Market Research and Validation

Sagar Chethan Kumar
sagar@andl.io

Atilla Colak
atilla@andl.io

Manu Gautam
manu@andl.io

Neel Lodha
neel@andl.io

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1 Introduction

The release of ChatGPT on November 30, 2022, marked a pivotal moment in the integration of artificial intelligence into everyday life. What began as a tool for basic coding assistance and fact-checking has rapidly evolved into an AI capable of performing roles traditionally held by professionals, such as teaching, accounting, and legal assistance. The proliferation of AI technologies, particularly large language models (LLMs), has opened new horizons across various domains.

However, this rapid adoption comes with significant risks. In complex fields like higher education, the unregulated and unchecked use of AI can lead to the dissemination of biased or incorrect information[1]. Over-reliance on AI-generated responses may undermine students' critical thinking skills and comprehension, potentially compromising the quality of education.

This paper explores the challenges posed by the integration of AI in higher education and introduces **A**I-**N**spired **D**igital **L**earning (**ANDL**), a solution designed to mitigate these risks while leveraging the benefits of AI. We will examine the customer profile, analyze the market size and potential, present anecdotal and empirical evidence, discuss our surveys and analyses, and detail how ANDL addresses the identified issues.

[1]Source: https://www.theguardian.com/technology/2023/oct/31/educators-teachers-ai-learning-classrooms-misuse

2 About the Product

ANDL is a responsible and explainable AI solution designed to enhance higher education by promoting appropriate reliance on AI. It helps learners interpret and effectively utilize AI-generated content, fostering a deeper integration of AI into educational practices.

2.1 MVP (Minimum Viable Product)

Our MVP includes three essential components that will help learners and educators navigate the use of AI within educational contexts.

1. **Conversational Interface:** With AI-assistance elements like model confidence, rationales, and counterfactuals, bias in prompt/response, example-based explanations, AI performance so far, and RAG pipeline for processing documents, students can interact with ANDL and make informed decisions when understanding the AI's response relative to a educational query. It is noted that these AI-assistance elements can help humans make more informed decisions surrounding an output from an AI system[2].
2. **Student-AI Infused Community Platform:** When the Conversational Interface is not enough, students can ask questions and get answers from other students, TAs, professors, and the AI. AI-generated responses are evaluated by the community, and the AI learns from these evaluations to improve its responses. The AI can also provide explanations and references to the students. This forum is a place where students can learn from each other and the AI, reinforcing both the AI's learning and the students' learning.
3. **Educator Analytics Dashboard:** Instructors can see the performance of the AI, the students, and the TAs. They can get key insights into topics that are difficult for students, and they can also see the performance of the AI in answering questions. Instructors can also make announcements to the students through the dashboard, and they can see the performance of the AI in answering questions.

AI-assistance Elements (AI Clarity Modules): In the first version, we include the following AI clarity modules alongside the ANDL's response to the prompt.

- *Rationale*: Reasoning behind the ANDL's response to a prompt.
- *Counterfactual*: How the response would change for different examples.
- *Bias*: Bias in ANDL's response. For instance, one such bias is recency. If 2 messages prior user mentioned Jaguar the car, and later asked 'What's Jaguar', most LLMs would talk about the car instead of the animal.
- *Confidence*: Confidence in ANDL's response.
- *Source Context*: In cases where the user provides a file and asks questions about it, ANDL returns the chunk from the file where it got the response from. We use RAG pipeline technology to get the most relevant chunk from the document concerning the user's prompt.

In future iterations, we plan to implement more AI clarity modules and reinforce ANDL with new information we discover.

[2] Source https://arxiv.org/abs/2112.11471

2.2 USP (Unique Selling Point)

The unique value proposition (USP) of ANDL is a synergy of three core components that together define its essence:

- **Explainability & Transparency**: Ensuring clear, understandable, and transparent processes in AI-driven learning.
- **Community-Driven Learning**: Fostering collaborative learning experiences, enriched by active community participation.
- **Student, AI, Educator Analytics**: Leveraging data-driven insights from students, AI, and educators to enhance learning outcomes.

The first key component of ANDL's USP is its explainability. ANDL stands out as the first educational large language model (LLM) that provides not only prompt responses but also supplementary assistance elements, offering users a holistic view and enabling more informed decisions.

The second USP is the community platform, designed to function as a Stack-like environment that fosters collaboration and knowledge-sharing within the university. Students can post questions, which are automatically answered by the most appropriate ANDL model. Additionally, responses from fellow students, professors, and teaching assistants (TAs) can contribute to a dynamic, supportive learning community.

Gamification plays a crucial role in the platform, encouraging engagement through a system of ratings for questions, answers, and comments. Participants can earn badges, points, and other rewards based on their contributions and interactions, thus enhancing the overall user experience.

The final key element is the analytics dashboard for educators and university staff. Professors and TAs, with appropriate access, can view insights into the types of questions students ask ANDL, allowing them to pinpoint learning challenges. This data can be used to refine the syllabus and adjust teaching strategies to better meet student needs. Additionally, the dashboard enables educators to monitor whether students are using ANDL in alignment with the university's guidelines and regulations.

3 Customer Profile

ANDL targets two primary customer segments: universities and individual learners. On the university side, we accommodate institutions looking to improve student engagement and integrate/regulate AI-powered solutions into their educational offerings. On the individual side, we cater to students and lifelong learners who seek to enhance their understanding of complex topics and help them navigate the use of AI systems in educational contexts appropriately.

3.1 Universities and Educators

With the rise of large language models (LLMs) and AI, many universities are exploring new ways to leverage these tools in the learning process. However, educators face significant challenges in integrating these technologies effectively:

- **Tracking Student Progress**: Professors struggle to monitor students' individual learning journeys, particularly in large classes. Current AI solutions often provide generic answers that lack course-specific fine-tuning, and this can further obscure a professors' ability to monitor their students progress.
- **Unreliable AI Support**: Without course-specific fine-tuning, educators are concerned that students may rely on potentially inaccurate or biased AI-generated answers, which could undermine (or take away) their learning process.
- **Community Relations**: With many available online individual-learning tools, many students have lost the community aspect of higher education. Specifically, with the introduction of popular LLM services like ChatGPT[3], students have been observed to have become more hesitant to reaching out to other classmates than before.

ANDL addresses the first two issues by providing fine-tuned models tailored to specific courses, as well as analytics that offer real-time insights into student questions and engagement. Professors can see which concepts students find challenging, enabling them to adjust their teaching methods accordingly. Additionally, they receive a comprehensive overview of AI usage within their course, which can assist in developing appropriate guidelines.

As for the lack of community relations problem, our collaborative learning platform will create a stronger sense of community between professors and students, by encouraging students to answer, evaluate, and understand the responses of their classmates or AI.

3.2 Students and Lifelong Learners

For students, the primary challenges are:

- **Limited AI Tools**: Current AI tools often fail to meet the specific needs of students in different courses, as they are not trained on the course materials. This sometimes leads to irrelevant or inaccurate responses.
- **Inability to Evaluate AI Responses**: Students lack the means to evaluate AI-generated responses for bias, accuracy, or relevance. This creates uncertainty around whether they can trust the information provided by these tools.

ANDL offers students course-specific models that not only answer their questions but also provide the response's bias and confidence levels. Responses are supplemented with examples, rationale (reasoning), and counterfactuals (how the response would change for a different

[3] https://openai.com/chatgpt/

case). This allows students to understand the model's answer as well as how reliable the response is. These AI clarity modules serve to enable the student to effectively gauge the quality of the response from ANDL.

Nevertheless, despite our best efforts, naturally, there will be times when ANDL responses are gonna fall short. Our community learning platform is for these cases. Students can ask questions on the platform and receive an auto-generated ANDL response. Other students, TAs, and even professors can interact with the students' questions, respond to them, and (if have permission) modify or evaluate ANDL's public response if it's wrong or biased. These modifications and evaluations will be used to further finetune ANDL and ensure that any knowledge gaps are addressed through the power of the crowd.

3.3 The Power of Community

Beyond individual use cases, ANDL fosters a sense of community by enabling students, TAs, and professors to collaborate. Students can ask public questions, review AI-generated answers, and contribute their own insights, creating a dynamic learning environment where knowledge is shared and validated by peers.

By addressing the needs of both universities and students, ANDL provides a comprehensive solution that supports learning at every level, from individual inquiry to institutional oversight[4].

[4]Source: https://arxiv.org/html/2405.13001v1#S2

4 Market Size and Potential

After the launch of ChatGPT, StackOverflow saw a decline in its recurring users [5]. Many software engineers and students now prefer using AI tools like OpenAI's GPT-4, ChatGPT, Codex, or GitHub Copilot for help. However, this shift doesn't imply that StackOverflow's collaborative learning community is becoming irrelevant. While large language models (LLMs) are particularly helpful for handling beginner-level questions in fields like programming and computer science, more complex, large-scale problems still benefit greatly from the collective expertise of the community.

What if we could combine the best of both worlds with ANDL?

4.1 Student-wise potential

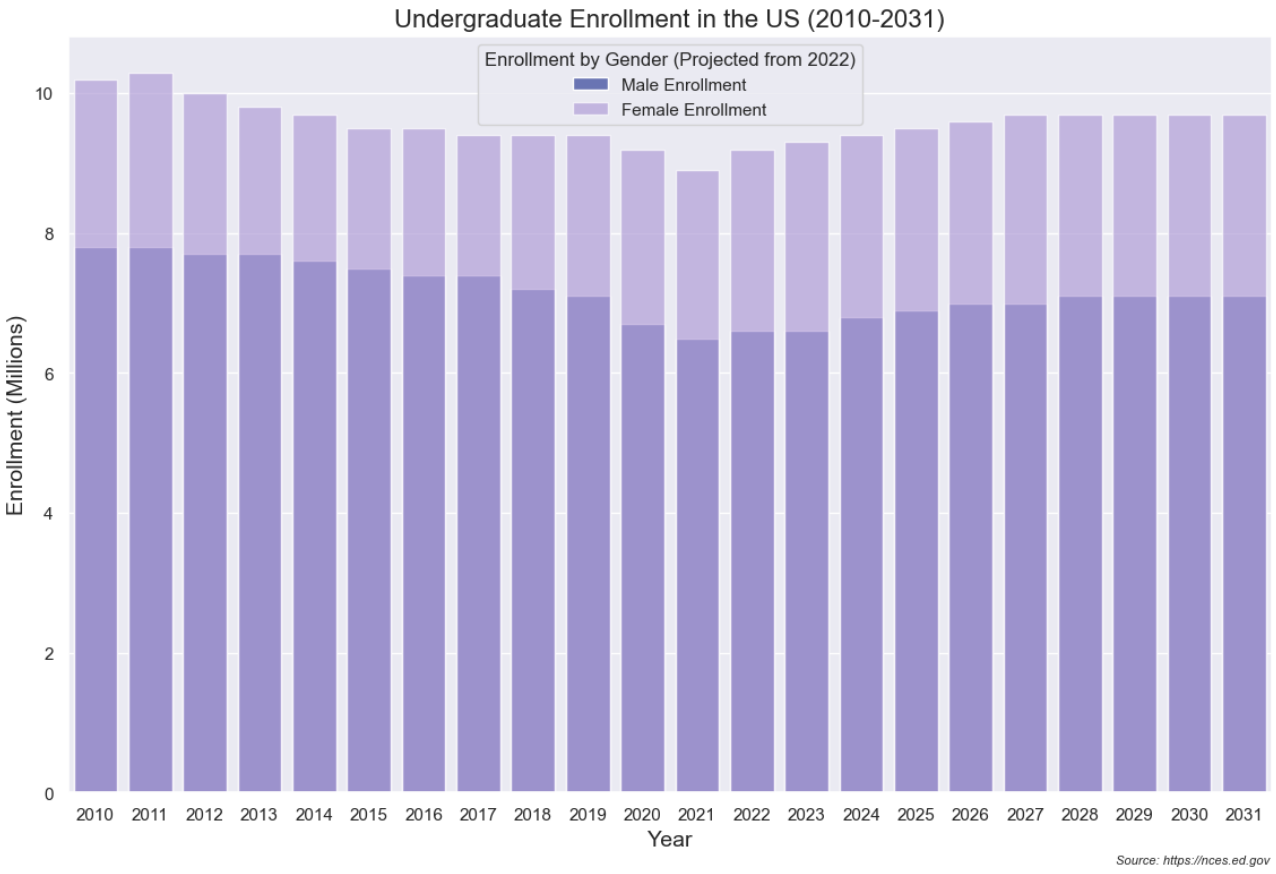

Figure 1: Undergraduate Enrollment Trends in the U.S.

The higher education landscape is undergoing a similar transformation. As seen in figure 1, in 2022, approximately 18.58 million students were enrolled in U.S. colleges, with 13.49 million attending public institutions and 5.09 million enrolled in private colleges. While higher education was already a substantial industry, the COVID-19 pandemic dramatically accelerated the shift to online learning, reshaping how students engage with educational resources and platforms. This, combined with the democratization of large language models (LLMs), has led to the widespread adoption of AI tools by students in educational contexts.

[5] Source: https://www.businessinsider.com/stack-overflow-crisis-future-of-online-data-ai-world-2023-7

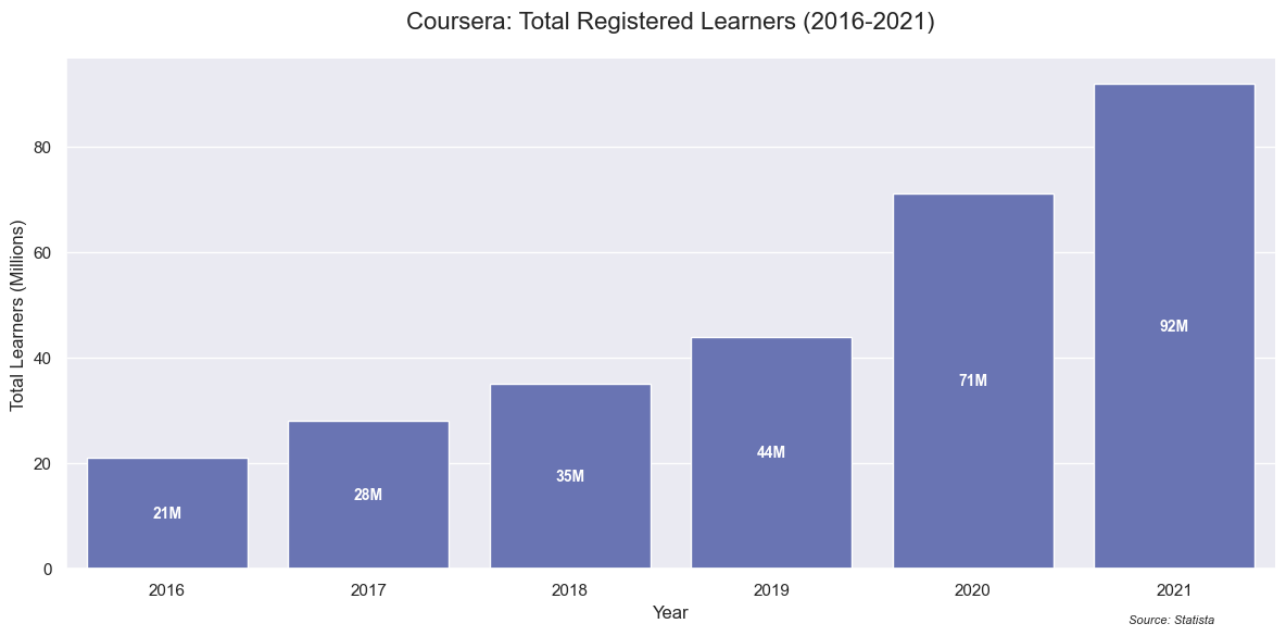

Figure 2: Coursera Enrollment Trends

Many students have shifted towards online education. As shown in figure 2, in 2016, Coursera had 21 million students, and by 2021, that number had grown by 438%. Furthermore, the e-learning market is projected to grow by 20.5% from 2022 to 2030, indicating continued expansion in digital education.

Despite this growth, the transition to online education presents challenges. For instance, in the fall of 2022, approximately 54% of college students were enrolled in distance education courses, a decline from 75% during the pandemic's peak in the fall of 2020. While this decrease is partly due to the pandemic subsiding, it also underscores the ongoing need for effective online learning solutions.

For students engaged in remote learning, accessing on-campus university facilities can be difficult. ANDL addresses these challenges by providing an advanced learning solution that enhances the online education experience. Our platform not only delivers responsive AI models but also helps students make well-informed decisions, optimizing their learning process.

4.2 University-wise potential

While online learning experienced a boom during the pandemic, the education technology market has been steadily growing for years.

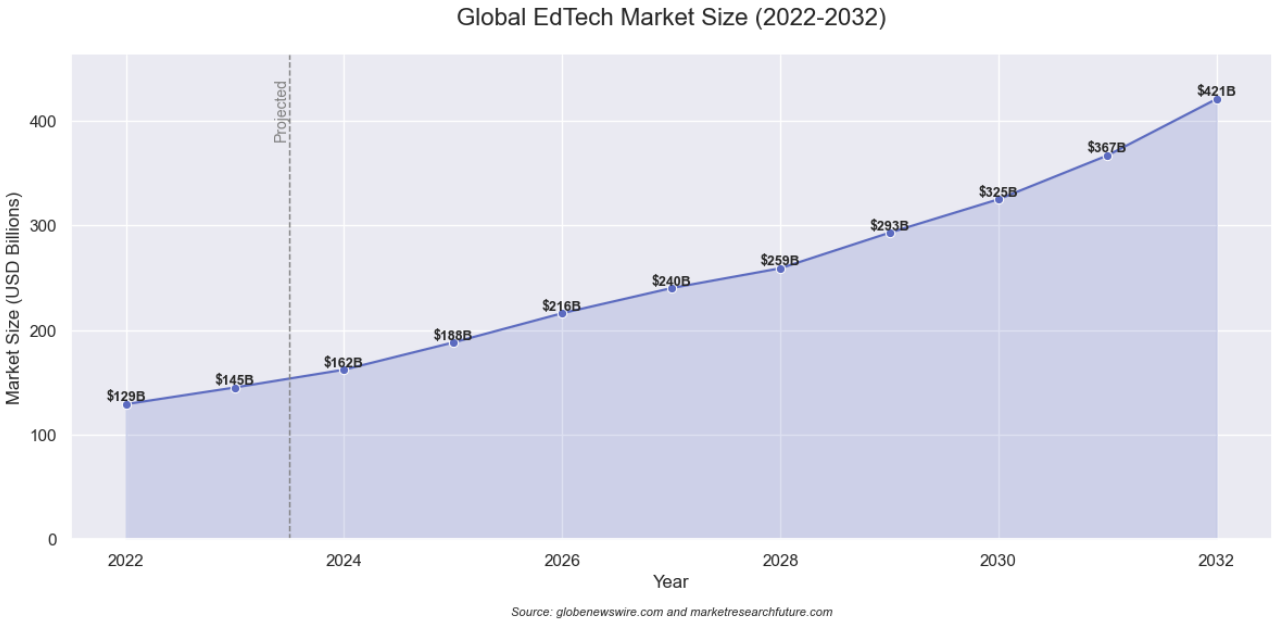

Figure 3: Education Technologies Market Size Trends

In figure 3, you can observe the steady growth of the global education technology market. Additionally, North America led the market with a revenue share exceeding 36 percent in 2023.

A significant portion of this growth can be attributed to the rising adoption of AI in education. In fact, 67 percent of EdTech unicorns are currently integrating or utilizing AI in their products or services.[6]

[6] According to ElifTech, "AI in EdTech Explained," https://www.eliftech.com/insights/edtech-ai-explained/.

With the rapid growth of AI in education, it was only a matter of time before universities began integrating this technology into their systems. However, along with the benefits of AI come concerns about its potential misuse and the risks associated with unrestricted use in educational contexts.

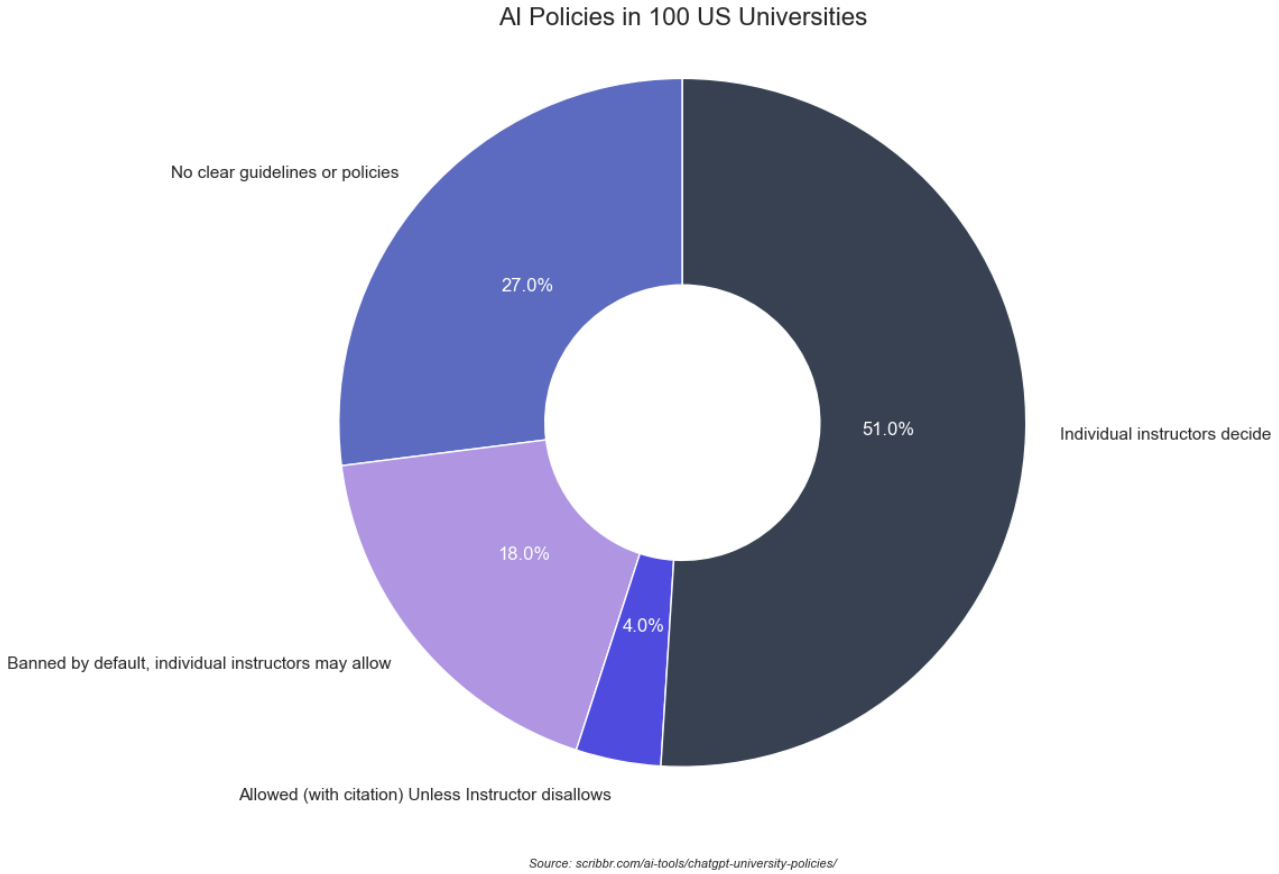

Figure 4: Universities AI Policies

As shown in figure 4, many universities still lack clear regulations or guidelines for the use of AI. Although some institutions, like Arizona State University, have made progress in this area with initiatives such as the Digital Trust Guidelines for Generative Artificial Intelligence Use[7], enforcing these regulations remains difficult due to the limited control universities have over these AI technologies.

This is where ANDL becomes essential. By utilizing ANDL for enhanced learning, students benefit from a system that provides universities with a dashboard to monitor their interactions. This feature enables professors to gain insights into how students are using ANDL and to identify areas where they may face challenges compared to other topics. More specifically, professors obtain a holistic view of their students' interactions with ANDL, both individually and in collaboration, which would otherwise be difficult to achieve.

[7]Referenced Guideline: https://tech.asu.edu/sites/default/files/2023-09/Digital%20Trust%20genAI.pdf

5 Similar Products and Comparison

Table 1: Comparison of ANDL and Competitor Products

Feature	**ANDL**	**Atlas**	**Studyable**
Fine-tuned Models	✓	✓	×
AI-assistance Elements	✓	×	×
Reinforcement with student's uploaded material	×	✓	×
Collaborative Learning Platform	✓*	×	✓
Prompt Dashboard and Regulating AI	✓*	×	✓
Homework-targeted Helper AI	×	×	✓

* Different versions available for the learner and academic plans.

6 Empirical Analysis - Educator's View on AI

As we explore the landscape of AI in education, it becomes evident that many educators have concerns about the role of artificial intelligence in the learning process. A notable example is a professor who initially welcomed AI tools in writing but eventually decided to ban them in lower-level classes[8]. The professor raised several key concerns: AI's potential to impede students' development of critical thinking, engagement with texts, and their ability to organize and communicate their own thoughts effectively. While these concerns are valid, they reflect a perspective rooted in traditional education models. Our product, ANDL, has been developed with these concerns in mind, offering a balanced solution that leverages AI while aligning with educators' goals for student development.

6.1 Addressing the Need for Critical Engagement

One of the professor's primary concerns is that AI can inhibit students' ability to critically engage with arguments and develop their own analyses. The reliance on AI-generated summaries and critiques, he argues, circumvents the cognitive processes essential for students' intellectual growth.

Our product, ANDL, addresses this concern by not merely providing answers or summaries. Instead, ANDL promotes deep engagement with course materials through features such as AI-assisted elements, which offer insights into the bias, rationale, and confidence levels of AI-generated responses. This enables students to critically evaluate AI outputs and interact meaningfully with the arguments presented. Additionally, students have the opportunity to explore counterfactuals and alternative perspectives, encouraging a more profound engagement with the content rather than passive consumption of AI-generated material.

This approach aligns with the professor's ultimate goal: nurturing students' ability to deconstruct arguments, understand them, and develop their own objections or alternative viewpoints.

6.2 AI and the Erosion of Trust in the Classroom

Another significant issue the professor addresses is the erosion of trust between students and teachers when AI is allowed in assignments. By relying on AI-generated content, students might not be fully honest about their own contributions. This could lead to a breakdown in the trust-based relationships that are essential to an effective learning environment.

Although ANDL provides tools for transparent AI use documentation and ensures that AI assistance is traceable, the concern about integrity in learning persists. For educators like the professor, even ethical AI use may be seen as a shortcut, which, in their view, prevents students from fully embracing the challenges of learning and hinders their growth as thinkers and problem-solvers. Trust is built on the notion that students are putting in the intellectual effort required for the task at hand—something that AI involvement, however transparent, might call into question.

6.3 Conclusion: a Balanced Approach

While there are skeptics of AI tools in education, ANDL is designed with educators' concerns in mind. By incorporating features that emphasize critical thinking, ethical use, and student-driven learning, ANDL serves not just as a tool for efficiency but as a platform for fostering intellectual growth. Rather than outsourcing learning to AI, our product augments and supports the development of skills that educators, like the referenced professor, value most: critical analysis, thoughtful engagement, and the ability to independently organize and express ideas.

[8] Referenced Blogpost: https://www.timeshighereducation.com/campus/why-i-ban-ai-use-writing-assignments

7 Closing Remarks

The integration of AI into education presents both unprecedented opportunities and complex challenges. As discussed throughout this paper, ANDL has the potential to revolutionize higher education by offering fine-tuned, course-specific models that not only enhance learning outcomes but also foster critical engagement, transparency, and collaboration. However, it is crucial to acknowledge the valid concerns raised by educators, particularly regarding the potential erosion of critical thinking and trust within the academic environment.

ANDL is designed to bridge this gap by providing a balanced approach that combines the efficiency of AI with a focus on student development. By addressing the needs of universities, educators, and students alike, ANDL creates a platform that promotes ethical AI use, supports intellectual growth, and facilitates community-driven learning. Our product is not a replacement for the human aspects of education but rather a tool that augments and enhances the learning process, making education more accessible, personalized, and effective for all.

As AI continues to evolve, ANDL remains committed to addressing these challenges while harnessing the full potential of this transformative technology to shape the future of education.

8 Appendix

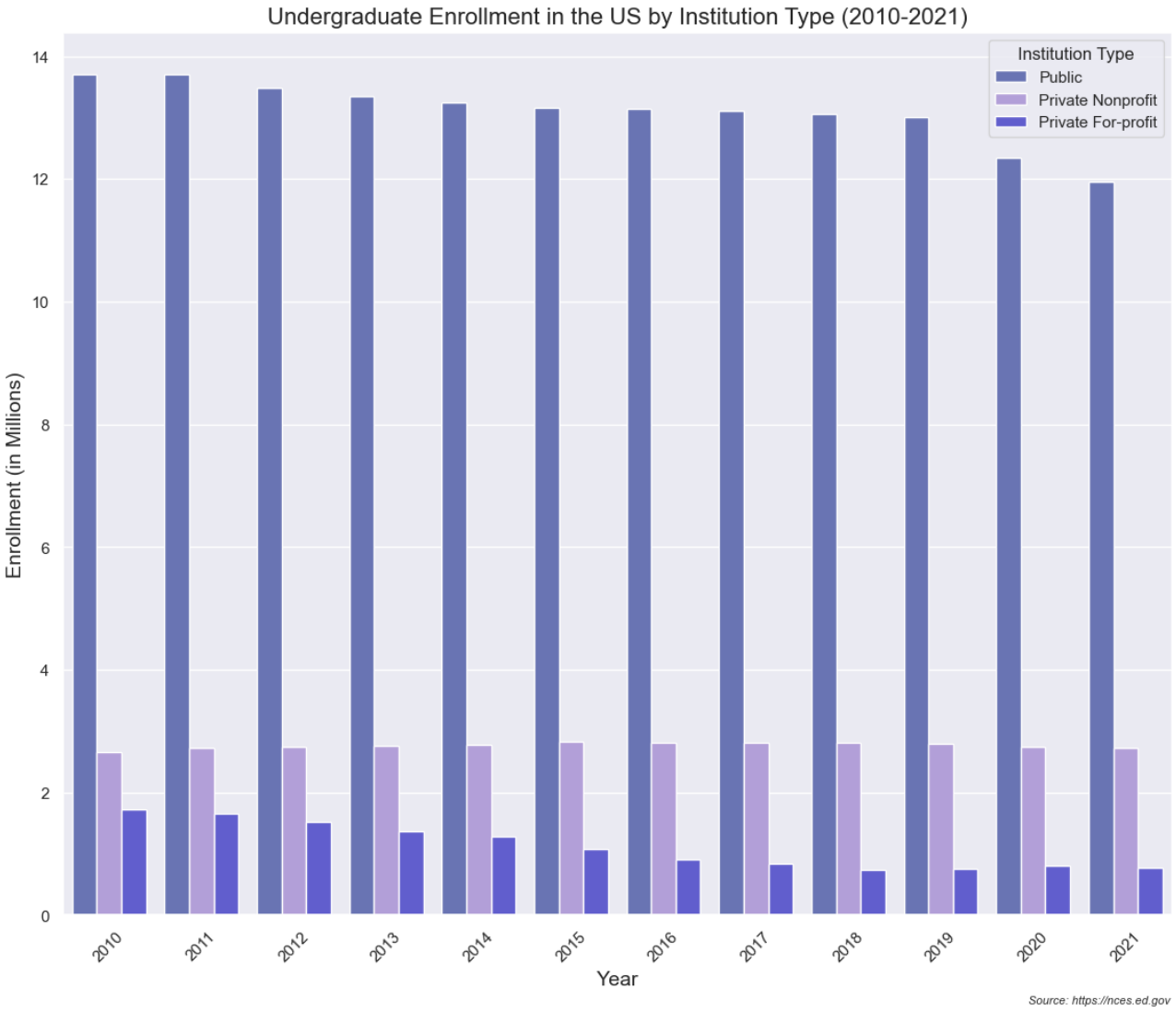

Figure 5: Undergraduate Enrollment Trends (By College Type)

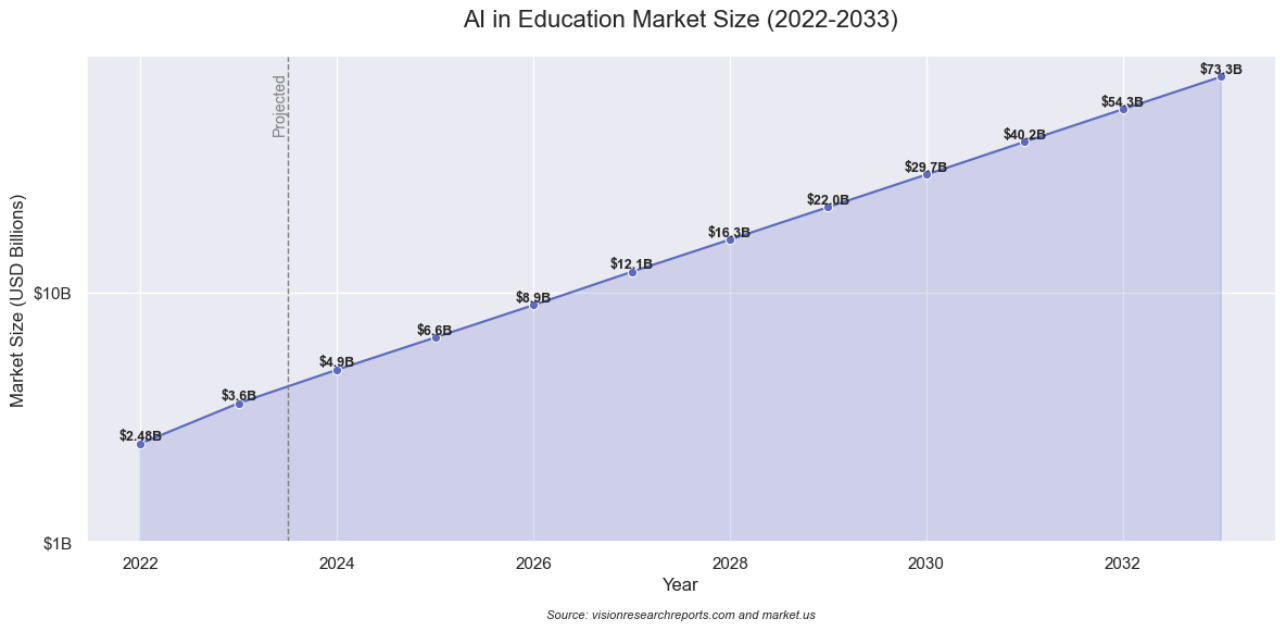

Figure 6: AI Educational Technologies Market Size Trends

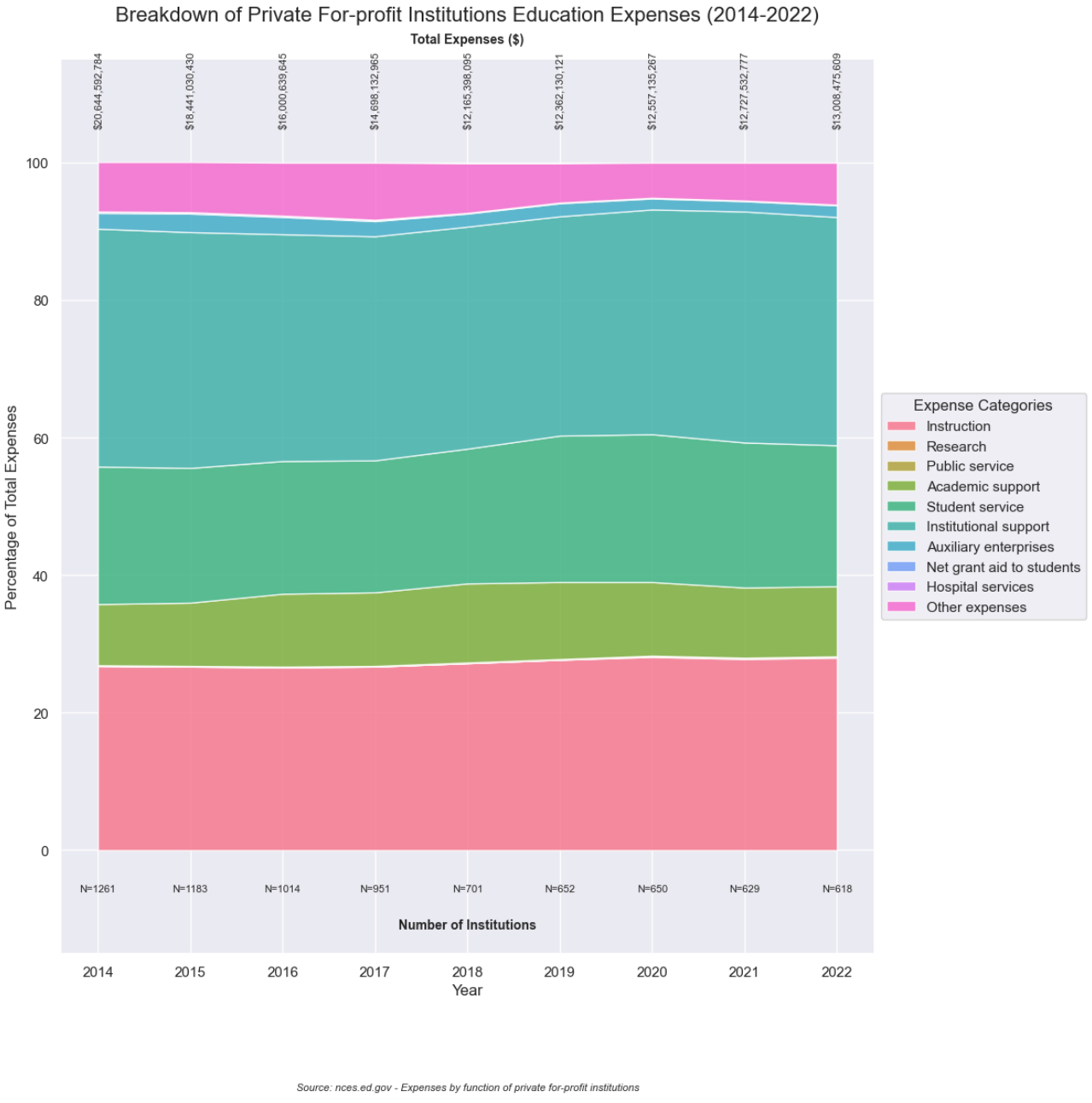

Figure 7: For-profit Private Colleges Education Expenses