

# **LearnoBot: An AI-Based Agent for Mediating Instructions for Struggling Students**

**לרנובוט: סוכן מבוסס בינה מלאכותית לתיווך הוראות לתלמידים מתקשים**

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## **Development and Research Presentation**

In this project, we aim to enhance the learning experience of elementary school students with learning disabilities by developing an AI-based bot that will help them break down, explain, and demonstrate educational instructions in the language domain.

International reports indicate that the number of students in classrooms continues to rise. As teachers are required to attend to a large number of students, personal interaction becomes increasingly limited. Students with special needs integrated into the regular education system, especially those diagnosed with learning disabilities, struggle to keep up with the class pace and complete academic tasks. This results in learning gaps, frustration, and a decline in self-confidence.

This reality led us to the idea of developing a technological solution—an intelligent agent that provides immediate and accessible support for educational instructions. Imagine an AI-powered agent accompanying students during lessons. Whenever they need additional support to understand an instructional task, they scan the instruction with their mobile device, and the agent explains it, breaks down the steps, or provides an example to aid comprehension. The agent will be trained on an existing dataset we have collected, focusing on providing assistance in understanding educational instructions. This dataset includes specific teaching practices used by special education teachers to characterize effective mediational (supportive) behavior.

Nofar initiated this project, and it will serve as her master's thesis. As part of our research, we will examine how the application impacts students' academic success and emotional development.

With your help, we aim to create a learning environment where every student feels included and capable, with the necessary support to progress and succeed.

## Technical Overview

The system will consist of four main components:

- **Assistance in understanding instructions:** The core of the application that reads the student's question and provides an appropriate response.
- **Application Entry:** Student registration and instructions on how to use the application.
- **Teacher Management and Monitoring Tool:** A tool for teachers to track and manage student progress.
- **Log Extraction Tool:** Partial logging of student interactions with the application will enable analysis of usage patterns. If the dataset is too large, the project can be implemented in two phases. If only one group is used, predefined hooks should be created for future development of the logging system and teacher management system.

## Devices, Operating Systems, and Language

We aim for the application to function on mobile devices and computers (tablets would be a great addition) running Android and iOS, with support for Hebrew.

## AI Bot Training Data

We are currently preparing numerous examples of these tasks to train the AI bot. This includes Hebrew text inputs that students might provide and the expected responses from the system. Additionally, a preliminary study gathered assisted teaching practices used by human teachers. This information has been structured into a sequence of support actions—essentially, a toolkit of assistance strategies the AI can apply in various support scenarios. We aim for the developed application to incorporate this data.

## Closed LLM system

To maintain ethical standards, rights, and privacy of the participants, it is crucial to **create a chatbot within a closed LLM system** and not to build on platforms that connect to large models like ChatGPT or Dialogflow, where data is transmitted to third parties. I found this video that offers an idea about how to do this.

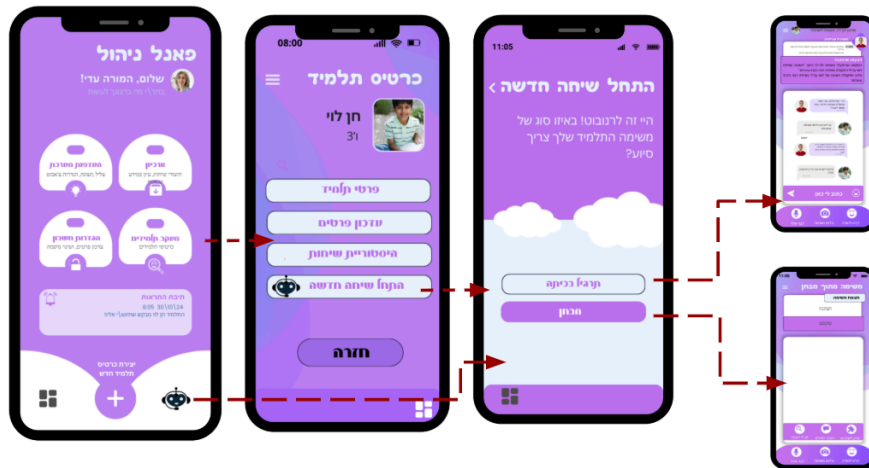
## Initial Design of the LearnoBot Application

A preliminary design of the application is described below.

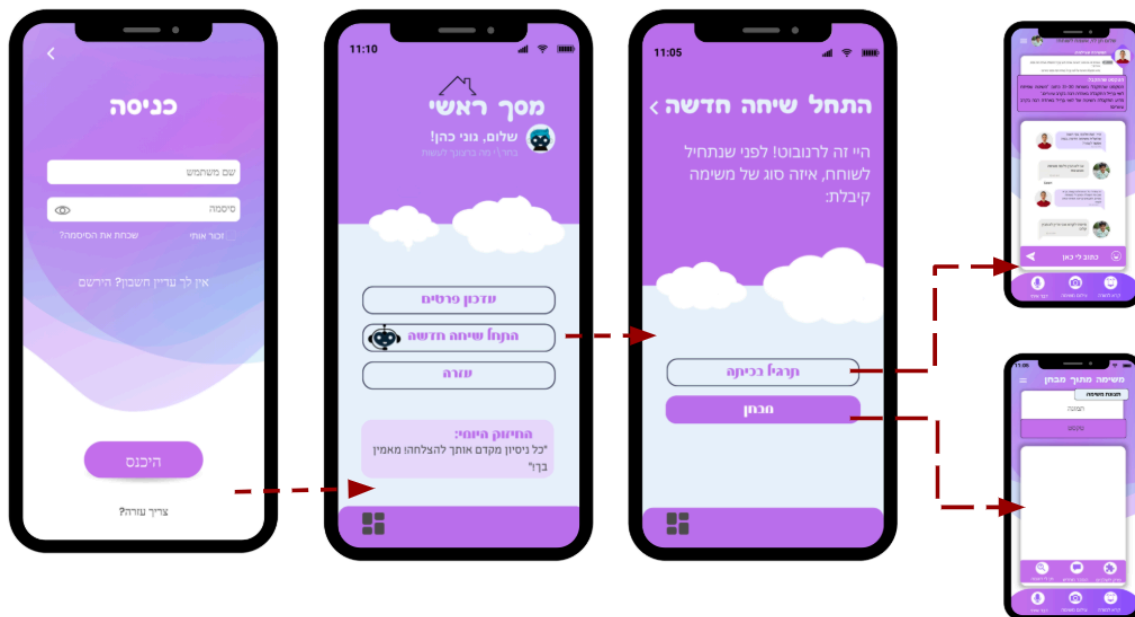
### 1. Task Mediation via AI Chatbot

This is the core component and the heart of the application. The idea is to enable students with special needs to receive immediate, accessible assistance in understanding instructional tasks.

**Some key considerations for chatbot design:** Illustrations 1 and 2 present a flowchart outlining how users can interact with the support agent.



**Figure 1:** Accessing the agent interface from the teacher's environment



**Figure 2:** Accessing the agent interface from the student's environment

## Test Mode and Practice Mode

We want the application to include options for selecting between two modes: "Practice" or "Test." It is likely that we will not develop the Test Mode at this stage, but we want to be prepared for future development.

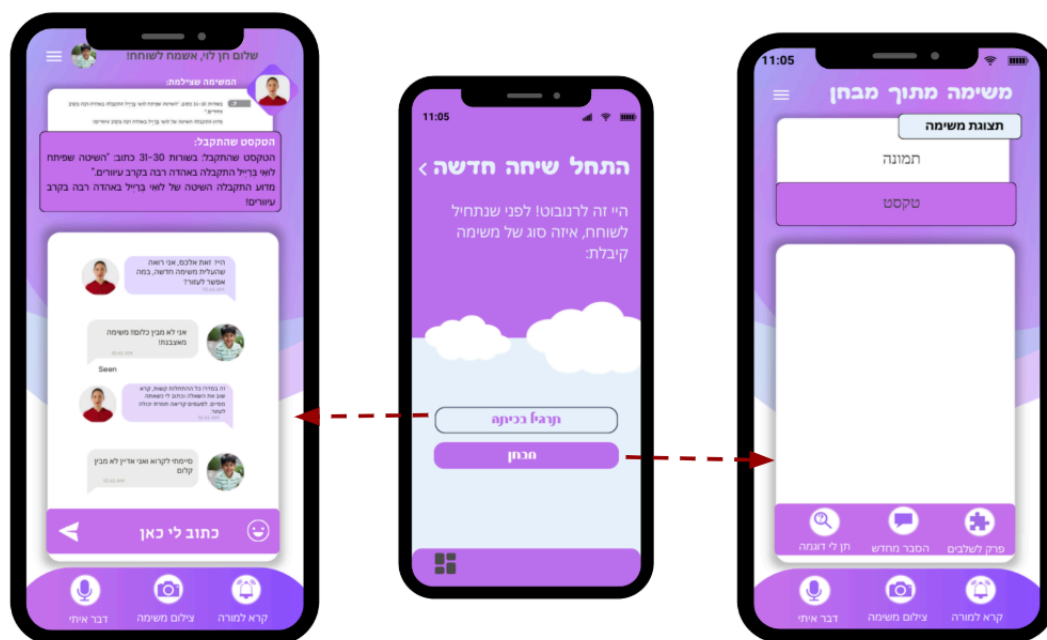
In Test Mode, the agent will provide minimal assistance. It will be able to perform tasks such as providing an example, breaking down a task into steps, and simplifying instructions—with a maximum of two repetitions (i.e., up to three examples, three levels of instruction simplification, and three levels of task breakdown).

Practice Mode will include two options, which we aim to compare:

- **Student Selection** – The student chooses the type of assistance they need using dedicated buttons (Break Down, Demonstrate, Explain).
- **Agent Selection** – A dialogue-based interaction simulating a teacher-student exchange. The agent will implement a pedagogy that we have not yet fully defined, but it will be based on professional teaching practices, balancing independent student work with guided problem-solving support.

We need to consider how a student enters Test Mode and ensure they do not switch back to Practice Mode independently

**Figure 3** presents a flowchart illustrating the two modes of the intelligent interface: Test Mode vs. Practice Mode.



**Figure 3**

## Focus and Prioritization in Case of Time Constraints

*If time constraints do not allow for the full design of both modes, we will prioritize designing the classroom practice mode over the test mode.*

*The second mode (test) could be marked in a way that users understand it as a "development zone" and that it is not currently available in the application. This could be indicated by a gray lock icon and/or an informational tooltip that appears when hovering over the lock icon (see **Figure 4**).*



**Figure 4:** Locked state of the "Test Mode" option.

## Functions to Integrate into the Chatbot

- **Task capture and upload** – Converting an image of a task into text, and if needed, translating it into English (in case there are no Hebrew-supported interfaces).
- **Call teacher button** – Pressing this button will send a notification to the teacher's mobile device, and the front indicator button will flash. Since the application is intended for multiple students, this feature should be designed so that when several students press "Call Teacher," the application organizes them in a queue, displaying the request order and timestamp.
- **"Talk to me"** – A feature for reading the verbal content aloud (to reduce cognitive overload and assist students with reading difficulties) and recording voice input (allowing students to record their questions instead of typing). This

requires a speech-to-text API.

- **Agent response satisfaction** – After each agent response, a question will appear: "How satisfied are you with the agent's response? 1 - Poor, 3 - Average, 5 - Excellent," with a selection between 1-5.

### Main tasks the agent performs:

פלט	קלט (שאלות מתוך מבחן מיצ"ב בשפה לכיתה ה')	
<p><b>טקסט:</b></p> <p>"מיכל השקיעה שעות רבות בלימוד נושא המתמטיקה, למרות שנכשלה במבחן הראשון. היא למדה מכל טעות וחיפשה שיטות חדשות כדי להבין את החומר."</p> <p><b>שאלה:</b></p> <p>מה אפשר ללמוד על אופייה של מיכל?</p> <p><b>תשובה לדוגמה:</b></p> <p>מיכל היא מתמידה, כי למרות שנכשלה, היא המשיכה להשקיע זמן בלמידה. זה מראה שהיא לא נכנעת לקשיים.</p>	<p>בשורות 11-13 כתוב: "למרות הקושי לקרוא בעזרת מישוש אותיות בולטות הצליח לואי ג'ריל לקרוא שוב ושוב את מעט הספרים שהיו בפנימייה, ואף התעקש ללמוד תווים לפי אותה שיטה ולנגן בפסנתר ובכינור." מה אפשר ללמוד מהכתוב בשורות האלה על אופיו של לואי ג'ריל? הסבירו את תשובתכם.</p>	הדגמה של פתרון בעיה דומה

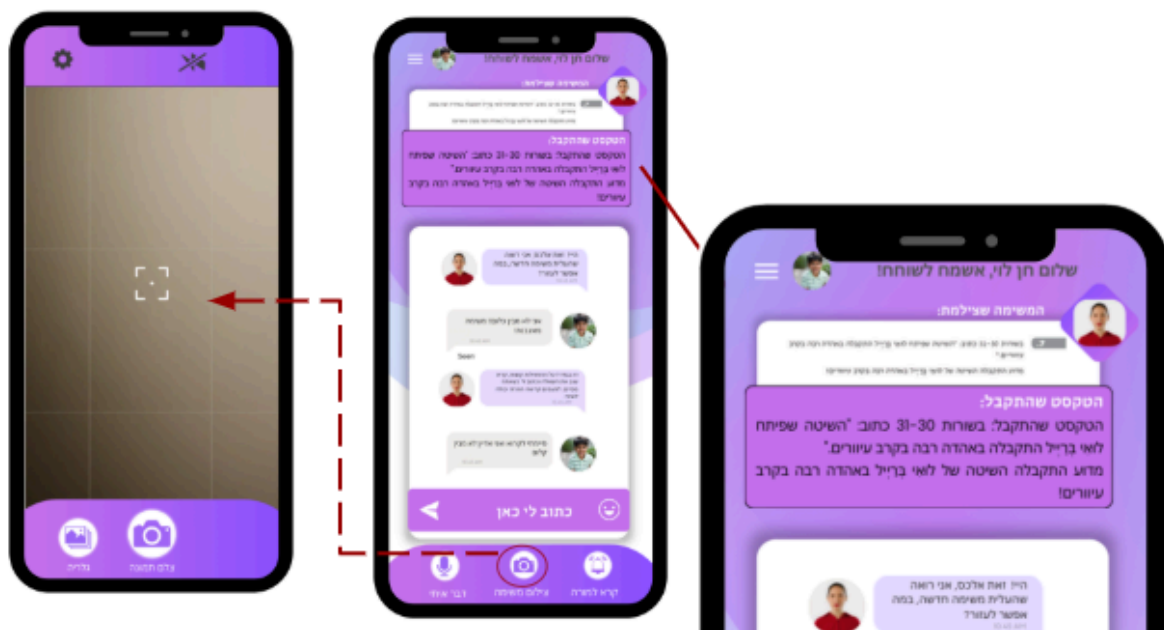
<p>נניח שכתבו על ממציא שהמציא משקפיים מיוחדות לאנשים עם קשיי ראייה.</p> <p>השאלה היא: למה משקפיים מיוחדות התקבלו באהדה? אפשר לחשוב כך:</p> <ol style="list-style-type: none"> <li>1. אנשים עם קשיי ראייה לא ראו טוב קודם.</li> <li>2. המשקפיים עזרו להם לראות טוב יותר.</li> <li>3. עכשיו הם יכולים לקרוא, לכתוב, ולעשות דברים שלא יכלו קודם.</li> </ol> <p>זה בדיוק מה שאתה עושה פה – אתה חושב איך השיטה של לואי ברייל שינתה את המצב לעיוורים ועזרה להם בחיי היומיום.</p>	<p>בשורות 30-31 כתוב: "השיטה שפיתח לואי ברייל התקבלה באהדה רבה בקרב עיוורים." מדוע התקבלה השיטה של לואי ברייל באהדה רבה בקרב עיוורים?</p>	<p>הדגמה של פתרון בעיה דומה</p>
<p><b>הנה רעיונות או דרכים שיעזרו לך להבין איך להתחיל את המשימה:</b></p> <ol style="list-style-type: none"> <li>1. דמיון את המצב של עיוורים לפני השיטה: איך הם הצליחו לקרוא או לתקשר? האם זה היה קל או קשה?</li> <li>2. חשוב : איך השיטה החדשה של לואי הקלה עליהם?</li> <li>3. נסה לנסח תשובה ראשונית, לדוגמה: "השיטה עזרה לעיוורים כי..."</li> </ol>		<p>פירוק הוראות</p>
<p>השאלה שואלת למה השיטה של לואי ברייל הייתה אהובה על ידי העיוורים?</p>		<p>הסבר של הבעיה</p>

In **Figure 5**, you can see the function bar as it appears at the bottom of the chatbot screen:



**Figure 5:** Function toolbar

**Figure 6** shows a flow chart of what happens when the "Photo Task" button is clicked.



**Figure 6:** Task Capture Function. The task image will be displayed in a window with a white background at the top of the screen. Below it, in a purple box, the extracted text from the captured image will be shown.



## Additional Functions to Integrate If Feasible

- **Avatar integration** – Embedding an AI-generated avatar (e.g., created with Synthesia AI) that synchronizes lip movements with the dialogue.
- **Reporting and teacher notifications** – A preliminary study identified low student motivation (e.g., lack of cooperation) as a potential barrier to AI-mediated interaction. Some teachers expressed concern about whether an AI-assisted interface could handle such situations.
  - As a possible solution, when interaction stalls (e.g., a student repeatedly responds "I don't know" or engages in unrelated conversation), the chatbot should have a defined option to call the human teacher.
  - Additionally, we want to include an option for reporting difficulties or unusual situations encountered during the mediated interaction.

## Example Data Collected in the Preliminary Study

Our research found that many teachers use the term "**balanced mediation**" to describe the assistance they provide during tests. Mediation refers to various actions that support students' understanding of academic tasks.

**Balanced mediation** means providing minimal guidance that does not direct students toward the correct answer. We define minimal mediation as up to two examples, breaking down instructions (to a certain degree), and one explanation.

The three most common strategies reported by teachers in the study were:

1. **Instruction simplification**
2. **Providing examples** (e.g., connecting tasks to students' daily lives)
3. **Breaking down tasks into steps**

These three functions were incorporated into the chatbot's **minimal mediation mode**.

## Example of a Mediated Interaction in Test Mode

1. **Student uploads an image of the instructions**
2. **System converts image to Hebrew text**
3. **Text is translated into English**
4. **Agent selects the appropriate response**
5. **Response is translated back into Hebrew**
6. **Response is displayed to the student**

If the text exceeds a certain length, it may need to be broken into components, with explanations provided for each part separately before presenting them together.

If a student repeatedly requests the same function, the system will offer a simplified version of the original response. For example, the chatbot will use increasingly simple language to rephrase the task instructions.

Here is an examples of the algorithm translation that Nofar performed for a report by one of the teachers in the preliminary study:

## Example of an Algorithmic Interpretation of Teacher Reports

**Example 1:** (Extracted from Teacher Report 6)

- **Every time** "student does not understand the task," instruct them to highlight key information – marking question words and instruction words.
- **If** this does not help → **then** prompt them to reread the task ("task decoding").

**Example 2:** (Extracted from Teacher Report 3)

1. **If** "student does not understand," **then** identify the source of difficulty. Example prompts:
  - "I see you raised your hand—why did you call me?"
2. **If** this does not help → **then** guide the student to **task decoding** (rereading the task). Example prompts:
  - "Alright, read it to me." → "What do you understand you need to do?"
3. **If** this does not help (student responds "I don't know") → **then** guide them to **highlight key information** (e.g., question words). Example prompts:
  - "Okay, let's start marking. What's the question word here?"
4. **If** this does not help → **then** provide structured **guided questions** to lead the student toward understanding.
5. **If** this does not help → **then task simplification** (e.g., "Basically, they're asking you to find out where Danny went on Monday morning").

An experimental translation attempt into a code language (presented here in the first part of the report):

```
def teach_student():
    while not student_understands():
        if not clarify_difficulty():
            if not ask_to_reread():
                if not ask_to_highlight_keywords():
                    if not ask_guiding_questions():
                        if not simplify_task():
                            if not guide_to_answer():
                                skip_to_next_question()
                                break

# אפשרויות נוספות אם התלמיד עדיין לא מבין
additional_strategies = [
    remind_strategies,
    provide_example,
    highlight_question_words,
```

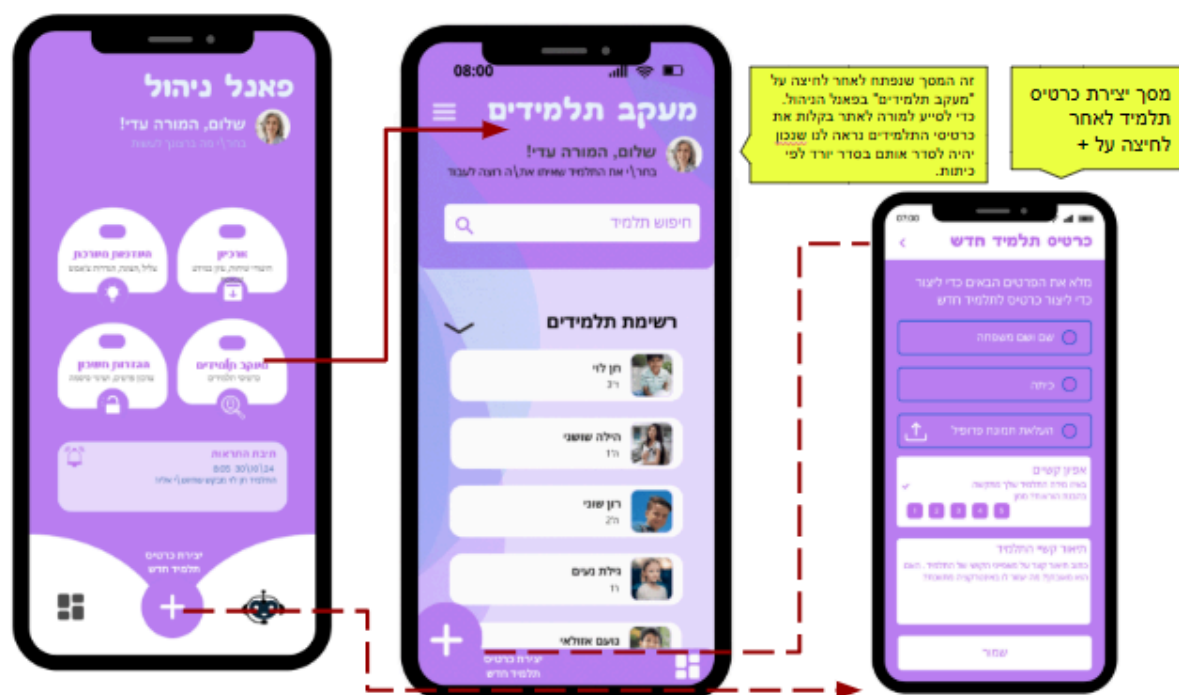
## 2. Teacher Management Panel

Through the management panel, we want the teacher to have the option to:

- Change **system preferences** - display, sound, chatbot settings (choose between test mode and practice mode)
- Access the **"Archive"** - where chat records and information gathered from interface use will be saved.
- Modify **account settings** - update account details such as username and password change.
- **Manage and track student lists** - we want the application to include an option to create different profiles for different students, with all the student cards created by the teacher appearing on this screen. When a teacher works with a particular student, they can open that student's card and continue the conversation with the smart agent from there. This option will allow us, the researchers, to collect and organize usage data under the same user consistently.

*\*To ensure ease of operation and data entry into the system (e.g., when creating a new student card), we want the application design to include an option to access the management features of the "Teacher Panel" also from a computer (as mentioned in the technical introduction, which was presented above).*

In **figures 7-10**, you can see a flowchart of the management panel options:



**Figure 7:** Creating a New Student Profile – The idea is to allow the creation of different profiles for individual students.

The student profile creation screen will enable the collection of background information about the student, who is a participant in the study, and store this information in an organized manner within the system. On the profile creation screen, the teacher will be

prompted to fill in details such as full name, grade, rate the student's difficulty in understanding instructions, and provide a free-form description of the student's difficulties. To help teachers easily locate student profiles, we believe it would be beneficial to design the application so that student profiles are organized by grade, in descending order.

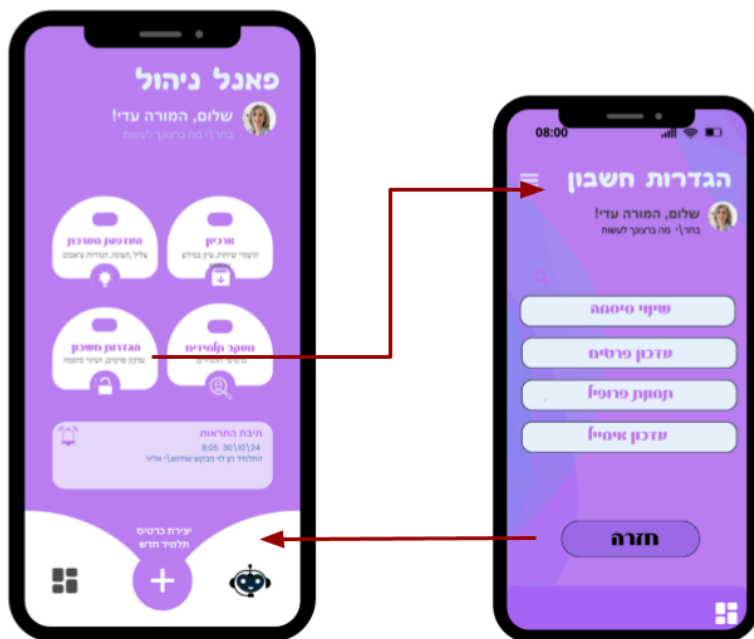


**Figure 8:** Describes what happens after selecting a student from the list; a screen opens showing the selected student card through which you can access background information about the student, conversation history with the smart agent, and the option to start a new conversation.

**Figure 8** also shows an example of what happens when you click the "Start Conversation" option; the Start Conversation screen leads to the task type selection screen.



**Figure 9:** When the student clicks "Call Teacher," a notification is sent from Learnobot to the teacher's mobile. In Figure 9, you can see how this will look. We want the front indicator light to blink upon receiving the notification because sometimes teachers switch to silent mode during their work. When multiple students click on the "Call Teacher" button, the application will organize the students in the order in which they called, which will be displayed to the teacher.



**Figure 10:** You can see how to access account settings through the management panel and what they include.

### 3. Login Screens and Application Registration System

To overcome ethical limitations related to the security of participant information, we want the application to include a registration system for both teachers and students. Registration will be possible in two modes: as a "Teacher" or as a "Student."

Choosing the "Teacher" option during registration will create an account with more extended options than the "Student" account and will also include a "Management Panel" screen.

In Figure 11, you can see a flowchart of the login and registration screen as we envision it:



**Figure 11:** Login and registration screens for the system

## **Other Important Information:**

**Information:** If you are not familiar with what a chatbot is, you can check out the following video by IBM Technology that explains what you need to know:

<https://www.youtube.com/watch?v=o9-ObGgfpEk>

To maintain ethical standards, rights, and privacy of the participants, it is crucial to **create a chatbot within a closed LLM system** and not to build on platforms that connect to large models like ChatGPT or Dialogflow, where data is transmitted to third parties. I found this video that offers an idea about how to do this.