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# Oscar: The Generative AI student assistant

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## Abstract

1 We introduce Oscar, a personalized educational assistant serving as a companion  
2 to young students to maximize the quality of education and enable them to learn  
3 at their own pace. Our formulation uses a comprehensive set of attributes that are  
4 needed to be modelled to provide individualized learning to students. We discover  
5 these attributes using an ensemble of three LLMs. We then use the attribute-based  
6 profile to build a GenAI solution for individualized learning. Through manual  
7 human annotation, we identify that only 19% common attributes are provided by all  
8 three LLMs, while 31.5% are common across two LLMs; and the remaining 49.5%  
9 are specific to only one of them; demonstrating diverging understanding across  
10 LLMs. Utilizing a consolidated attribute profile, Oscar displays highly customized  
11 responses to individual student needs. We discuss the strengths and limitations of  
12 the approach and offer recommendations for educators, GenAI developers as well  
13 as policymakers to promote the integration of GenAI tools in childhood education.

## 14 1 Introduction

15 The current educational system stems from the education system we had 150 years ago, teaching  
16 based on the same model that was used during the Industrial Revolution [1]. This way of teaching  
17 was optimal for the time, however, in the 21st century, the path known to accomplish the same  
18 level of excellence requires additional activities, such as starting a non-profit, and participating  
19 in competitions. The current education system does not include such activities. Additionally, the  
20 existing schooling system has a one-path-for-all approach, irrespective of a student's interests or  
21 skills until the 12th grade. As a result, students are forced to shape their life in a predefined way till  
22 the age of 18, instead of carving their paths based on exploration and aptitude. This work focuses on  
23 young students from preschool to middle school.

24 We propose Oscar, a GenAI-based individualized education solution. It is an educational tutor that  
25 will provide a custom path to each student based on their aptitude while adhering to a designed  
26 curriculum. Oscar achieves this by first asking what the student's interests, likes and dislikes are and  
27 thus creates the student's profile, which will help the AI to initiate conversation and form a basic  
28 work outline. Then the AI will observe the student's engagement and enthusiasm within each area, to  
29 predict the student's future interests and morph the pathway. Oscar will continuously observe the  
30 students and keep developing an enriched and personalized path, providing the education that will  
31 help them learn at their own pace.

32 The contributions of this work are fourfold. First, we are the first to identify student profile attributes  
33 that need to be modelled for individualized learning experiences as a consensus of three LLMs and  
34 two human preschool teachers, to the best of our knowledge. Second, we identify that LLMs agree  
35 only 19% of the time on key attributes. Third, we demonstrate a GenAI solution using LLM prompt  
36 tuning which provides an individualized learning experience that maximizes the engagement of young  
37 students. Fourth, we identify strengths, opportunities and risks associated with GenAI in education  
38 and offer recommendations to AI developers, educators and policymakers.

## 39 2 Relevant Work

40 Recently, a thesis published in April 2024 by the University of Eastern Finland explored the use of  
41 AI and machine learning in educational robotics for K-12 students [2]. It proposed a new robotics kit  
42 designed to foster innovation and engage students in STEM learning. The assistant would leverage  
43 machine learning techniques to provide personalized guidance, adaptive content, and real-time  
44 feedback to students as they interact with the educational robotics platform. The thesis outlined the  
45 design, development, and evaluation of this AI-powered educational robotics system, highlighting its  
46 potential to enhance student’s learning outcomes.

47 Moreover, a study done by Locky Law in March 2024 [3] about the application of GenAI for teaching  
48 language found that there are research gaps in the field related to the effectiveness of GenAI tools  
49 and highlighted the need for stakeholder engagement. Similarly, a research paper by Abdullahi Yusuf  
50 et. al. [4] informs about the ethical boundaries that can be crossed with GenAI in today’s higher  
51 education system, such as plagiarism.

52 Relevant to our work, a research article from May 2024, titled "Fostering students’ AI literacy  
53 development through educational AI assistants," explores the use of generative AI (GenAI) as a tool  
54 for young students [5]. It highlights how AI assistants can improve students’ understanding and  
55 engagement with AI technology through user-friendly, age-appropriate interfaces Furthermore, the  
56 study found that using educational AI assistants enhanced students’ grasp of AI principles, their  
57 ability to identify AI applications, and their overall interest in the subject. The findings suggest  
58 GenAI’s potential to boost AI literacy among young learners.

## 59 3 Methodology

60 We develop Oscar through a three-step methodology. First, we build a consensus student profile using  
61 an ensemble of three LLMs and two highly qualified preschool teachers (> 10 years experience). This  
62 is achieved by asking the LLMs what are the key attributes that need to be modeled for a student’s  
63 profile for individualized education. The consensus list is built across the LLMs and verified by the  
64 two expert teachers. These created the profile attributes that Oscar needs to model

65 Second, we conducted an open-ended survey with preschool teachers to identify aspects that are  
66 required to keep students engaged and enhance their learning experience. These created insights for  
67 the prompts of Oscar.

68 Third, we iterated over a series of prompt iterations, totalling 16, to create Oscar. The final Oscar  
69 prompt is publically available at github<sup>1</sup>, and interactive ChatGPT<sup>2</sup>. In the first iteration, we created  
70 a prompt that steered the LLM to act as the tutor figure the student wanted it to be. This prompt did  
71 not achieve any of the given tasks. We then added instructions on observing the student’s response,  
72 tone and content to morph the AI’s personality towards serving as the friend the student needs. This  
73 prompt was better as it started using examples from the student’s interests. Through experimentation,  
74 we identified relying on profile attributes steered Oscar towards the desired behaviour.

75 We used the following three base LLMs in this work, 1) ChatGPT, v3.5 from OpenAI, 2) Gemini 1.0  
76 Pro, from Alphabet Inc. and 3) Claude Sonnet 3.5, from Anthropic. The final prompt is built using  
77 OpenAI’s ChatGPT-3.5. We used the *wordcloud* library in Python to plot the word cloud and used  
78 ChatGPT to help with coding.

Table 1: Attribute agreement among GPT-3.5, Sonnet 3.5, and Gemini 1.0 Pro

# of Attributes	LLMs in Agreement	% of agreement
35	1	49.5%
24	2	31.5%
14	3	19%

<sup>1</sup><https://github.com/MansurAKhan/Oscar/blob/main/prompt>

<sup>2</sup><https://chatgpt.com/share/2291e5b6-ed76-4241-8b9e-82fad5c760f9>

79 **4 Results**

80 **4.1 Profile Attribute Analysis**

81 We first identify consensus attributes to represent a student’s profile using LLMs. We  
 82 found 75 unique attributes when asking three different LLMs (GPT-3.5, Gemini 1.0 Pro, and  
 83 Claude 3.5 Sonnet) for 40 attributes each. We cross-referenced the attributes from each  
 84 LLM through manual annotation and found that 19% of the attributes were the same across  
 85 all three LLMs, 31.5% were common across two LLMs, and the remaining 49.5% were  
 86 provided by only one (see Table 1). This lack of agreement between the LLMs indicates the  
 87 concept of personalized education is not equally understood across the models. Figure 4.1 shows  
 88 all the 17 attributes while source breakdown data is provided in github<sup>3</sup>.

92 Two expert preschool teachers reviewed the 14  
 93 consensus attributes similar across the three  
 94 LLMs and verified them to be accurate. Three  
 95 additional attributes were sourced from experts  
 96 in Montessori teachers to build a list of 17  
 97 attributes that represent the characteristics that  
 98 need to be modelled for personalized education  
 99 as shown in Table 2.



Figure 1: Word cloud of all attributes generated by GPT-3.5, Sonnet 3.5, and Gemini 1.0 Pro

Table 2: List of attributes determined for an accurate profile of student

Attribute	Source
Decision-making Skills	LLM Ensemble
Learning Style	LLM Ensemble
Learning Preferences	LLM Ensemble
Learning Pace	LLM Ensemble
Academic Goals	LLM Ensemble
Motivation Factors	LLM Ensemble
Attention Span	LLM Ensemble
Collaboration Skills	LLM Ensemble
Communication Skills	LLM Ensemble
Resilience	LLM Ensemble
Learning Motivation	LLM Ensemble
Technology Proficiency	LLM Ensemble
Reading Level	LLM Ensemble
Problem-solving Skills	LLM Ensemble
Teacher Patience Level	Montessori
Teacher Social-Emotional Skills	Montessori
Teacher Ability to Focus	Montessori

100 **4.2 Model Comparisons**

101 To measure the effectiveness of Oscar as an AI  
 102 assistant, three different modelling scenarios are compared. Model 1 simulates the average teacher,  
 103 Model 2 is a NaïveGenAI without attribute profile, and Model 3 is Oscar. The student’s name is Sally  
 104 and the input given to each model is: ‘I need help drawing the eyes for my pirate!’. Here are the  
 105 responses of each of the models:

106 **TeacherSimulation:** That sounds like a fun project, Sally! Let’s start with the eyes. Do you want  
 107 them to be big and round like cartoon eyes, or more realistic? And are you drawing a friendly pirate  
 108 or a fierce one?

<sup>3</sup>[https://github.com/MansurAKhan/Oscar/blob/main/oscar\\_attributes.csv](https://github.com/MansurAKhan/Oscar/blob/main/oscar_attributes.csv)

109 **NaïveGenAI:** That sounds like an exciting drawing! Pirates have such cool looks, don't they? For  
110 the eyes, let's start with a bold, adventurous look. How about drawing one eye wide open like they're  
111 searching the horizon, and the other eye could be winking mischievously? What do you think?

112 **Oscar:** Ahoy, Sally! Drawing pirate eyes is a grand task! Are you imagining fierce, bold eyes like a  
113 captain's, or maybe mischievous eyes like a sneaky crew mate? Let's sketch them together!

114 TeacherSimulation and NaïveGenAI have similar responses. In contrast, Oscar responded in a pirate-  
115 like voice, with descriptive language related to Sally's interest in pirates such as 'mischievous eyes  
116 like a sneaky crewmate'. When queried for the profile Oscar created for Sally, her Motivation Factors  
117 are labelled as '*Enthusiastic and quick to engage in topics of interest, like pirates and adventurous*  
118 *stories.*' and her attention span as '*Engages deeply in activities she finds exciting, like drawing*  
119 *pirate adventures.*' Oscar demonstrated building and using the attributes to respond to Sally with a  
120 pirate-like voice and descriptive language to attract her attention.

## 121 5 Discussion

122 **Societal Impact.** The solution constructed a personalized pathway towards success in a student's skill  
123 set and created a personality profile of the student which included the student's interests (academic  
124 and non-academic). The solution used this profile to engage the student, creating an educational  
125 path that allows them to complete more activities linked to their aptitude and excel in their area of  
126 interest. Notably, an AI assistant would be advantageous to students who require attention from their  
127 tutors, thus closing the achievement gap between students needing further aid and those who don't.  
128 Therefore, AI assistants will help us create a more inclusive society with motivated young students.  
129 and emphasize the areas of interest

130 **Strengths:** GenAI can create an accurate profile by analyzing the message length, tone, and vocabu-  
131 lary. It can change its personality to become the figure that engages the student based on their profile.  
132 This ability makes AI supportive and approachable. AI can steer focus and growth on the subjects the  
133 student needs to enhance their skillsets and recommend inline extracurricular activities.

134 **Limitations:** GenAI occasionally forgets the main objective of teaching the student. When reminded,  
135 it stopped using the student profile to engage. These limitations show its inability to multitask and  
136 respond with 100% certainty. Further, LLMs today require a typing-based interface, which is elusive  
137 for preschool-age students.

## 138 6 Recommendations

139 We finally present recommendations for AI developers, educators and policymakers. **For AI develop-**  
140 **ers,** it is important to improve GenAI models to consume audio and video inputs. This will remove  
141 barriers for GenAI to engage with audiences that do not read and write fluently, such as preschool  
142 students. Secondly, large language models (LLMs) need to be powerful enough to do multiple tasks  
143 simultaneously and remember the tasks given to them. These improvements are necessary for the  
144 wide-scale adoption of GenAI in education. **For educators,** we recommend actively adapting GenAI  
145 solutions to support the students in carving their educational pathways. This will help students to  
146 proceed at their own pace.

147 **For policymakers,** we recommend integrating GenAI solutions into early childhood education, so  
148 that every student has access to it and can gain the benefits of support tailored to their educational  
149 needs. We consulted Redmond City Council Member Osman Salahuddin on the use of GenAI in  
150 early childhood education. "*By implementing AI solutions to support childhood education initiatives,*  
151 *we can help our youth become prepared for real-world scenarios at a young age.*" said Osman  
152 *Salahuddin, City Council Member of Redmond, WA.*<sup>4</sup>

153 However, privacy and security are two major risks associated with GenAI solutions. Given that the  
154 profile is unique to each student, we recommend the student profile should be considered sensitive  
155 as personally identifiable information (PII). Further, we encourage policymakers to form laws that  
156 provide provisions to the consumers of GenAI solutions for being able to request deletion of their  
157 data at any time they'd like, similar to the European GDPR Law.

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<sup>4</sup>quote with permission; received June 2024 via personal communication.

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