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Integrating AI Applications into Learning Management Systems to Enhance e-Learning

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ABSTRACT

Artificial intelligence technologies have the potential to greatly enhance the organization of learning management systems and online learning experiences. In particular, the public release of OpenAI's GPT-3 model in December 2022 has given society a chance to learn more about the current status of artificial intelligence. There have been much research on the use of artificial intelligence in e-learning processes, but very few of them demonstrate how to integrate these applications step-by-step and with examples into learning management systems. This study intends to close this gap by demonstrating how artificial intelligence technologies are integrated into learning management systems using real-world examples. This study provides examples of practical applications as well as integration steps. Finally, GPT-3 plugins for Moodle are examined and sample JavaScript code is included for integrating Chat GPT into Moodle. By presenting a useful guide for integrating artificial intelligence technology into learning management systems, this work adds to the body of literature.

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E-Öğrenmeyi Desteklemek için Yapay Zeka Uygulamalarının Öğrenme Yönetim Sistemlerine Entegrasyonu

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ÖZET

Yapay zekâ teknolojileri, öğrenme yönetim sistemlerinde çevrimiçi öğrenme deneyimlerini ve yönetimini önemli ölçüde geliştirme potansiyeline sahiptir. Özellikle Aralık 2022'de OpenAI'ın GPT-3 modeli çıktılarını herkese açık hale getirmesi yapay zekanın ulaştığı noktayı daha iyi anlamak için toplumsal bir fırsat yaratmıştır. Yapay zekanın e-öğrenme süreçlerinde kullanımı üzerine birçok çalışma olsa da bunların çok azında yapay zekâ uygulamalarının öğrenme yönetim sistemlerine entegrasyonu adım adım ve örneklerle sunulmaktadır. Bu çalışma, yapay zekâ teknolojilerinin öğrenme yönetim sistemlerine entegrasyon sürecini pratik örneklerle sunarak bu boşluğu doldurmayı amaçlamaktadır. Çalışmada; entegrasyon adımları ve kullanılabilecek örnek uygulamalara yer verilmiştir. Son olarak, GPT-3 modellerine ilişkin eklentilere yer evrilmiş ve Chat GPT'nin Moodle entegrasyonu için örnek JavaScript kodları sunulmuştur. Bu çalışma, yapay zekâ teknolojilerinin öğrenme yönetim sistemlerine entegrasyonu için pratik bir rehber sunarak literatüre katkıda bulunmaktadır.

1. Introduction

Learning Management Systems (LMS) are platforms used to deliver and manage online learning content and experiences. LMSs are used by educational institutions, businesses, and other organizations to provide online learning opportunities to students and employees. The most widely used open-source LMSs worldwide are Canvas and Moodle. The examples given in this research are limited to Canvas and Moodle.

Increasing demands and expectations for online learning in the digital world have created a pressure for clear development on LMSs. In particular, the promise of big data-focused personalized learning through learning analytics, the emergence of Learning Experience Platforms (LXP), the rapid development of artificial intelligence technologies and its clear demonstration in real-life applications indicate that a strong integration period can be entered into in LMSs.

An LMS is a software platform used to deliver and manage online learning content and experiences. In recent years, Learning Experience Platforms (LXP) have emerged as an alternative to LMS. LXP platforms are designed to offer personalized learning experiences to students. LXPs typically include features such as content recommendation algorithms, adaptive learning capabilities, and social learning tools and can be used in conjunction with an LMS.

While both platform types offer similar features, they differ in their approach to learning and target audience. LMSs are designed to support the delivery of structured courses and programs, while LXPs focus on providing personalized learning experiences to students. LMSs typically include features such as course management, communication tools, and assessment tools, while LXPs include features such as content recommendation algorithms, adaptive learning capabilities, and social learning tools (Clark and Mayer, 2016; Valdiviezo and Crawford, 2020). Another difference between LMS and LXP is their target audience. While LMSs are generally used by educational institutions, businesses, and other organizations to provide online learning to students and employees, LXPs are generally designed for individual learners and can be used in conjunction with an LMS (Weigert and Behrendt, 2022). When comparing the effectiveness of LMS and LXP, certain features of LXP or LMS may stand out. However, it can be said as a common opinion that LMSs are much more widely accepted and used. Given that LXPs can also be used within LMSs, it can be said that more focus should be given to LMSs. Additionally, learner records in LMSs can also be processed with algorithms such as KNN, Naive Bayes, SVM, CART, and C5.0, similar to LXPs, and thus support learning processes (Yavuzarslan and Çiğdem, 2022).

1.1. Using Artificial Intelligence in e-Learning

The use of artificial intelligence (AI) in e-learning has gained great interest in recent years due to its potential to enhance the effectiveness and accessibility of education. Especially with the Chat GPT application released to the public by OpenAI in December 2022, which reached 1 million users in 5 days, many people had the opportunity to directly experience the level of AI achieved (Firat, 2023). In the literature, many researchers have investigated the integration of AI for various purposes in e-learning, including personalized learning, assessment and grading, educational games, and simulations (Kothari and Verma, 2022).

Personalized learning, also known as adaptive or individualized learning, refers to the use of technology to adapt educational content and experiences to the unique needs, interests, and abilities of each student (Fariani, Junus, and Santoso, 2022). It has been found to increase student motivation and engagement and improve learning outcomes (Manciaracina, 2022). AI-supported personalized learning systems can analyze data on a student's performance, preferences, and other factors to create customized learning paths and provide targeted support and feedback (Tapalova and Zhiyenbayeva, 2022).

AI can also be used for assessment and grading in e-learning. AI-supported assessment tools such as multiple-choice test graders and composition scoring software can automatically grade student submissions, allowing teachers to save time and effort and focus on providing personalized feedback and support (Bearman, Nieminen, and Ajjawi, 2022). AI-supported grading can also provide more objective and consistent grading, reducing the potential for bias and error.

Educational games and simulations are another area where AI can play a valuable role in e-learning. AI-supported games and simulations can provide engaging and interactive learning experiences that can help students develop critical skills such as problem-solving, decision-making, and creativity (Bennani, Maalel, and Ben Ghezala, 2022). For example, AI-supported virtual simulations can allow students to experiment with complex scenarios and test their knowledge and skills in a safe and controlled environment.

AI has the potential to improve the effectiveness and accessibility of e-learning in various ways. Personalized learning, assessment and grading, and educational games and simulations are some of the key use cases where AI can provide significant benefits to students and educators. However, it is important to carefully evaluate the ethical and pedagogical implications of using AI in education and ensure that the technology is used to enhance, rather than replace, human teaching and learning.

1.2. Research Purpose

There are numerous studies in the relevant literature regarding how AI can be used in e-learning processes. Additionally, there are studies that provide framework structures for the integration of AI in LMSs (Pardamean et al., 2021). However, studies that present the integration process of AI technologies into LXP or LMSs with simple steps and application examples are quite limited (Eggmann, 2022). It is believed that this study will contribute to filling this gap in the literature. In this context, the aim of the study is to present the integration process of artificial intelligence technologies into LMSs with application examples. Accordingly, steps for AI integration in LMSs, areas of AI use in LMSs, and code examples that can be utilized are provided along with examples.

2. AI Integratıon in LMS

It is possible to mention the basic steps to integrate artificial intelligence applications into any LMS. There are numerous artificial intelligence application platforms in the market for different usage areas. This number has been rapidly increasing in recent years. In this section, first, the integration steps are discussed, then artificial intelligence examples are provided according to different usage areas. Finally, the process is demonstrated through a real example. For this, the steps for integrating Chat GPT into Moodle and the JavaScript codes that can be used are provided.

2.1. Integration Steps

The steps to be followed to integrate AI applications into an LMS may vary depending on the LMS structure. However, to provide a general understanding, five steps that can be followed for AI integration with all LMSs can be mentioned.

1) *Determining the AI application:* The first step in integrating AI into an LMS is to determine the AI application to be installed. The selected AI application can be related to personalized learning, assessment and grading, or educational games and simulations. It is important to understand a specific AI application and how it aligns with educational goals and objectives clearly to avoid unnecessary time and cost.

2) *Selecting the AI platform:* After determining the AI application, the next step is to select a AI platform that can support it. Various AI platforms are available, each with different features. Examples of artificial intelligence platforms for e-learning include *Google Cloud AI*, *Microsoft Azure Machine Learning*, and *IBM*

Watson. It is necessary to carefully evaluate the features and capabilities of different AI platforms to ensure that the selected platform meets the needs.

3) *Integrating the AI platform with the LMS:* After selecting a AI platform, the next step is to integrate it with the LMS. This usually involves adding the API (application programming interface) of the AI platform to the LMS, which enables the two systems to communicate and exchange data. The characteristics of this integration process will depend on the AI platform used and the LMS.

4) *Installing and configuring the AI application:* After the AI platform is integrated into the LMS, the next step is to install and configure the AI application. This includes creating and uploading necessary data or content as well as configuring settings or parameters. For example, if a AI-supported personalized learning system is being implemented, student data needs to be uploaded (introduced) to the system and customized learning paths need to be determined.

5) *Testing and evaluating the AI application:* After the AI application is installed and configured, it needs to be tested and evaluated to ensure that it works correctly and achieves the desired results. This involves conducting pilot implementation with a user group and collecting feedback. Thus, data collected about the effectiveness of the AI application is analyzed, and the results are used to improve AI integration.

2.2. Usage Areas and Sample Applications

The AI applications can be used for many purposes in LMSs. It is possible to categorize the prominent usage areas under three headings: personalized learning, assessment and evaluation, educational games and simulations.

1) *Personalized learning:* Personalized learning, which involves using technology to adapt educational content and experiences to each student's unique needs, interests, and abilities, is one of the most common applications of artificial intelligence in LMSs. IBM Watson platform is one of the AI platforms used for personalized learning in LMSs. The IBM Watson artificial intelligence platform can be used to analyze student data and create customized learning paths. To do this, the platform's API is first integrated into the LMS, and then student data is uploaded to the system to create personalized learning paths. Examples of artificial intelligence applications that can be integrated for personalized learning in LMSs such as Canvas and Moodle are *IBM Watson*, *Google Cloud AI*, *GPT-3 models* and *Knewton Adaptive Learning*. AI can also be used to create adaptive learning systems that adjust learning content and experiences in LMSs

based on student performance and progress. *Smart Sparrow* and *Learnosity* are examples of AI applications for adaptive learning in LMSs such as Canvas and Moodle.

2) *Assessment and evaluation:* Artificial intelligence can also be used to score open-ended text entries (such as compositions) or multiple-choice tests. Examples of AI technologies that can be used for this purpose are ChatGPT, Gradescope, and e-rater. For example, when the API provided by *Microsoft Azure Machine Learning* is integrated into an LMS, students' compositions, assignments, or any text they enter can be scored by artificial intelligence. When the LMS is integrated with the AI platform's API, student composition submissions will be automatically graded by the AI tool.

3) *Educational games and simulations:* Artificial intelligence-supported educational games and simulations can provide engaging and interactive learning experiences that can help students develop critical skills such as problem solving, decision making, and creativity. An example of integrating artificial intelligence into an LMS for educational games and simulations is possible. A platform that supports artificial intelligence such as those provided by *Google Cloud AI* or *IBM Watson* can be used. Additionally, *Classcraft, Quest Atlantis*, and *Kahoot!* can also be integrated into LMSs for AI-supported games and simulations. When the LMS is integrated with the AI platform's API, students can access games or simulations through the LMS. Thus, an integrated learning environment is provided on the same platform.

In general, there are various AI applications, APIs, and plugins that can be integrated into many LMSs such as Canvas and Moodle to increase the effectiveness and accessibility of e-learning. At this point, it becomes even more important to carefully evaluate the specific needs and goals of students and organizations and choose AI solutions that are suitable for these needs. The integration of the Chat GPT artificial intelligence platform, which gained widespread use worldwide in December 2022, into Moodle is given as an example integration in the next section.

2.3. Chat GPT Integration to Moodle

To integrate Chat GPT (GPT-3) into Moodle, it should be remembered that the GPT-3 API should be used to generate text according to the request and parameters. Essentially, the steps that can be followed to integrate GPT-3 with Moodle are as follows:

1) *Access to the GPT-3 API:* sign up for an API key from the OpenAI website (https://beta.openai.com/signup/).

2) *Determining the Usage Purpose:* it should be determined how and for what purpose GPT-3 will be used in Moodle. GPT-3 can be used to create summaries of reading materials, create multiple choice questions, or create personalized feedback for students.

3) *Creating a Prompt:* after deciding on specific tasks for using GPT-3, a prompt should be created for the model. The prompt is a short text that specifies the task and provides the context or information required for the model to generate text. For example, if we want to use GPT-3 to create multiple choice questions, we need to specify the question stem, placeholders for the correct answer and wrong answers in the prompt.

4) *Using the GPT-3 API:* after creating the prompt, the GPT-3 API can be used to send the prompt to the model and receive the generated text in response. The API allows various parameters to be set, such as the length of the generated text and the confidence level required for the model to return a response.

5) *Using in LMS:* in the final stage, the generated text can be used appropriately in Moodle. For example, the created multiple choice questions can be used as part of a quiz or exam, or the created summaries can be used as part of a reading assignment.

To integrate GPT-3 into Moodle, it may be necessary to write code to send requests to the GPT-3 API and receive the generated text in response. A programming language such as Python or JavaScript can be used for this purpose. Sample JavaScript code that can be used to integrate Chat GPT into a Moodle page is given in Figure 1 below.

Figure 1

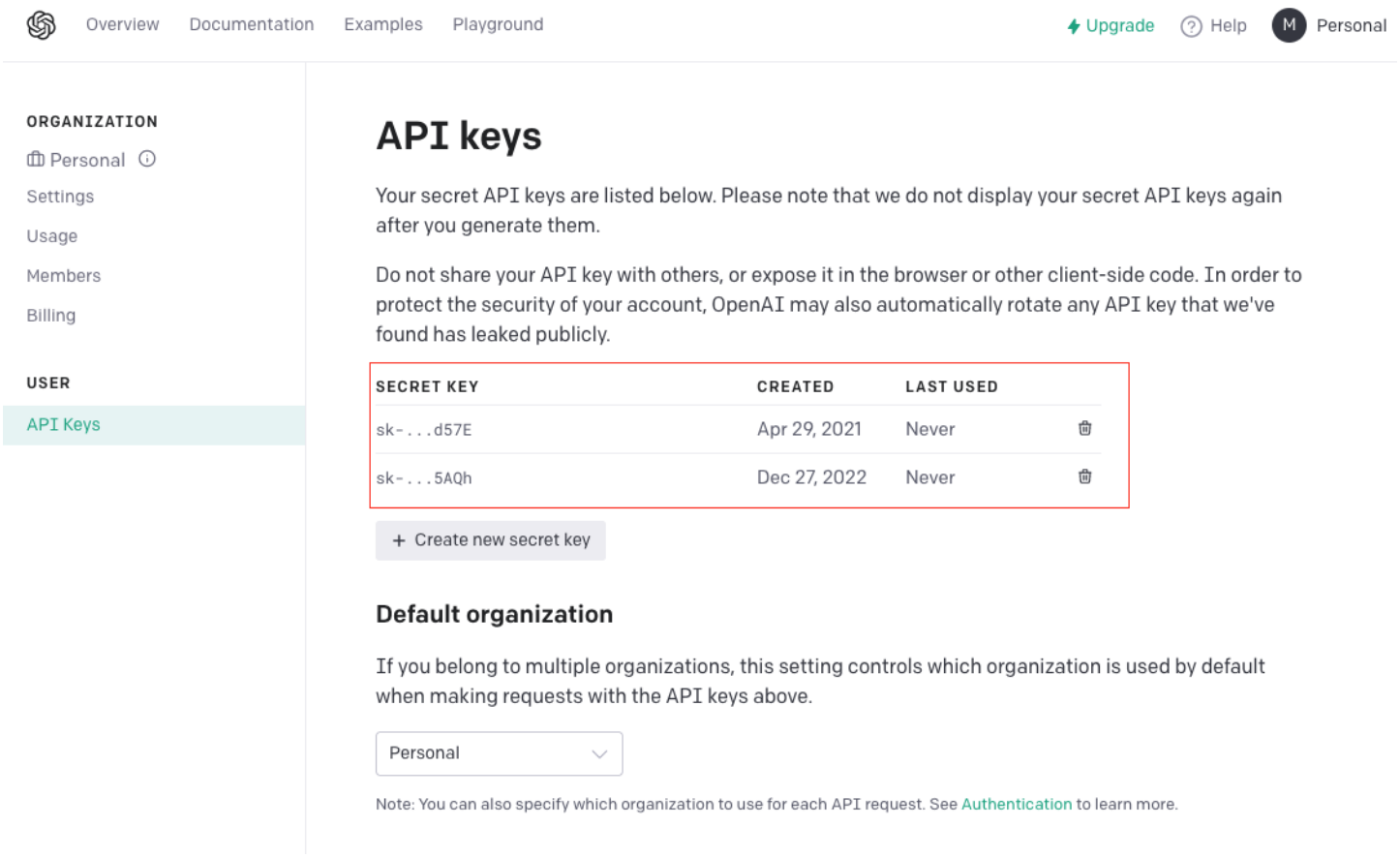
Sample JavaScript code to integrate ChatGPT into Moodle

```javascript
// Add the ChatGPT script to your Moodle page
var chatGPTScript = document.createElement('script');
chatGPTScript.src = 'https://cdn.jsdelivr.net/npm/@openai/chatgpt@0.2.0/dist/chatgpt.min.js';
document.head.appendChild(chatGPTScript);

// Wait for the script to load
chatGPTScript.addEventListener('load', function() {
  // Initialize the ChatGPT instance
  var chatGPT = new OpenAI.ChatGPT({
    apiKey: 'Your Api Key', // Replace with your OpenAI API key
    model: 'text-davinci-002', // Replace with the model you want to use
    temperature: 0.7, // Adjust the temperature to control the "creativity" of the AI's responses
    maxTokens: 50 // Set the maximum length of the AI's responses
  });

  // Find the Moodle chat element and add a listener for when the user submits a message
  var chatInput = document.querySelector('#id_message');
  var chatForm = chatInput.closest('form');
  chatForm.addEventListener('submit', function(e) {
    e.preventDefault();

    // Get the user's message from the chat input field
    var userInput = chatInput.value.trim();

    // Clear the chat input field
    chatInput.value = '';

    // Send the user's message to the ChatGPT instance to generate a response
    chatGPT.generateResponse(userInput)
      .then(function(response) {
        // Append the AI's response to the chat window
        var chatWindow = document.querySelector('.messageboxcontent');
        chatWindow.insertAdjacentHTML('beforeend', '<div class="message other">' + response.text + '</div>');
      })
      .catch(function(error) {
        console.error(error);
      });
  });
});
```

This code initializes a ChatGPT instance with the OpenAI API key (Figure 2) and the desired model, and then adds a listener to the Moodle chat input field. When the user sends a message, the code sends the message to the ChatGPT instance to generate a response, and then adds the AI's response to the chat window. This is just a basic example and the code can be modified as needed.

Figure 2

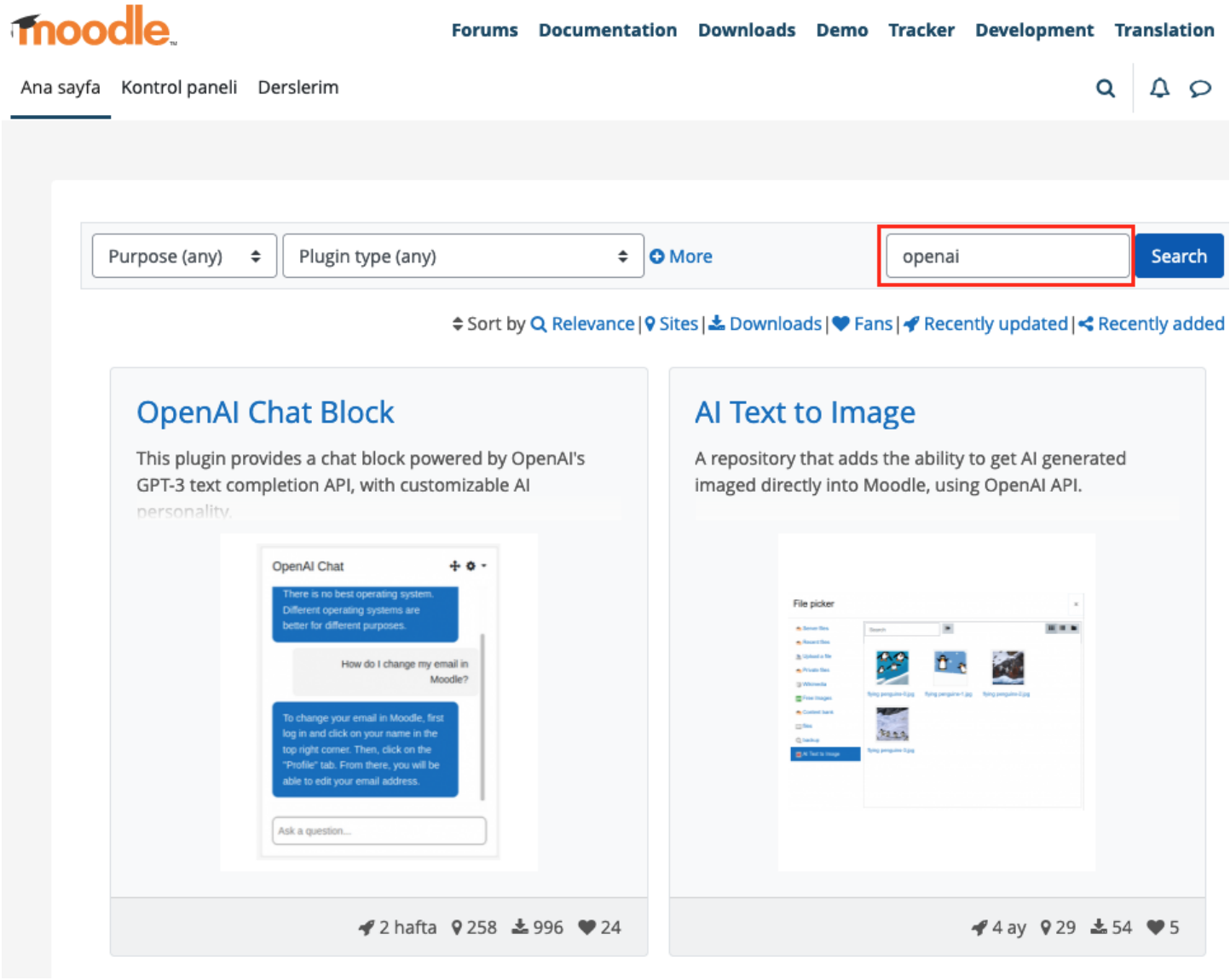
OpenAI GPT-3 API keys (https://platform.openai.com/account/api-keys)



When the existing Moodle plugins are examined, it is possible to see numerous plugins that focus on AI integration. Among them, a plugin has also been created for Chat GPT, whose integration process was explained above. With this plugin named *OpenAI Chat Block*, Chat GPT integration to Moodle can be made with ready interface preferences. This plugin provides a personalized chat block supported by OpenAI's GPT-3 text completion API. Additionally, the Moodle plugin named *AI Text to Image* is a plugin that supports visual production from text. Both plugins can be accessed from Moodle Plugins by searching for "openai" (Figure 3).

Figure 3

OpenAI plugins in moodle



The two OpenAI plugins that can be actively used in Moodle LMS are OpenAI Chat Block and AI Text to Image plugins. It is observed that OpenAI Chat Block has reached a higher number of downloads.

3. Conclusions and Suggestions

The aim of this study was to demonstrate the process of integrating AI technologies into LMSs through sample applications. Thus, process steps, sample applications, and codes were presented that could be useful not only for researchers but also for practitioners. However, it should not be forgotten that the integration of AI technologies into an LMS is a complex process that requires careful planning and evaluation. It has been observed

that users do not have sufficient knowledge about personal data privacy in AI usage (Başkaya and Karacan, 2022). In addition to the integration steps presented in the study, there are also several other factors that need to be considered when integrating AI into an LMS. These factors can be listed as follows:

1) *Security and privacy:* Ensuring the security and privacy of student data is crucial when integrating AI into an LMS. It is important to carefully evaluate data protection measures and ensure that all data is processed in accordance with relevant laws and regulations.

2) *Ethics:* The use of AI in education raises a number of ethical issues, including bias problems and the potential to replace human teaching and learning. It is important to carefully evaluate these issues and ensure that the use of AI is in compliance with ethical principles.

3) *Pedagogy/Andragogy:* The integration of AI into an LMS should be guided by pedagogical/andragogical considerations, such as how AI applications can support student learning and how they can be integrated into the overall teaching and learning process.

4) *Technical:* When integrating AI into an LMS, there are several technical considerations to take into account, including the compatibility of the AI platform with the LMS, the availability of necessary resources and infrastructure, and the need for continuous maintenance and support.

In general, the integration of AI into an LMS requires careful planning and evaluation in order to be effective and compatible with educational goals and objectives. By following the steps outlined above and carefully evaluating various relevant factors, it is possible to successfully integrate AI into an LMS and take advantage of its potential to increase the effectiveness and accessibility of education.

Ethical Statement and Conflict of Interest

There is no conflict of interest in the article. The study has not received funding from any institution or organization. Throughout this study, ethical standards and conditions of the Committee on Publication Ethics (COPE) have been followed, and scientific ethical principles and rules have been taken as a basis.

4. References

Başkaya, F., & Karacan, H. (2022). Yapay Zekâ Tabanlı Sistemlerin Kişisel Veri Mahremiyeti Üzerine Etkisi: Sohbet Robotları Üzerine İnceleme. *Bilişim Teknolojileri Dergisi*, 15(4), 481-491.

Bearman, M., Nieminen, J. H., & Ajjawi, R. (2022). Designing assessment in a digital world: an organising framework. *Assessment & Evaluation in Higher Education*, 1-14.

Bennani, S., Maalel, A., & Ben Ghezala, H. (2022). Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, 30(2), 628-642.

Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. john Wiley & sons.

Eggmann, N. (2022). Not Plug-and-Play: Successful Adoption of an AI-Based Learning Experience Platform. In *Artificial Intelligence Education in the Context of Work* (pp. 215-226). Cham: Springer International Publishing.

Fariani**,** R. I., Junus, K., & Santoso, H. B. (2022). A Systematic Literature Review on Personalised Learning in the Higher Education Context. *Technology, Knowledge and Learning*, 1-28.

Firat, M. (2023, January 12). *How Chat GPT Can Transform Autodidactic Experiences and Open Education?*. https://doi.org/10.31219/osf.io/9ge8m

Kothari, G., & Verma, B. L. (2022). AI-Implanted E-Learning 4.0: A New Paradigm in Higher Education. *Impact of Artificial Intelligence on Organizational Transformation*, 305-325.

Manciaracina, A. (2022). How to Design Learning Using Technology and Users' Needs?. In *Designing Hybrid Learning Environments and Processes: Interactive Communication Tools for Active Learning* (pp. 93-128). Cham: Springer International Publishing.

Pardamean, B., Suparyanto, T., Cenggoro, T. W., Sudigyo, D., Anugrahana, A., & Anugraheni, I. (2021, August). Model of Learning Management System Based on Artificial Intelligence in Team-Based Learning Framework. In *2021 International Conference on Information Management and Technology (ICIMTech)* (Vol. 1, pp. 37-42). IEEE.

Tapalova, O., & Zhiyenbayeva, N. (2022). Artificial Intelligence in Education: AIEd for Personalised Learning Pathways. *Electronic Journal of e-Learning*, 20(5), 639-653.

Weigert, D., & Behrendt, F. (2022). Conceptual framework of a Learning Experience Platform (LXP) to strengthen AI competence by linking simulation technologies and AI. Proceedings of the *21st International Conference on Modelling and Applied Simulation (MAS)*, doi: 10.46354/i3m.2022.mas.024.

Valdiviezo, A. D., & Crawford, M. (2020). *Fostering soft-skills development through learning experience platforms (LXPs). In Handbook of Teaching with Technology in Management, Leadership, and Business* (pp. 312-321). Edward Elgar Publishing.

Yavuzarslan, M., & Çiğdem, E. (2022). Öğrenme yönetim sistemi log kayıtlarının akademik başarı tahmininde kullanılması. *Bilişim Teknolojileri Dergisi*, 15(2), 199-207.