
- Repetitive instruction pattern is used in order to utilize as many sensory modalities
- Students are encouraged to make their own decisions and choices
- Giving examples results in more effective learning of a new concept
- Most instruction material is presented in a visual based story format.
- Short attention spans of the students' requires the teachers to focus individually on each student

Sample Test Material

ON OUR BIRTHDAY WE…




BIRTHDAY

HOW DO THEY LOOK???







USE LANGUAGE COURTESIES

- HAPPY BIRTHDAY
- GOOD MORNING
- NAMASTE
- THANK YOU





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Teaching strategies

Techniques used in class

- Providing frequent progress checks to the students. Letting them know how well they are progressing in class
- Giving immediate feedback to students – relating what was taught to real life experiences
- Making activities concise and short, whenever possible
- Providing them with concrete objects and events to overcome their difficulty in learning abstract terms and concepts
- Provision of oral instruction for students with reading disabilities
- Giving lots of encouragement and specific praise to students

1



Tools available

Picture Exchange Communication System (PECS)

Evidence-based practice - a form of augmentative and alternative communication

Typically used as an aid in communication for children with learning disability and other special needs (Communicative and cognitive difficulties)

PECS aims at teaching functional communication with an initial focus on spontaneity and intended to be combined with elements of behavioural analysis

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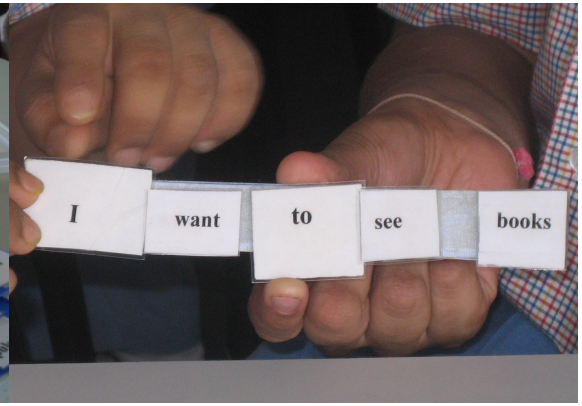

Tools available

Students learn to exchange pictures with a communication partner in order to communicate their desire. Using pictures, students are taught to be more persistent communicators.

Pictures are placed in a communication book – a ring binder with velcro strips where pictures are stored and easily removed for communication.

Over a period of time, students learn to locate their communication book, open it and retrieve picture icons to form sentences and communicate with the partner.

Discrimination begins between preferred and non-preferred items before working on comparisons between equally rewarding items

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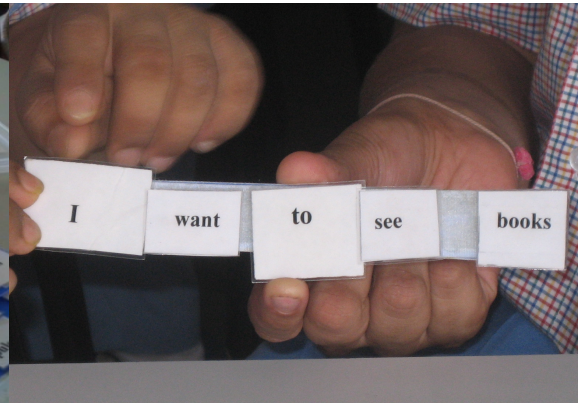

Error spotting

Feel	:	Most of the times, children fail to communicate even though they feel the emotions. Language barrier is often misjudged as incapability to emote.
Find	:	Card / picture search is random and time consuming. Students lack the concentration to search. Inventory of cards is unorganized and not portable.
Identify	:	Many students find it confusing to recognize an image due to the multiple representations of the same image.
Express	:	As the tool gives stress on simple sentence formation in order to communicate effectively, children lack vocabulary skills. Limited vocabulary remains insufficient to express their true thoughts
Respond	:	Incorrect perception by teacher or undesired response leads to failed communication often causing frustration

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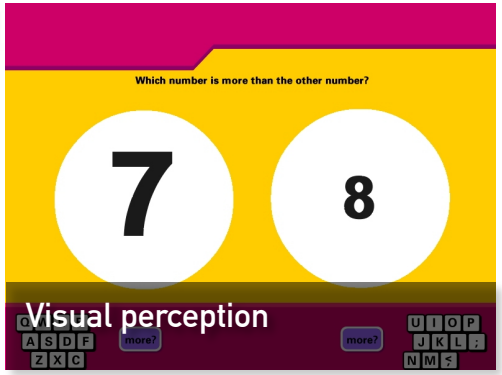
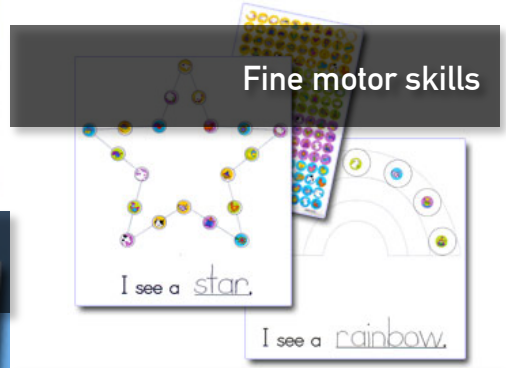
Tools available



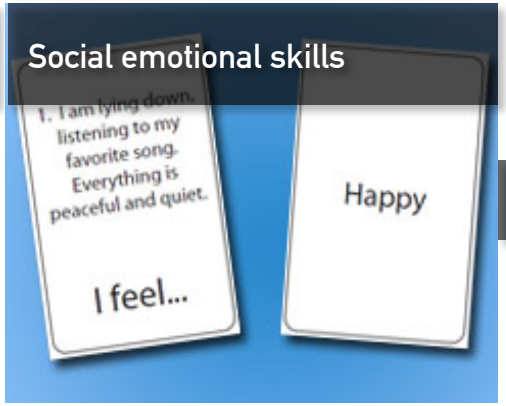
















2. Analysis

Four categories of problems identification

Constraints specific to disability

Distinguish, identify, or separate the sounds in spoken words

Difficulties in understanding concepts in Math

Reversing or mis-sequencing letters or numbers within words

Academic problems and drawbacks

Difficulty with memory (taking orders, listening to the teacher, recalling what's learnt)

Expressing what is known and understood (tests)

Not making use of reading to gather information (focus on word recognition)

Challenges to teachers

Successfully communicating concepts to the children

Sustaining the knowledge imparted to the child

Avoiding incorrect perception of the students response (incorrect assessment)

Issues in tools available

Focus on a very specific need of the students

Lack of resources dedicated to help *overcome* a cognitive deficit

Optimization according to individual needs

Reusability and scalability

2 *Further Classification*

Input Discomfort :	Collecting and recording information
Visual Perception :	Subtle differences in positions and relationships Tendency to skip words and jump lines Difficulty in focusing around clutter
Auditory Perception :	Distinguishing between slight differences
Integration Difficulty :	Sorting information Focusing on required information
Sequencing Difficulty :	Remembering a sequence or order
Abstraction :	Struggle in building concepts Understanding the bigger picture
Memory :	Acquiring, storing and recalling information Recalling after a long period of gap Explicit, visual and auditory memory
Output Discomfort :	Expressing what is known No desire to respond Finding the right words

Focus Area

2

Design brief

Enhance the child's ability to recall by helping the child discover how to pay attention, memorize and learn effectively.

Specific Memory & Cognitive Skills :

Working memory
Ability to store items in memory for a brief time and manipulating them

Attention stamina
Ability to focus attention as and when required and stay focused for an extended period of time

Recall memory
Ability to retrieve information from the past

Processing
Ability to understand and perform tasks instructed with speed and accuracy

2

Design brief

Enhance the child's ability to recall by helping the child discover how to pay attention, memorize and learn effectively.

User group

12 to 15 years
Pre-Vocation Students
Completing special schooling
Acquired certain behavioural and cognitive skills

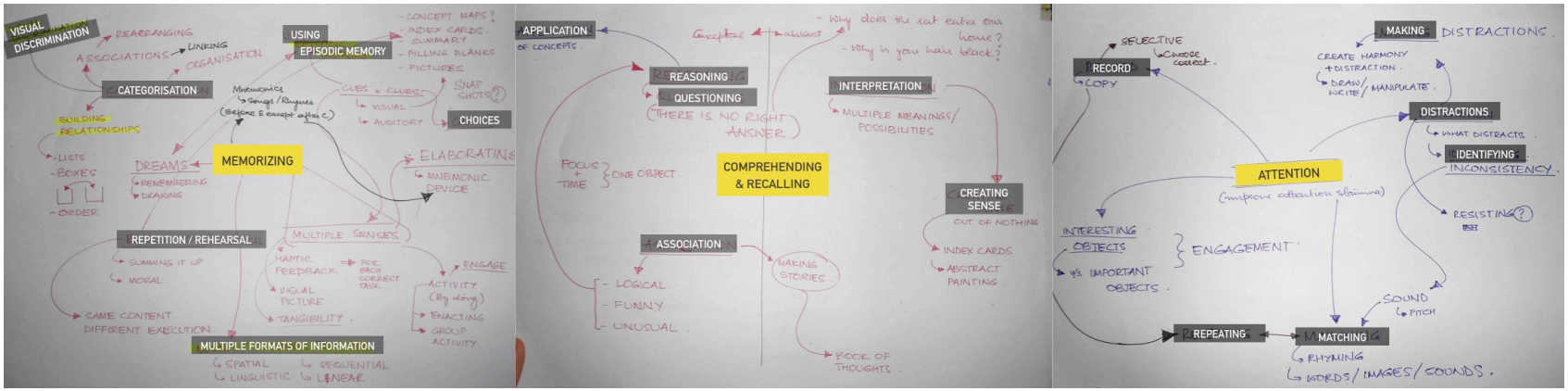
Introduction of complex concepts in academics
Less assistance and more self reliance expected

3. Ideation

Learning how to learn

Factors influencing child's power to concentrate and learn

MEMORIZE	COMPREHEND AND RECALL	FOCUS ATTENTION



Few initial ideas testing

Aim:
Identifying techniques for
memorizing, recalling and focusing attention
that best suit the user segment

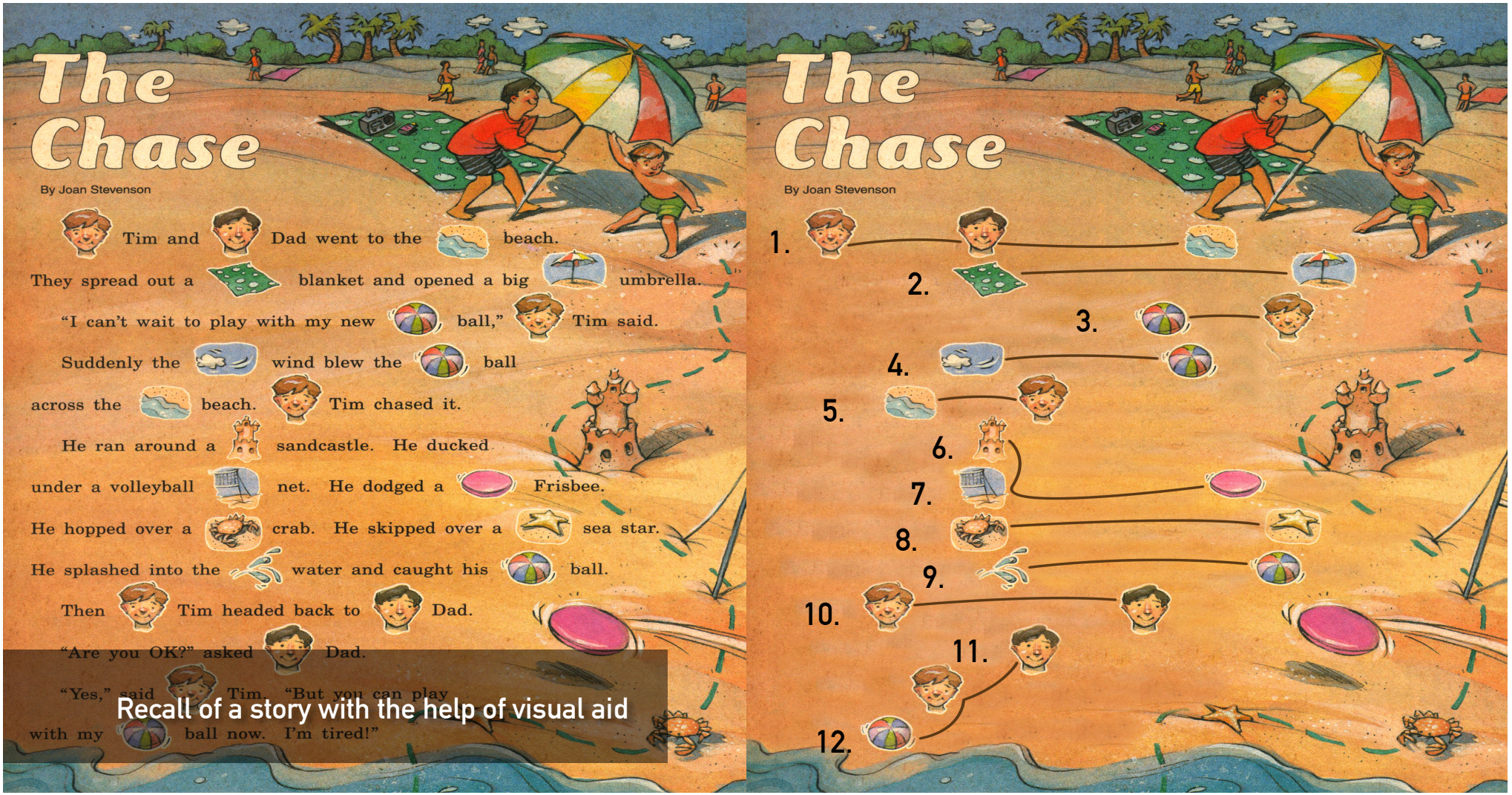


Image credit: Highlight Comics for children (Aug- 2005)

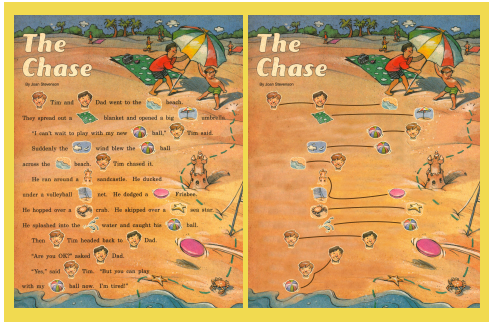

Spotting silly objects, with and without reference
Image credit: Highlight Comics for children (July- 2009)

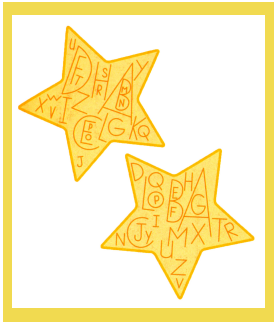


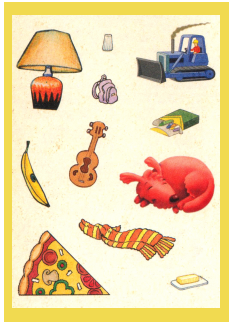
Image credit: Highlight Comics for children (Feb- 2006)

2

MEMORY







- Association
- Choices
- Elaboration
- Visual discrimination

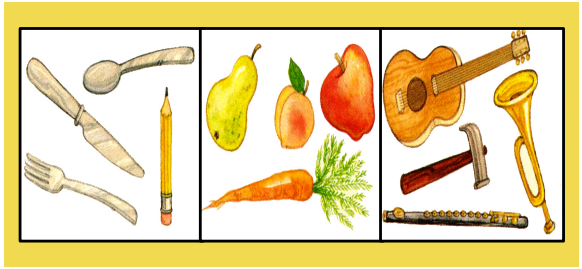
ATTENTION
& VISUAL PERCEPTION





- Matching
- Repeating
- Identifying distractions

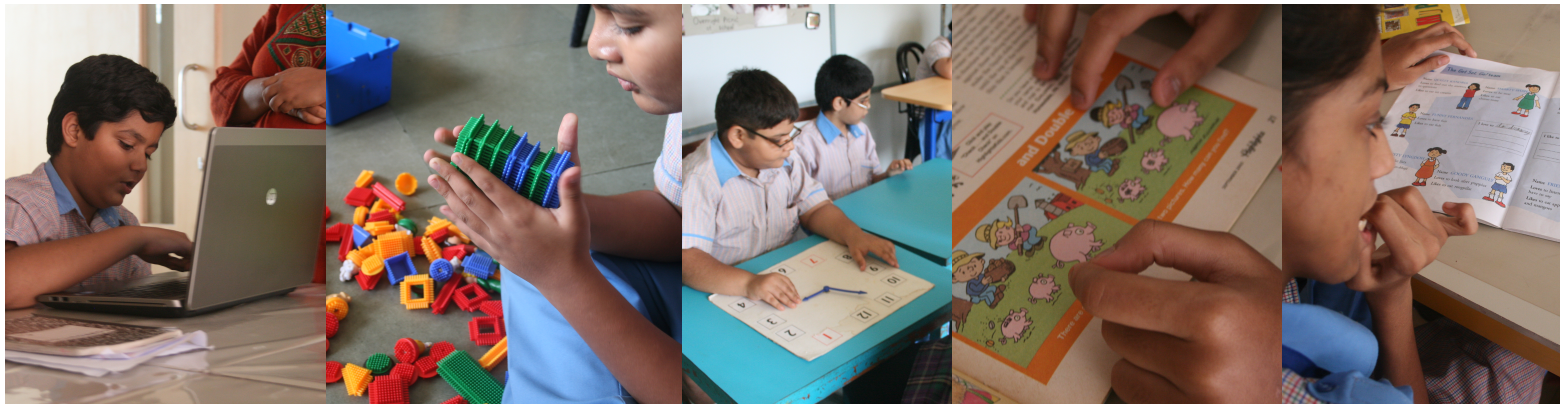
REASONING





- Questioning
- Application
- Interpretation
- Making stories

3



Key insights

Tasks that required deliberate memorization led to disinterest in completing the task affecting the child's will to learn readily

Children were unlikely to exploit their abilities even when, on request, they showed tremendous scope

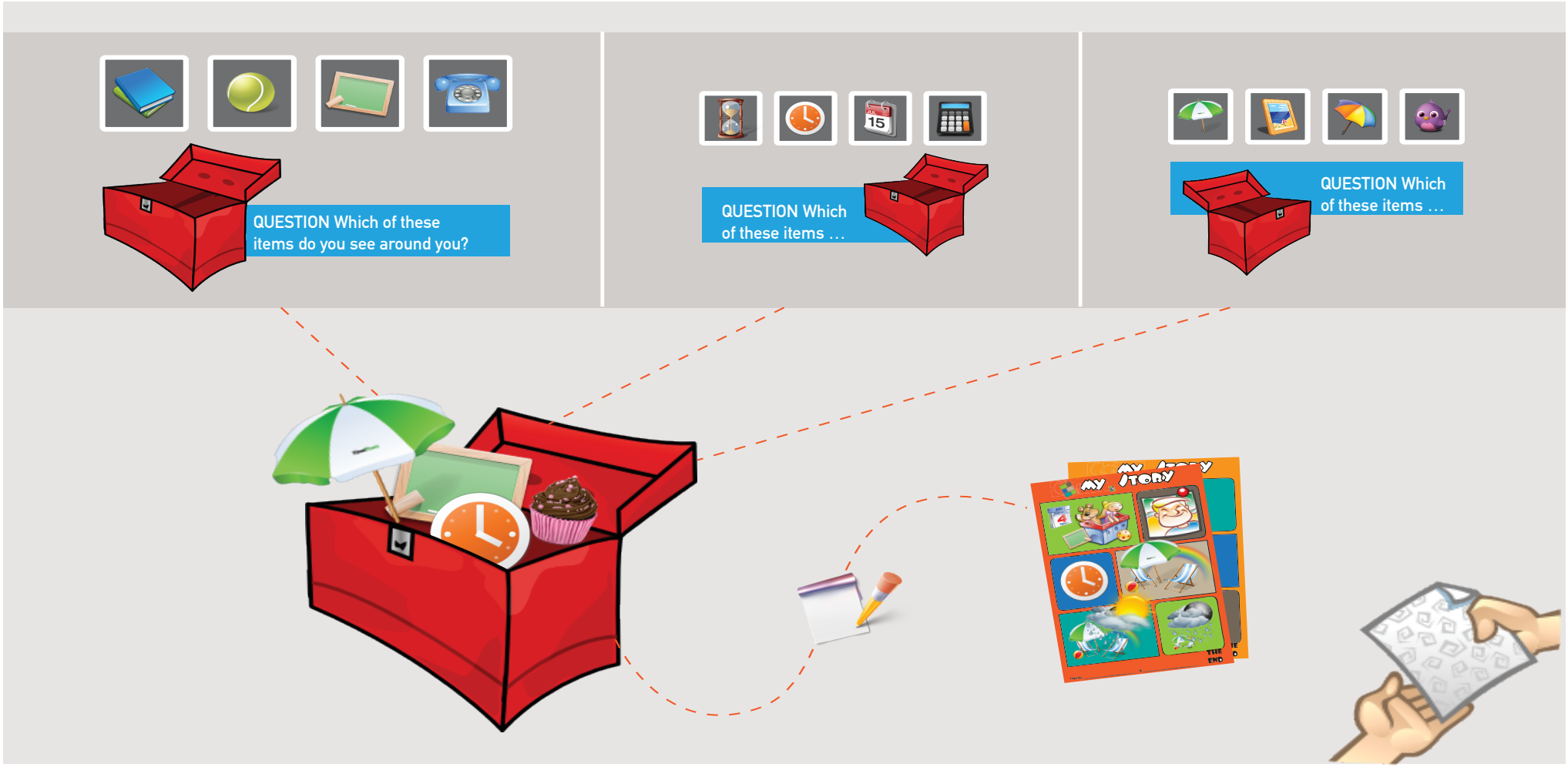
Child's perception was dominated by what one chooses to attend to as opposed to what was required to be focused on

Non-selective nature made the child attend to what he got correct instead of acting upon what needs to be corrected

Providing external cues like questions prompted recall, thus leading the child to act upon the material to be remembered

Shared, social activities proved to be more engaging than individual tasks

Concept Maps



THE RED BOX

- A story building program that exercises the child's episodic memory and increases alertness and awareness on a day to day basis
- Allows the child to build relationships and promotes thinking while reading



Customised plan and performance index per student

Series of memory and rehearsal exercises related to classroom lessons

MIND REMIND

- Program designed to build on the foundational skills developed in classroom lectures
- Each exercise focuses on a different cognitive skill improving processing speed and accuracy required for learning efficiently

Detailing of concept

MindRemind, the concept, is made up of three key components.

1. Digitised lesson / story
2. Cognitive exercises based on the story
3. Individual student performance index for teachers and parents

THE FORGETFUL GORILLA



Jojo, the Gorilla lived in the land of monkeys. He worked everyday as a tour guide for new monkeys.

He was always forgetting things.

When the other monkeys asked him where a place was, he could never remember.

"Nevermind, I'll find it myself," they would say.

◀ ▶

MindRemind

LESSON ONE
THE FORGETFUL GORILLA

LESSON TWO
TALENTED ANNIE AND HER FRIENDS

LESSON THREE
A STORY ABOUT TAJ MAHAL

STORY / LESSON

The program is worked on in a sequence starting with narrated lessons for revision of the class work.







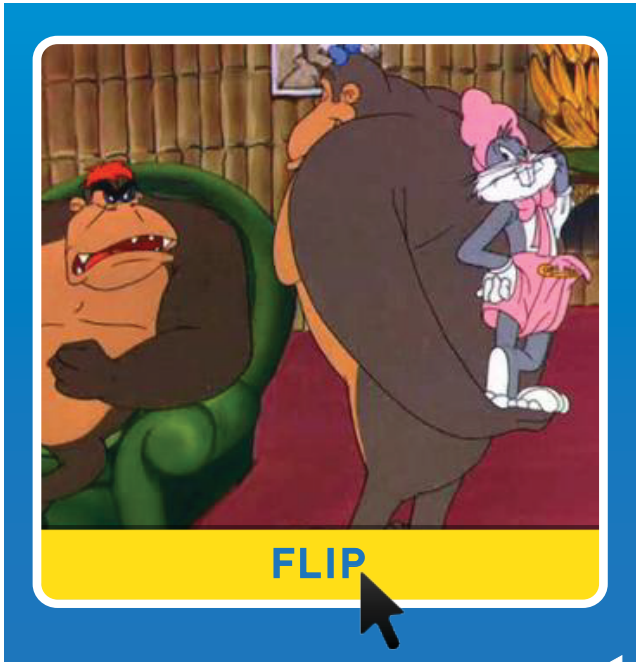


MEMORY & REHEARSAL EXERCISES

These exercises squeeze intensive memory activity into short sessions while adapting to the students capability.

The program builds memory and processing skills in tiny incremental steps

– eventually reaching speed and accuracy required for learning success

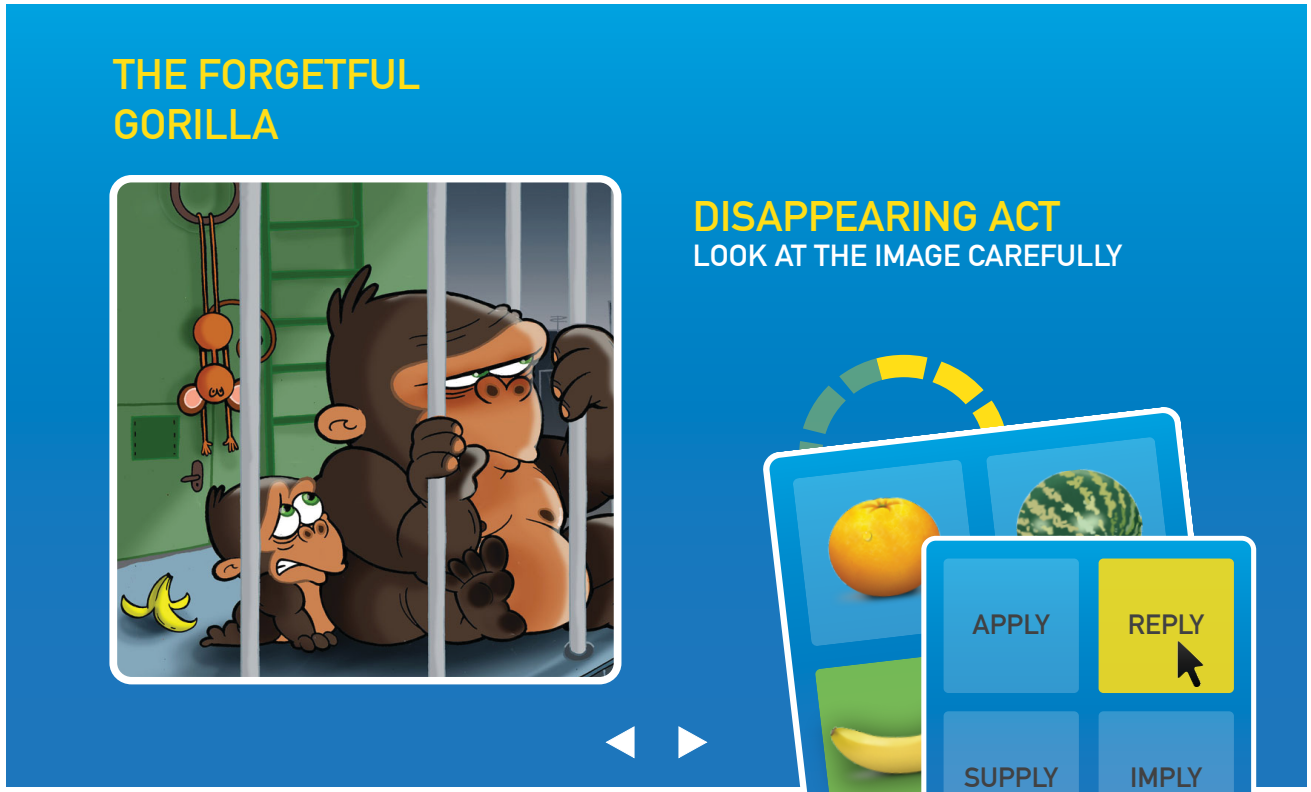




FLIP OR FREEZE?

Students identify true and silly images and click to freeze the correct side of the card.

Students are forced to switch tasks because of the changing parameter for choosing the image

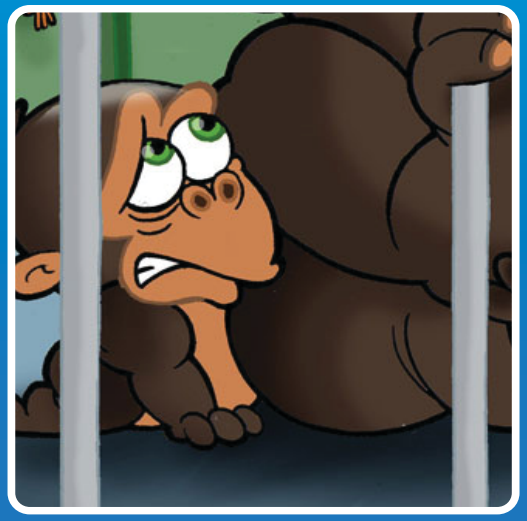


DISAPPEARING ACT, HEAR ME

These exercises build attention stamina and working memory skills forcing the students to hold one sound or image in memory while waiting for its match to appear.

As the student improves, images and words get added and matches get harder

THE FORGETFUL GORILLA



CHECK, DOUBLE CHECK

WHICH OF THESE SENTENCES BEST MATCHES THE IMAGE?

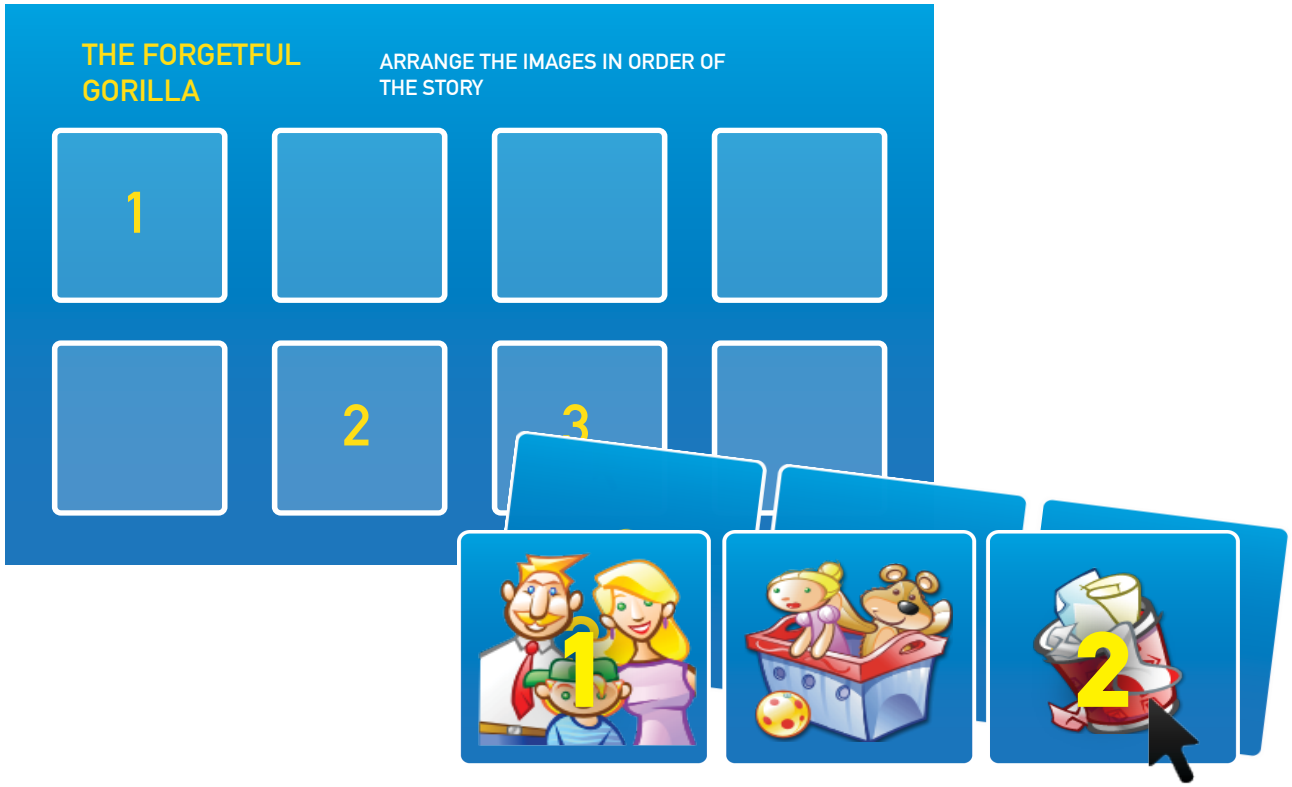
1. Sometimes he even forgot how to eat the banana!
2. Jojo had found a magic book!
3. He had an idea. But he was scared that Jojo will forget.

◀ ▶

CHECK, DOUBLE CHECK

This decision making exercise promotes understanding through thinking while reading, an essential skill for rehearsal.

The task is to select the sentence that best describes the picture from the lesson.



ORDER ORDER

This is the final exercise of the program testing sequential processing.
Students arrange the chunks of the story in correct order.

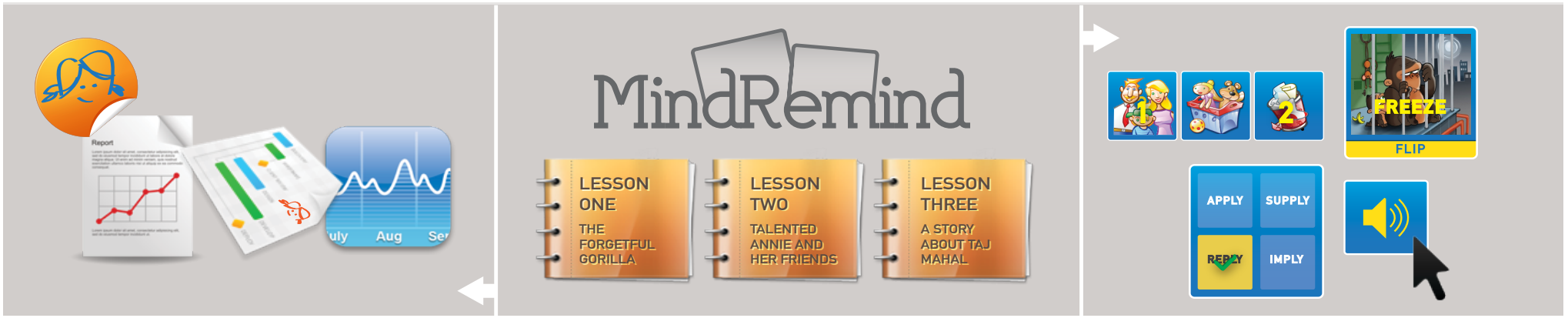
With this final exercise the child uses all memory and cognitive skills acquired throughout the program and develops potential to transfer information into long term memory.



SUPPORT SERVICES

Throughout the program the child is monitored on parameters like accuracy and speed while working on exercises that stimulate the brain.

This data is transferred onto support services like daily reports and performance index allowing teachers and parents to keep a track on the progress of the child.


Report
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Aug
MindRemind
LESSON ONE
THE FORGETFUL GORILLA
LESSON TWO
TALENTED ANNIE AND HER FRIENDS
LESSON THREE
A STORY ABOUT TAJ MAHAL
1
2
FREEZE
FLIP
APPLY
SUPPLY
REPLY
IMPLY

4. Prototype


QUESTIONS
HOME
MindRemind
PLANNER
YOU
Jojo, the Gorilla lived in the land of monkeys. He worked everyday as a tour guide for new monkeys.
He was always forgetting things.
When the other monkeys asked him where a place was, he could never remember.
"Nevermind, I'll find it myself," they would say.
#1 The Forgetful Gorilla
Series #3
LESSON ON
Simple Reading
REPLAY
STOP
VOLUME

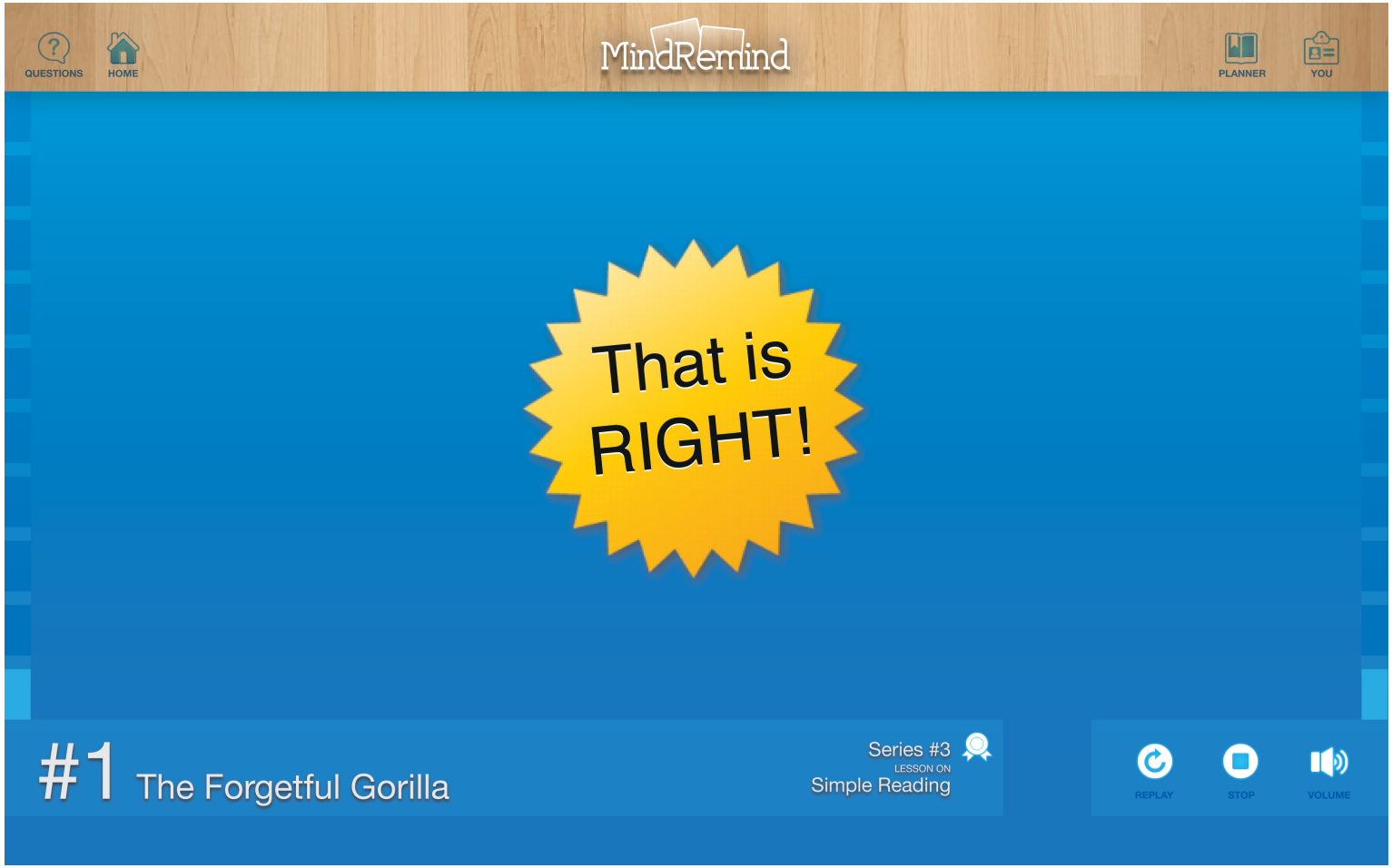
4. Prototype


QUESTIONS
HOME
MindRemind
PLANNER
YOU
What was Jojo hiding from the king?
FREEZE
FLIP
#1 The Forgetful Gorilla
Series #3
LESSON ON
Simple Reading
REPLAY
STOP
VOLUME

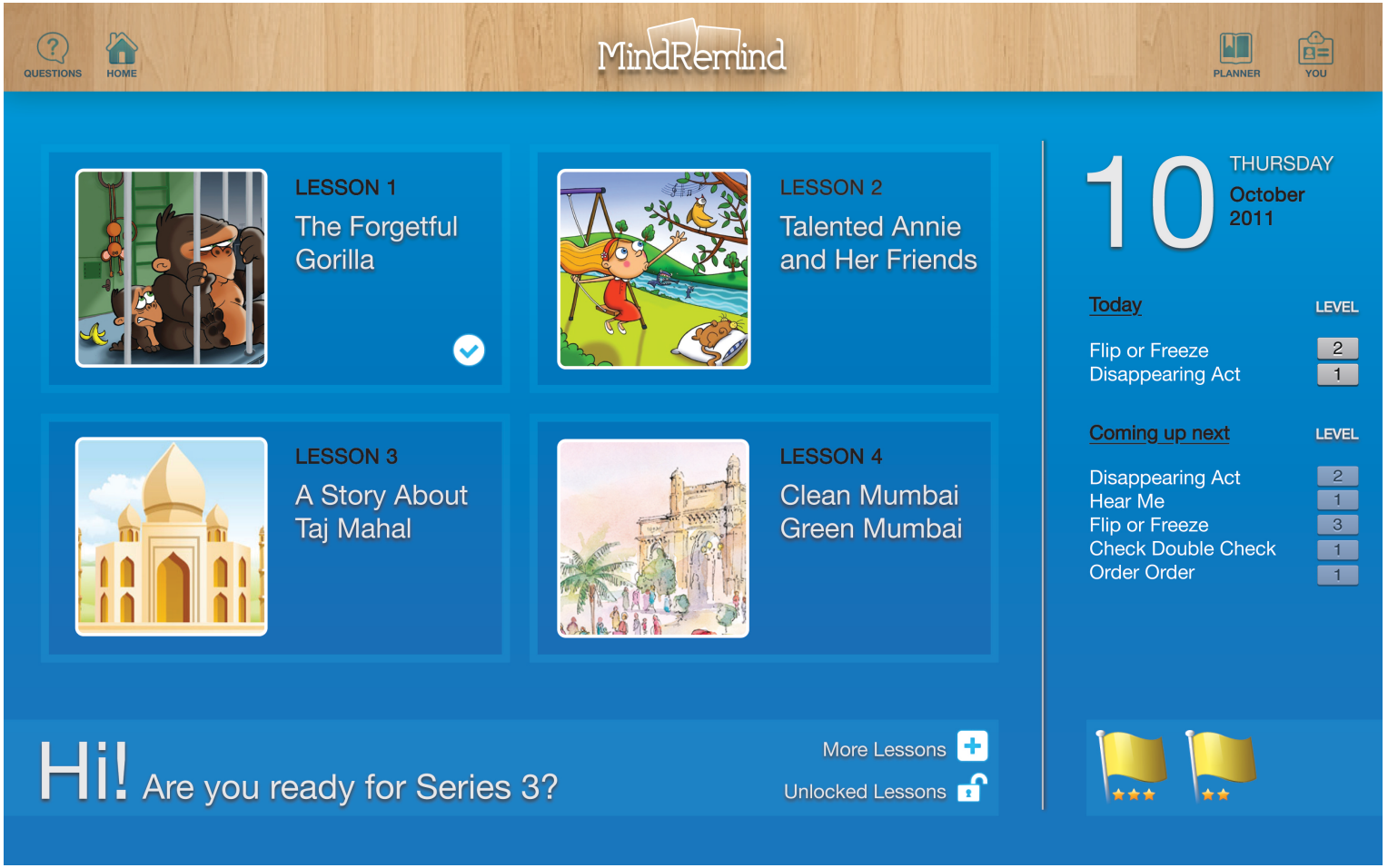
4. Prototype


QUESTIONS
HOME
MindRemind
PLANNER
YOU
What was the colour of the disappearing object?
BLUE
YELLOW
GREEN
RED
#1 The Forgetful Gorilla
Series #3
LESSON ON
Simple Reading
REPLAY
STOP
VOLUME

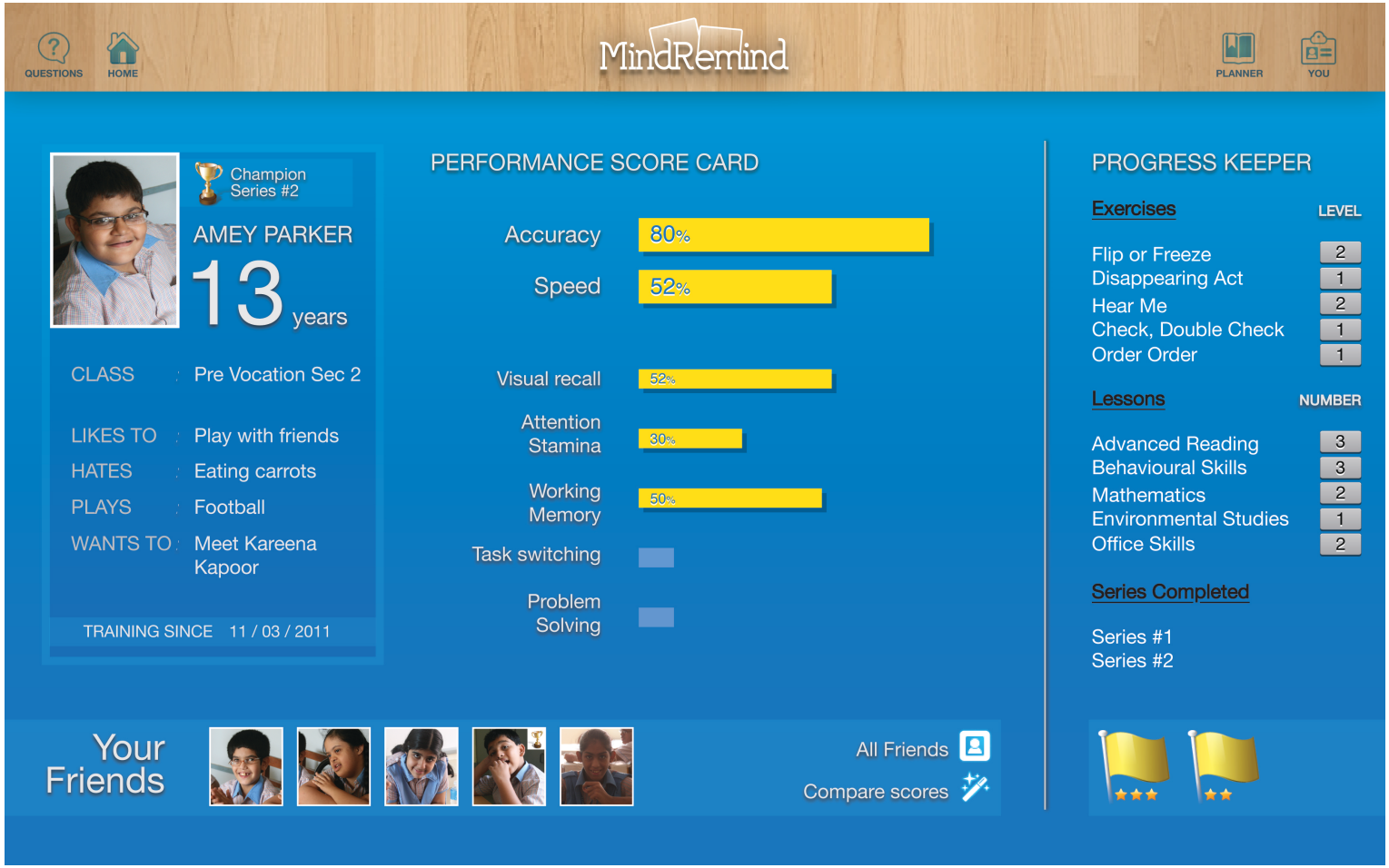
4. Prototype


QUESTIONS
HOME
MindRemind
PLANNER
YOU
That is RIGHT!
#1 The Forgetful Gorilla
Series #3
LESSON ON
Simple Reading
REPLAY
STOP
VOLUME

4. Prototype

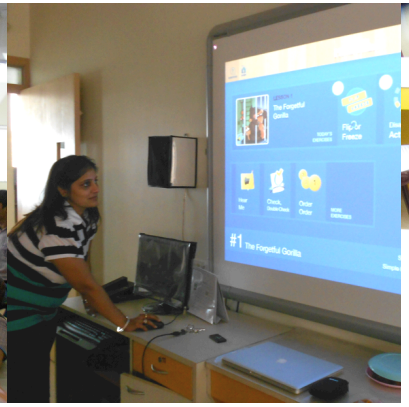

QUESTIONS
HOME
MindRemind
PLANNER
YOU
LESSON 1
The Forgetful Gorilla
LESSON 2
Talented Annie and Her Friends
LESSON 3
A Story About Taj Mahal
LESSON 4
Clean Mumbai Green Mumbai
10
THURSDAY
October
2011
Today
LEVEL
Flip or Freeze 2
Disappearing Act 1
Coming up next
LEVEL
Disappearing Act 2
Hear Me 1
Flip or Freeze 3
Check Double Check 1
Order Order 1
Hi! Are you ready for Series 3?
More Lessons
Unlocked Lessons

4. Prototype


QUESTIONS
HOME
MindRemind
PLANNER
YOU
Champion Series #2
AMEY PARKER
13 years
CLASS : Pre Vocation Sec 2
LIKES TO : Play with friends
HATES : Eating carrots
PLAYS : Football
WANTS TO : Meet Kareena Kapoor
TRAINING SINCE 11 / 03 / 2011
PERFORMANCE SCORE CARD
Accuracy 80%
Speed 52%
Visual recall 52%
Attention Stamina 30%
Working Memory 50%
Task switching
Problem Solving
PROGRESS KEEPER
Exercises LEVEL
Flip or Freeze 2
Disappearing Act 1
Hear Me 2
Check, Double Check 1
Order Order 1
Lessons NUMBER
Advanced Reading 3
Behavioural Skills 3
Mathematics 2
Environmental Studies 1
Office Skills 2
Series Completed
Series #1
Series #2
Your Friends
All Friends
Compare scores

5. Testing







	Participants	Task	Session 1	Session 2
(Pre- Vocation 13 – 16 years)	12 students	Exercise 1 (Flip or Freeze)	Set A (10 questions)	Set B (10 questions)
	12 students	Exercise 2, (Disappearing Act)	Set A (10 questions)	Set B (10 questions)
	6 students	Exercises 3, 4 and 5 and Interface testing	Sample questions (3 to 5)	

5

Minnie and Bobo

16 images



Sample tests

Who was with Minnie when she was feeling lonely?



Who was with Minnie when she was feeling lonely?



Who got scared when Bobo was swinging on the branch?



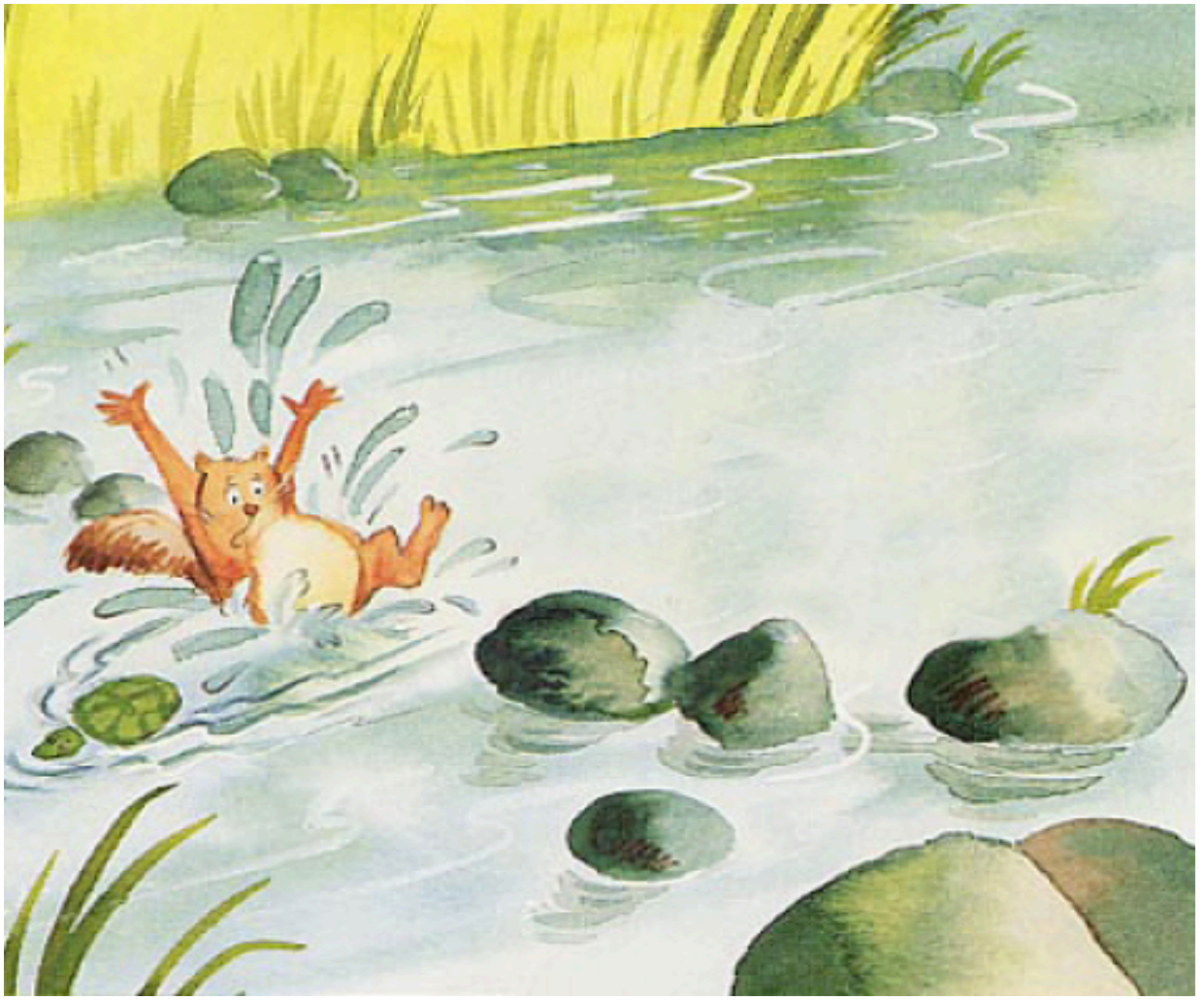
Who got scared when Bobo was swinging on the branch?



Look at the image carefully.



Look at the image carefully.



Which of these disappeared from the picture?











5



Testing Criteria

Performance - **Accuracy | Response Time**

Accuracy - **Correctness of the answer** | **Number of attempts**

Correct response – 1 | **1, 2 or 3**

Incorrect response – 0

Sample :

Participant	*Question No.*	*Answer*	*Attempts*	*Score*			*Answer*	*Attempts*	*Score*	
1 - 15/F	1 2 3 4	1 1 0 1	2 1 3 2	0.5 1.0 0.0 0.5	%		1 1 1 1	1 1 2 1	1.0 1.0 0.5 1.0	%

5



Observation Criteria

Ability to perform required task

Understandability of instructions

Navigation – Obstacles in the interaction flow of the program

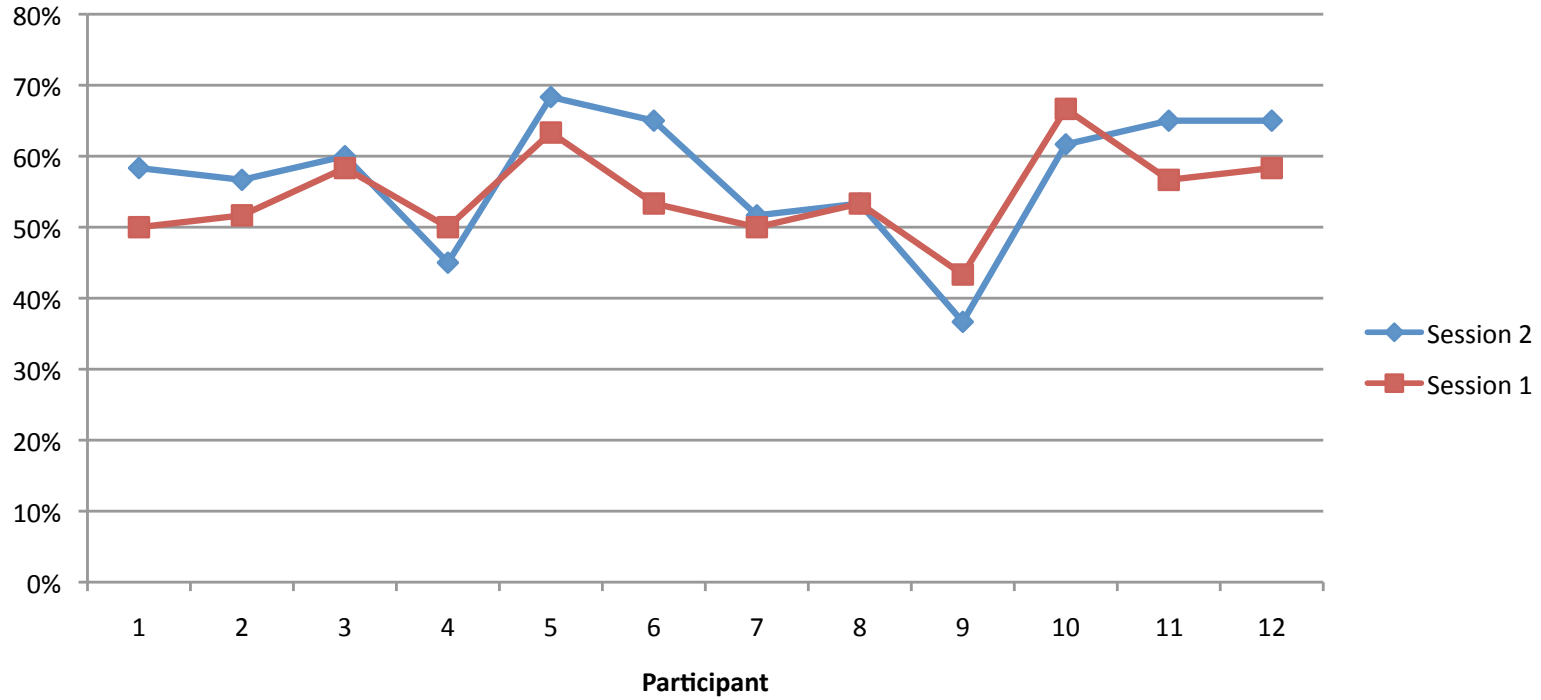
Level of ease in learning actions pertaining to a particular task

Time taken to learn new tasks

Comfort level with regards to the difficulty of the question

Common difficulties faced throughout the program

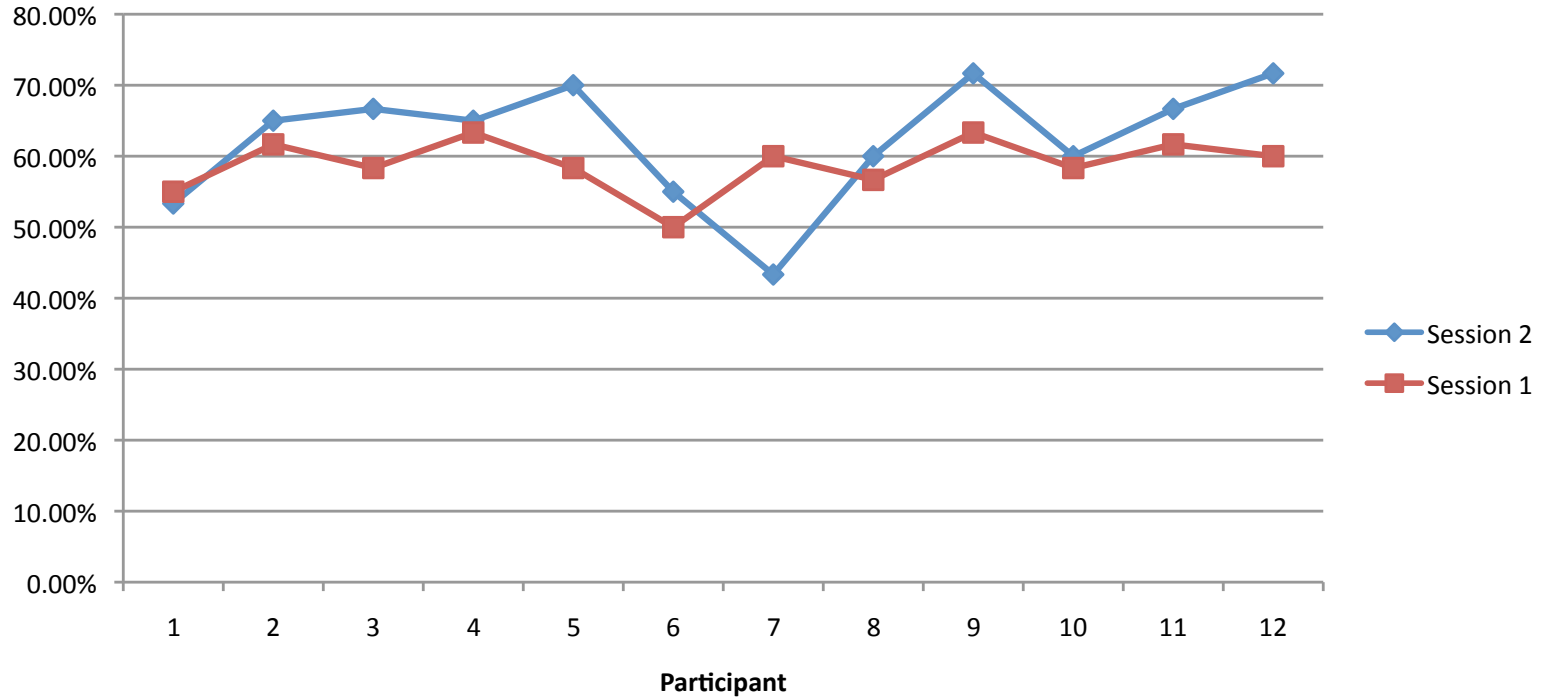
Flip or Freeze



Participant	*Session 1*	*Average performance*	*Session 2*	*Average Performance*	*Improvement*	*Overall improvement*
1 - 15/F	50.00%		58.33%		8.3%	
2 - 14/F	51.67%		56.67%		5.0%	
3 - 14/M	58.33%		60.00%		1.7%	
4 - 15/F	50.00%		45.00%		-5.0%	
5 - 13/M	63.33%		68.33%		5.0%	
6 - 15/M	53.33%	54.58%	65.00%	57.22%	11.7%	2.6%
7 - 15/M	50.00%		51.67%		1.7%	
8 - 16/F	53.33%		53.33%		0.0%	
9 - 14/M	43.33%		36.67%		-6.7%	
10 - 13/F	66.67%		61.67%		-5.0%	
11 - 15/M	56.67%		65.00%		8.3%	
12 - 14/M	58.33%		65.00%		6.7%	

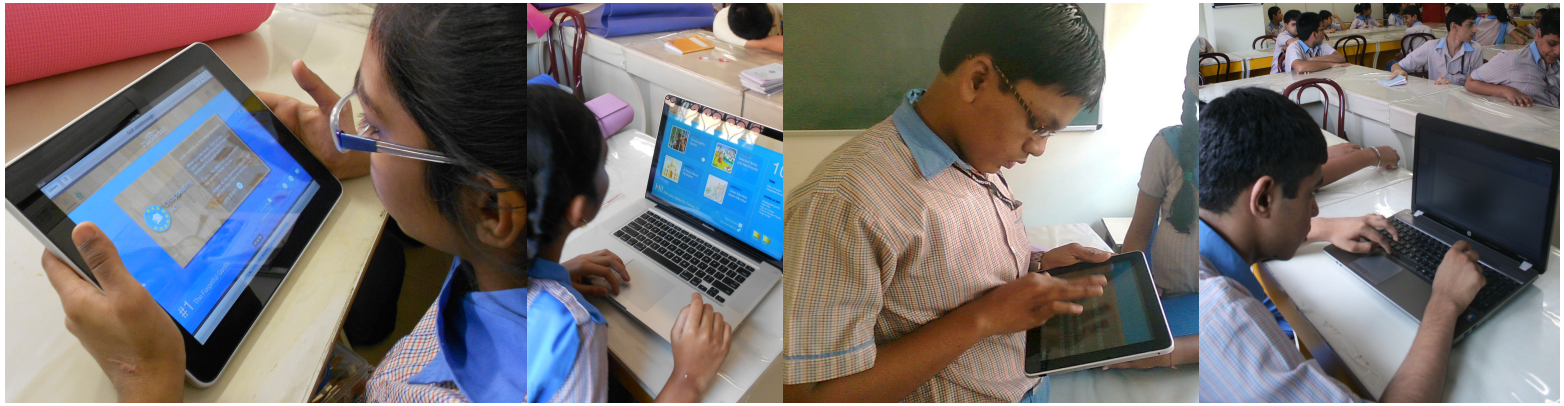
5

Disappearing Act



Participant	*Session 1*	*Average performance*	*Session 2*	*Average Performance*	*Improvement*	*Overall improvement*
1 - 15/M	55.00%		53.33%		-1.7%	
2 - 14/F	61.67%		65.00%		3.3%	
3 - 16/M	58.33%		66.67%		8.3%	
4 - 15/F	63.33%		65.00%		1.7%	
5 - 13/M	58.33%		70.00%		11.7%	
6 - 15/M	50.00%	58.89%	55.00%	62.36%	5.0%	3.5%
7 - 15/M	60.00%		43.33%		-16.7%	
8 - 14/F	56.67%		60.00%		3.3%	
9 - 15/F	63.33%		71.67%		8.3%	
10 - 15/F	58.33%		60.00%		1.7%	
11 - 13/M	61.67%		66.67%		5.0%	
12 - 14/F	60.00%		71.67%		11.7%	

5



Key observations

Alternative explanations prompted correct responses

Tasks that required holding information in memory for a long duration showed inadequate results

Alterations in level of difficulty of the tasks had a positive impact on performance

Appreciation after successfully completed tasks were incentives for better performance

Children were more likely to explore in the absence of a teacher; exploring as opposed to giving the right answer

Modifications to compensate poor visual scanning of the students

Simplification of fonts used and display of written information

5

MindRemind

Modifications and final prototype

EXERCISES STORIES

MindRemind

PLANNER YOU



STORY 1

The Forgetful Gorilla



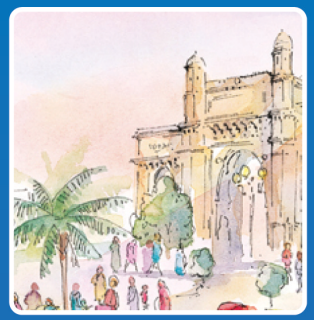
STORY 2

Talented Annie and Her Friends



STORY 3

Never Lonely Again!



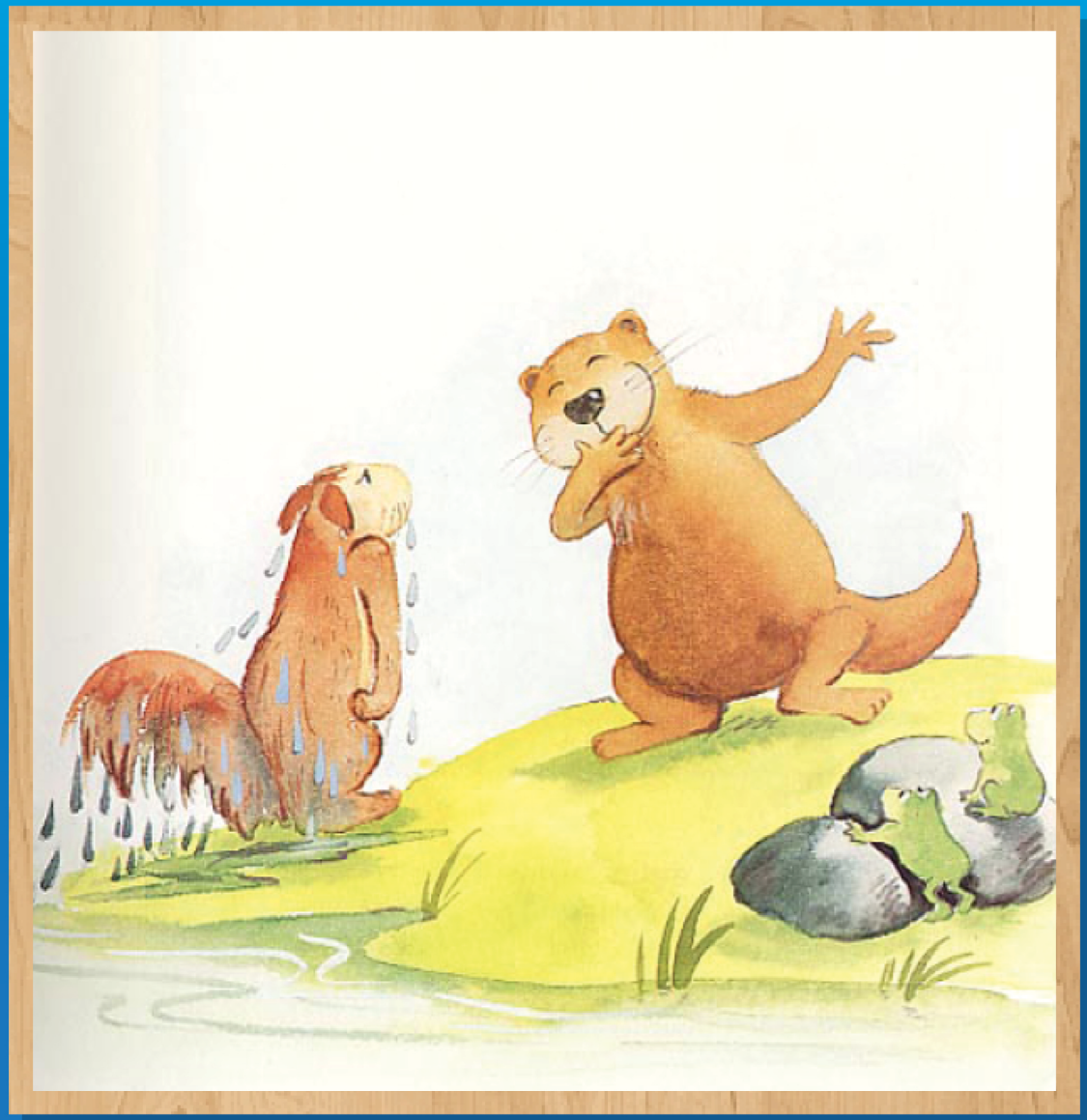
STORY 4

Clean Mumbai Green Mumbai

Hi! Are you ready to read a story?

More Stories

Unlocked Stories



Minnie said angrily “Is water your friend too?!”

“Ofcourse!” said Bobo.

“Water can be fun. And so can be wind. Come with me.”

“Never Lonely Again!”

THE END



BRAIN GYM



MORE STORIES

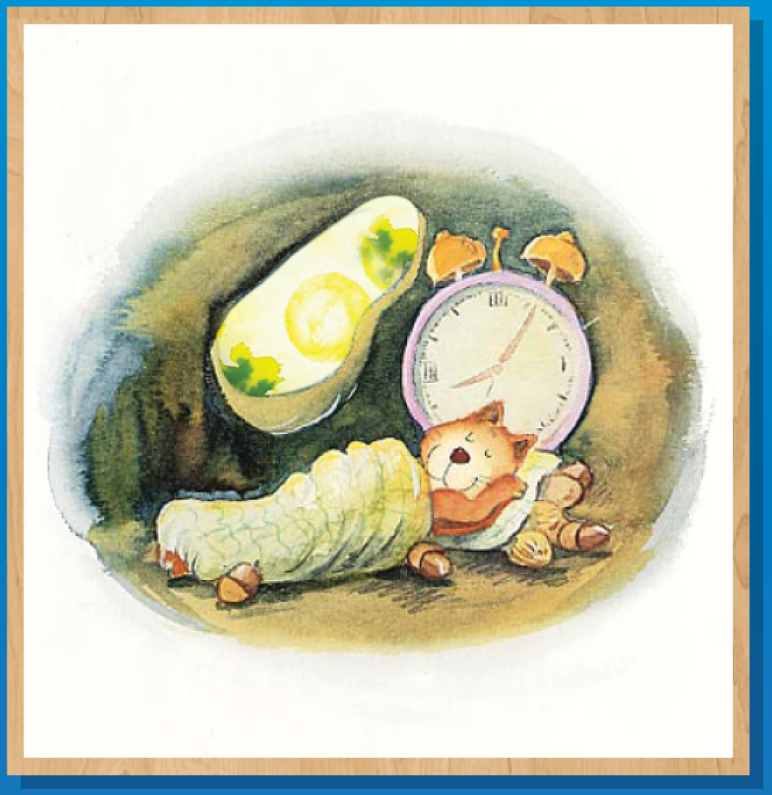


Flip or Freeze

Flip to change or Freeze to choose the image that answers the question

EXERCISES STORIES MindRemind PLANNER YOU

FLIP

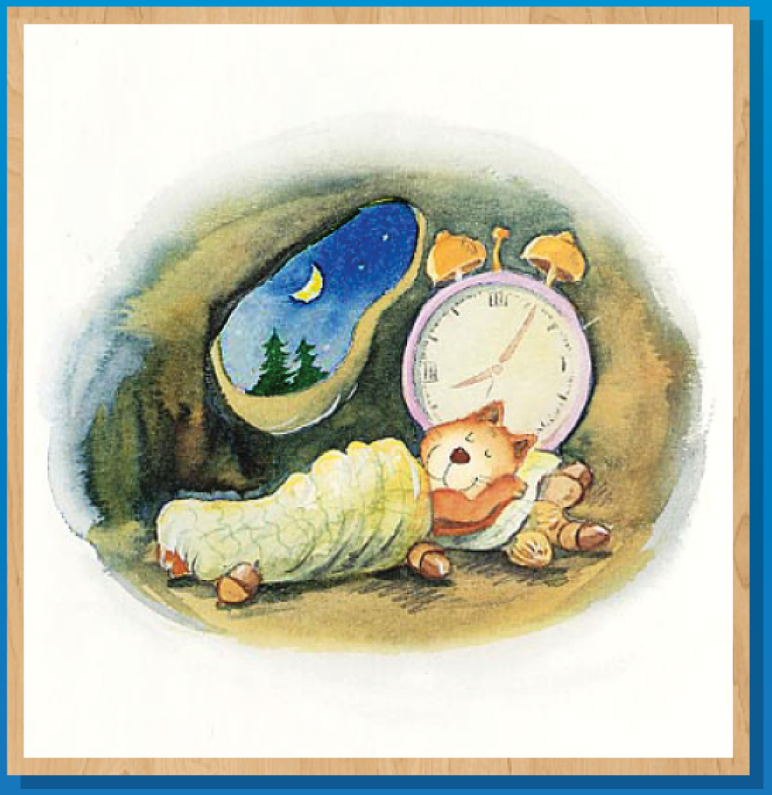


FREEZE

When did Minnie go to sleep?

EXERCISES STORIES MindRemind PLANNER YOU

FLIP



FREEZE

When did Minnie go to sleep?

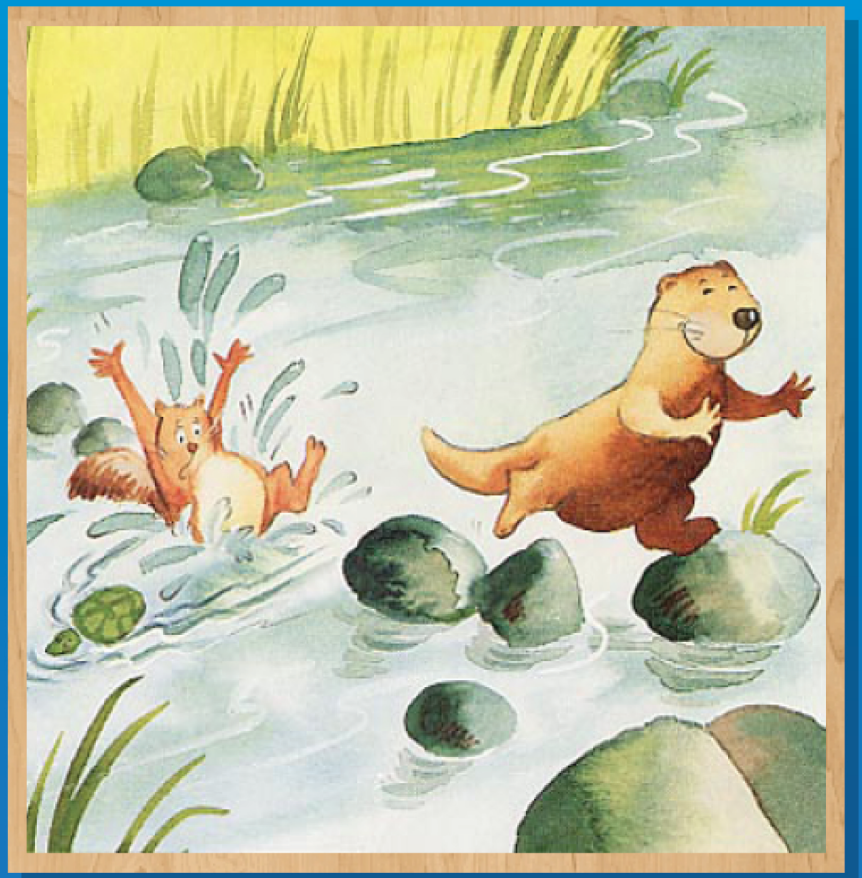


Disappearing Act

Look carefully at the image to identify the object disappearing from the scene

EXERCISES STORIES MindRemind PLANNER YOU

AGAIN

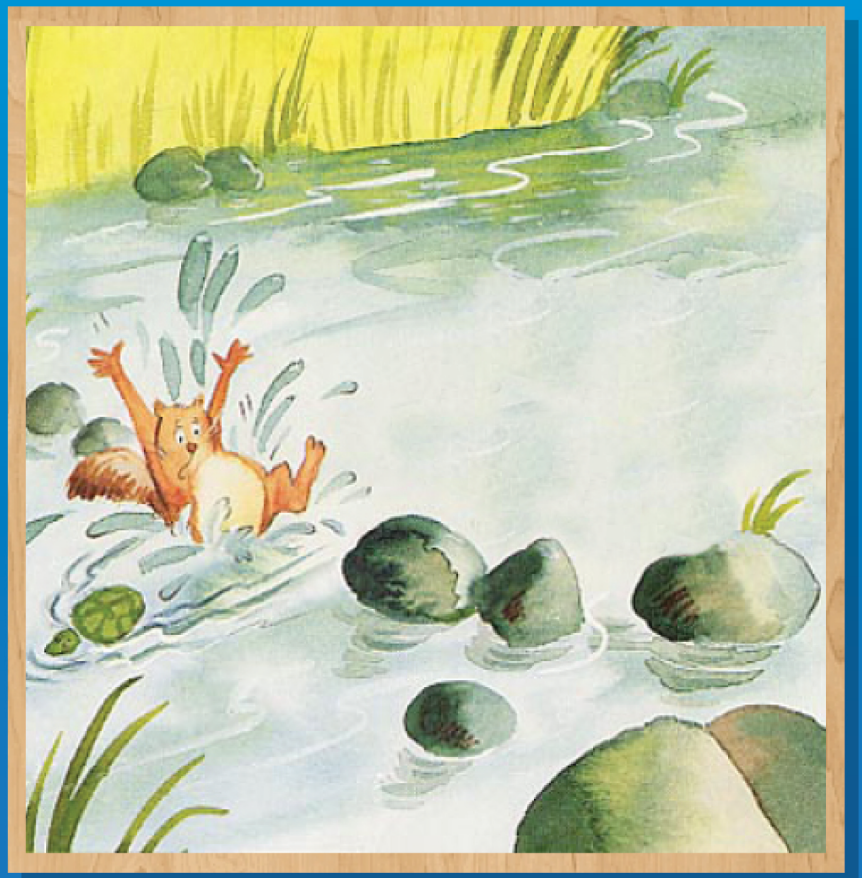


READY

Look carefully at the image

EXERCISES STORIES MindRemind PLANNER YOU

AGAIN



READY

Look carefully at the image






Which of these disappeared from the picture?



Hear Me

Listen carefully to the audio played and choose what the speaker said

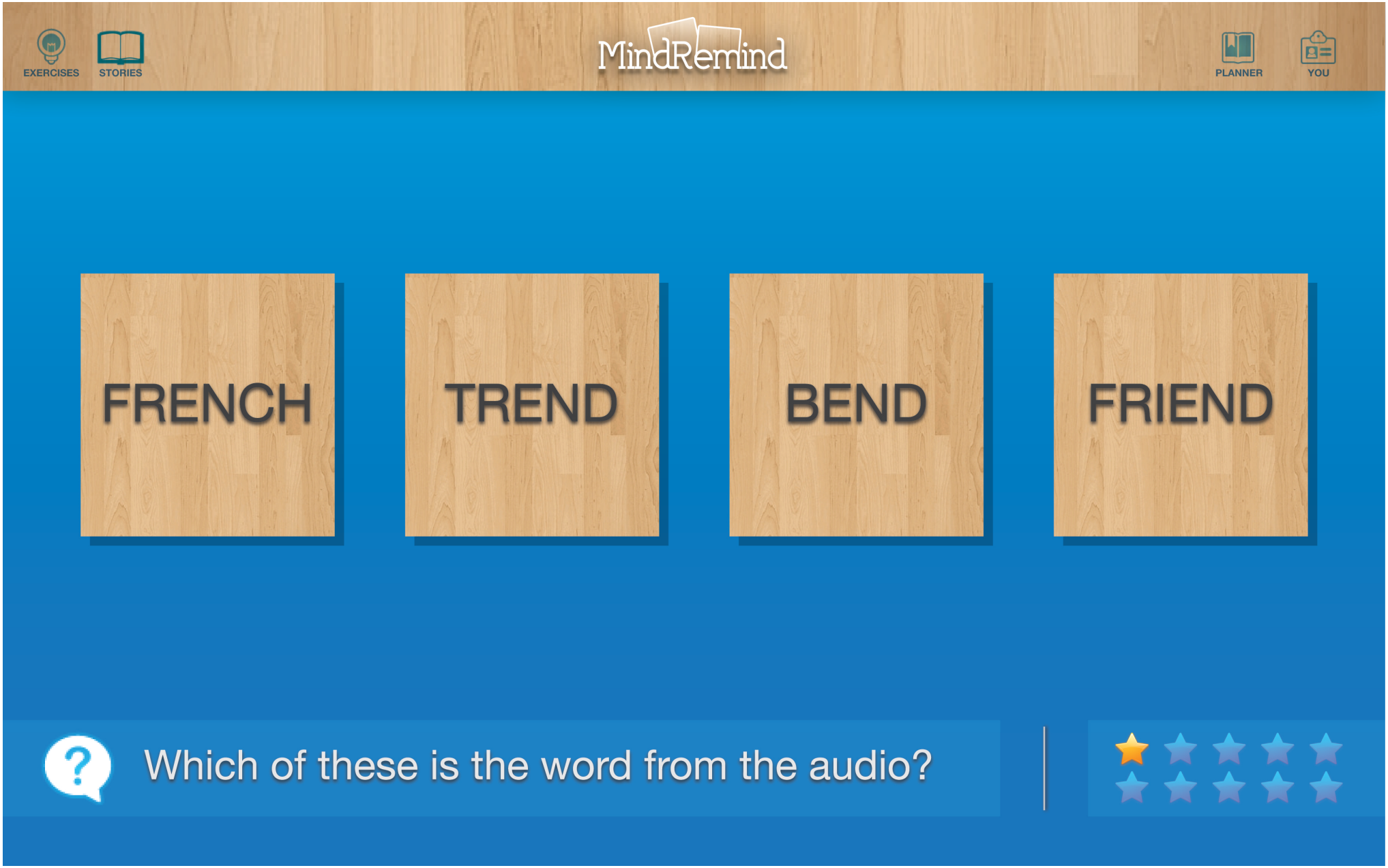
EXERCISES STORIES MindRemind PLANNER YOU

AGAIN



READY

Listen carefully to the audio


EXERCISES
STORIES
MindRemind
PLANNER
YOU
FRENCH
TREND
BEND
FRIEND
Which of these is the word from the audio?



CHECK, DOUBLE CHECK

Find the right sentence that matches the image



Suddenly she heard some noise.

She did not have anyone to play with.

She went closer to see the flowers.

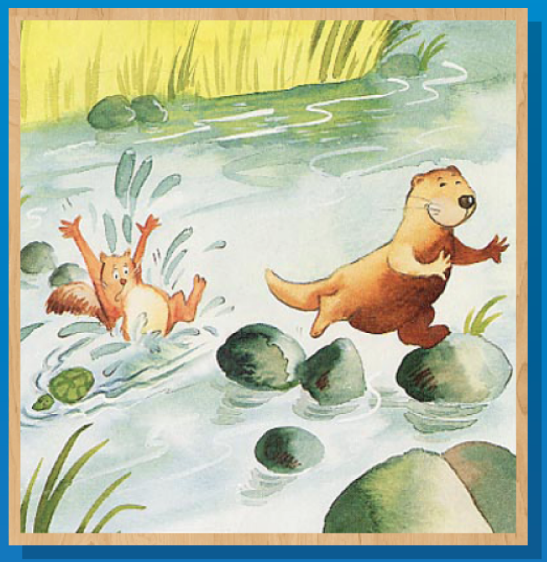
Choose the correct sentence for this image.



ORDER ORDER

Click on the images to put the story in right order

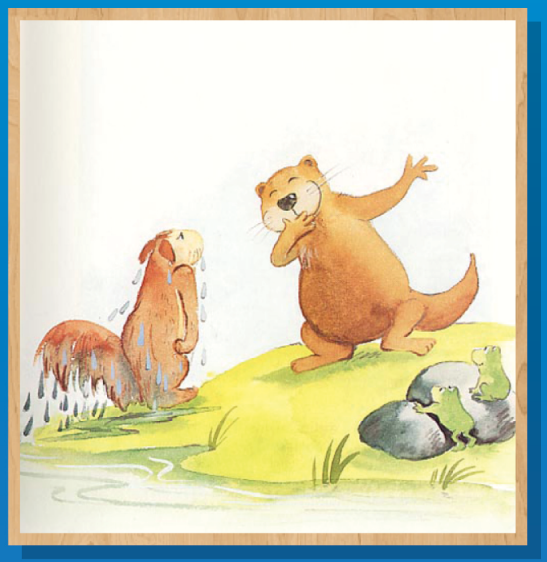
1



3



2



Choose the correct sequence of images.

CONGRATULATIONS!

You have earned a flag for completing the exercise!





- The system is usable by the child without any need of assistance from teachers, parents or friends
- The system provides scope for contextual association to lessons from classroom lectures and /or real life relatable examples
- The system encourages thinking and inquisitiveness in the child motivating the child to use the program on a regular basis
- As the student improves, the program adapts to the improved cognitive skills developed by the child
- The system provides information in multiple formats to the user (different types of users) in case of difficulty
- In case of an incomplete task or inability to complete a task, the system give multiple clues helping the child to discover the correct answer on his own
- The system provides ample appreciation in feedback to each successful completion of a task



Thank you