Artificial intelligence as a supportive tool for teachers' activities

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Abstract: *Digital technologies are integrated into education to improve the quality of teaching and learning and meet the needs of today's generation of learners. Recently, the usage of Artificial Intelligence-based tools in education has been accelerating, significantly changing the educational process. Teachers can use Artificial Intelligence-based tools to create lesson plans, learning content and tasks as well as to generate assessment resources. The current paper aims to present the use of two Artificial Intelligence-based tools – ChatGPT and MagicSchool in basic teacher's activities. The results show that such tools can create lesson plans in detail, generate learning content and practical examples, and provide ideas for homework assignments and quiz questions. Artificial Intelligence-based tools emphasize teachers' activities in classrooms, recommending suitable teaching methods and techniques. Reasonable usage of such tools, considering their advantages and possible risks and challenges can greatly support teachers' activities.*

Keywords: Artificial Intelligence, AI-based tools, education, teaching, ChatGPT, MagicSchool.

1. Introduction

Technologies significantly change people's way of life. Using technologies, people perform daily life's activities faster and more efficiently. Digital technologies provide instant communication between users from different parts of the world and opportunities for collaboration and interaction, that results in creating products of various natures, including knowledge. Education, although it is a more conservative field, also integrates digital technologies to improve the quality of educational services and meet the needs of the modern generation of learners. Today's digital students rely on technologies to acquire learning content and engage in learning activities.

In recent years, the integration of Artificial Intelligence (AI) in education is accelerating and this is significantly changing learning and teaching. AI has the potential to revolutionize them by providing personalized and engaging learning experiences for students (Vinay, 2023). AI can help people learn better and achieve educational goals more effectively (Fitria, 2021). AI-based tools help create an advanced educational environment where learning can be more personalized, teaching more flexible and management more inclusive (Pokrivcakova, 2019). Creating personalized learning experiences is possible by analyzing learners' data,

determining their individual learning needs, and offering activities and content tailored to their strengths and weaknesses (Fitria, 2021). AI-powered tools such as chatbots and virtual assistants are increasingly being used in educational platforms to assist and support learners and automate administrative tasks (Vinay, 2023). The integration of a virtual mentor that provides feedback on users' performance of various learning activities or a voice assistant that enables an interaction with learning materials without communication with teacher allow the use of educational platforms anywhere and at any time (Fitria, 2021).

Education is a social process aimed not only at acquiring knowledge and skills, but also at developing communication and interaction skills. AI can automate administrative tasks, provide personalized learning experiences, but it cannot fully replicate the human qualities and atmosphere that teachers create in the classroom (Ghamrawi, Shal & Ghamrawi, 2024).

Like any technology, AI has its advantages and disadvantages. To derive maximum benefits for all participants in education, it is necessary for teachers, students and society to objectively assess its capabilities and capacity, but also to be aware of the risks and challenges associated with its integration into education. The current focus and emphasis is on the ethical and responsible use of AI-based tools to ensure that they support students' learning and well-being (Vinay, 2023). The current paper aims to present the use of two AI-based tools – ChatGPT and MagicSchool in basic teacher's activities. They include creating lesson plans, developing learning content on the lesson topic, as well as resources for assess learners' knowledge and skills.

2. AI-Based tools in teaching activities

In their work, teachers can use AI-based tools to create lesson plans, generate learning content and materials on given curriculum topics, tailored to the learners' preferences and needs, create practical tasks and tasks for independent work and homework, as well as for assessment. AI can ease the burden on educators in dealing with repetitive administrative tasks and learning activities that take time and effort. Automating their implementation gives educators more opportunities to monitor student progress, improve teaching techniques (Fitria, 2021) and helps them to perform activities more effectively (Pokrivcakova, 2019).

With AI-based tools, curricula and lesson plans do not need to be created from scratch, which saves educators' time to search for the necessary learning resources (Fitria, 2021). The curriculum can be analyzed by AI-based systems and based on the results, they can create personalized content (Singh, & Hiran, 2022). AI helps educators to identify the educational needs of each learner and generate and deliver the appropriate learning content and activities with the necessary immediate and personalized feedback (Celik, et al., 2022), which ensures deeper learning and retention (Singh, & Hiran, 2022). AI can support educators, saving time and effort in developing resources to assess learners' knowledge and skills, as

well as automating assessment processes. By automating the grading of homework, essays, quizzes, teachers will be able to spend more time on discussions and conversations with learners (Singh, & Hiran, 2022) and to focus on timely and additional support for learners (Celik, et al., 2022, Murphy, 2019). AI-based educational systems can assist educators with instructional suggestions aimed at effectively organizing of teaching activities in their classrooms based on observations of learners' behavior and progress (Luckin, et.al., 2022). AI-based applications analyze learners' data, actions and results, and are able to recognize their strengths and weaknesses, helping teachers to identify problems in students' learning and intervene at an early stage to overcome them (Singh & Hiran, 2022).

It should be noted that AI limits human interaction, the development of social skills and the ability to build relationships – significant disadvantages in the context of education (Fitria, 2021). Teaching involves not only disseminating information and knowledge; it requires developing social and critical thinking skills, creating a constructive atmosphere in the classroom, stimulating the creative abilities of students. Effective teaching is possible thanks to the unique abilities of teachers to engage, motivate and inspire learners (Ghamrawi, Shal, & Ghamrawi, 2024).

In recent years, more and more educational applications based on AI have appeared. Educators quickly adopt and use them as a learning aid and pedagogical tool (Singh & Hiran, 2022) integrated into directed by them classroom activities (Murphy, 2019).

3. Creating learning resources with AI-based tools

The paper aims to present the use of two AI-based tools – ChatGPT and MagicSchool in teachers' activities. They include creating lesson plans, developing learning content on the lesson topic, as well as resources for assess learners' knowledge and skills. The selected topic is: Primitive Data Types in C++, which is part of the subject Fundamentals of Programming studied by students of different specialties at Trakia University – Stara Zagora, Bulgaria.

ChatGPT is the most popular and powerful AI-based tool. ChatGPT is an AI language model developed by OpenAI that can generate text by predicting the next word in a sentence based on the context of the preceding words (Božić, & Poola, 2023). ChatGPT is a generative AI model that process and produce human-like text using deep learning methods (Roumeliotis, & Tselikas, 2023). The ChatGPT-3 model was trained on a huge amount of text and documents and from them, the model had learned how to process natural language and write well-structured text (Sharma & Yadav, 2022).

MagicSchool is a generative AI platform primarily designed for educators that supports their work in preparing learning resources and activities (MagicSchool AI). MagicSchool AI is a set of tools to help teachers develop lesson plans, generate learning materials and practice tasks, questions and quizzes, and

more, saving their time and efforts. Magic School offers tools for developing learning resources in various subject areas and supports over 25 languages (AI Tools for Education).

3.1 Creating a lesson plan

Experienced teachers already have built skills for structuring learning content on a given topic and appropriately organizing and delivering learning materials to students. They are also experienced in emphasizing the key points of the topic, they are aware of possible difficulties learners face and know what additional resources to provide to support and help them, as well as how to organize the learning activities, to achieve the educational goals. For beginner teachers, it is a challenge to prepare each new lesson. AI-based tools can be helpful in recommending a preliminary lesson structure or plan that can be further developed by them.

The following prompt was made to both tools – ChatGPT and MagicSchool: Create a lesson plan (90 minutes) for university students on topic Primitive data types in C++. It was specified what students learned in the previous lecture.

ChatGPT proposed a lesson plan that clearly highlights the defined objectives (1. Identify and understand different primitive data types in C++.; 2. Declare and use variables of these types. 3. Understand the size and range of each type. 4. Use typecasting and understand its necessity) and indicated the necessary technical and didactic tools, which teachers are encouraged to use during the class (Whiteboard and markers, Projector and computer for code demonstrations, Handouts (optional): Summary of C++ primitive data types, Access to a C++ compiler or IDE (e.g., Visual Studio, Code: Blocks, or an online compiler).

The proposed structure of the lesson included several stages, and for each of them ChatGPT specified the time that the teacher should allocate (Figure 1).

MagicSchool offers a variety of tools to assist teachers. The Lesson Plan tool is used to create a lesson plan. It is necessary to specify the level of learners (university students), the topic and some additional criteria such as students last lesson topic, has the lesson include group work, etc.

MagicSchool's answer included clear definition of Objective (Students will be able to identify, describe, and utilize the primitive data types in C++, including their characteristics and uses in programming), Assessment method (Students will complete a short quiz that requires them to define each primitive data type, provide an example of its usage in C++, and explain the differences between these types) and Key Points (the main concepts that are included in the topic - Primitive Data Types, Memory Allocation, Type Conversion, Usage in Programs, Common Errors).

The proposed structure of the lesson included several stages, and for each of them MagicSchool gave advices and recommendation to teachers (Figure 2).

- *Introduction (10 minutes)* – recal of knowledge from the previous lecture and introduction to the new topic.
- *Theoretical part (20 minutes)* – a lecture with an emphasis on the definitions of data types (Integer, Floating-Point, Character and Boolean) and why data types are important in programming.
- *Detailed Explanation and Code Examples (30 minutes)* – code examples for each of the data types.
- *Practical work (20 minutes)* – the recommended activity for students is to write a program that includes the actions demonstrated in the previous part. ChatGPT gived detailed instructions on what explanations the teacher has to give to students and what to do during this stage – Walk around the class to assist with any issues.
- *Typecasting and Its Importance (10 minutes)* – ChatGPT recommended a discussion of typecasting issues and explanations with examples.
- *Q&A and Review (10 minutes)* – time for questions from the students and a Review made by the teacher and Homework Assignment.
- *Conclusion* – ChatGPT offered the teacher to thank the students for their participation and inform them about the next topic Advanced Data Types in C++ (e.g., arrays, strings, and pointers).

Figure 1. The lesson plan generated by ChatGPT

- *Opening* – guidelines and instructions on how to start the lecture (what introductory questions to have)
- *Introduction to New Material* – guidelines how to present the new content – short video on the topic, discussion on a given program, presentation of the new content. MagicSchool recommended that students should take notes.
- *Guided Practice* – instructions to teachers to give examples of creating programming code, encoure students to participate in pair discussions when solving the tasks, monitore the discussions and give feedback and help.
- *Independent Practice* – recommendations to teachers to assign students tasks to create elementary C++ programs using variables of any primitive data type, including comments explaining their choices. The instructions to the teacher are to set clear requirements for neatness and clarity of the code.
- *Closing* – recommendation to teachers to use a game approach to check what was learned during the lesson, summarizing the topic.
- *Extension Activity* – recommendation to teachers to prepare additional tasks for students who work faster to challenge them to research and present on a more complex data type in C++.
- *Homework* – recommendation for homework.
- *Standards Addressed* –CCSS.ELA-LITERACY.RST.11-12.7 and CSTA K-12 Computer Science Standards 3B-AP-10.

Figure 2. The lesson plan generated by MagicSchool

During the conversation MagicSchool tool showed as hints additional questions that the teacher can ask – such as, *What resources can I use to help students understand type conversion better?*

Table 1 summarizes the results given by the AI-based tools. Both tools have given clear guidelines regarding the structure of the lesson including the educational objectives. For each stage, the tools have recommended what educational resources to be provided to learners and what teaching methods to be used. There is a balance between the theoretical and practical part. Both tools have included as learning content the basic primitive data types, and ChatGPT provides many examples and explanations for them.

Table 1. Creating a lesson plan

Lesson Plan	ChatGPT	MagicSchool
Prompt	Text message or attach a file	Text message, attach a file or voice instruction
Educational objectives	Clearly defined	Clearly defined
Technical and didactic means	Specified	Not specified
Lesson Structure	The main activities in the lesson and the time that is recommended to be allocated are indicated, as well as the methods that teachers should use.	The main activities in the lesson are indicated, as well as the recommended methods for teachers to use
Theoretical part	Recommendations on what learning content to be included as well as specific examples of programs are provided	Recommendations on what learning content to be included
Practical part	Specific examples of programs are given	Guidelines for the examples to be included are given
Additional Resources	They are not part of the suggested lesson plan. They can be obtained by additional prompt	They are provided as guidelines as part of the lesson plan
Feedback (Questions and Answers)	Questions and answers are recommended as a part of the closing phase	Instructions for giving feedback during the practical part. Questions and answers are also included in the concluding section
Homework	A typical task with a variety of options, as well as specific performance recommendations	Recommendations what to be assigned as a homework
Conclusion	Recommendation on how to end the lesson	Guidelines for possible methods to use for feedback and summary

The developed lesson plan can support teachers in organizing class activities appropriately. They can take advantage of the given guidelines and enrich both the learning content and diversify the learning activities, actively involving the students.

3.2 Creating a presentation with learning content

The presentation is one of the most frequently used means by educators to deliver new learning content. Both tools were requested to create a presentation based on the proposed lesson plan.

ChatGPT created a presentation outline with content for each slide. Upon additional prompt created Power Point presentation and made it available for download. The presentation (17 slides) included: ***Introduction*** (recall the knowledge from the previous lesson and indicate the learning objectives of the current one.), ***Main part*** (essence of Primitive Data Types with slides for each of the types (Integer, Floating-Point, Character, Boolean) with examples (programming code), ***Practical part*** (the content is similar to that in the lesson plan), ***Type conversion*** (with an example with programming code). The last 3 slides ***Q&A and Review, Homework Assignment*** and ***Conclusion*** include instructions for the teacher not the learning content.

MagicSchool platform includes a tool Academic Content to create learning resources. The tool does not provide the ability to create a presentation, but the teacher can set as a criterion in Content type box, as well as how many slides to be created. MagicSchool offered an outline of the presentation, breaking down the learning content into slides: ***Slides from 1 to 7*** (include learning content that was specified in a prompt as already presented in a previous lesson (C++ Alphabet, Comments in C++, Constants and Variables, Identifiers and Operators in C++, Structure of a C++ Program), ***Slides from 8 to 14*** (the basic data types with examples of declaration and initialization of variables, Size and Range of Primitive Data Types and type conversion), Slide 15 ***Conclusion and Next Steps*** with general recommendations.

After additional prompts, MagicSchool generates a PowerPoint-style presentation, describing the content of each slide as it would appear in a real presentation. The presentation had to be created in PowerPoint by the teacher and needed significant improvements both in terms of content and design.

Both tools have generated content for presentations, but they need significant improvements in both content and design. The presentations have included rather guidelines for what content to have on the slides, which overlaps the lesson plan content. The suggestions for presentation content can support educators, but the main burden and responsibility of creating them falls on teachers. They have to invest time and effort to create well-designed presentations with appropriate content to deliver the new learning content to students.

One of the major drawbacks of AI is that sometimes AI-based tools generate false information. For teachers is very important to ensure the reliability of the generated learning content. In this study, the credibility of the generated content and the correctness of the examples can be confirmed. Of interest was the question what sources AI-based tools had used to generate the lesson plan and presentation.

Both tools gave identical responses that they did not use specific literature sources. They generated the content based on the data on which the model was trained. In addition, they have listed and recommended existing literature: "C++ Primer" by Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo and "The C++ Programming Language" by Bjarne Stroustrup, as well as online resources - The official C++ documentation available on cppreference.com. In addition, ChatGPT pointed to "Programming: Principles and Practice Using C++" by Bjarne Stroustrup, "Effective C++" by Scott Meyers, as well as online resources: GeeksforGeeks, Tutorialspoint, and cplusplus.com.

3.3 Creating practical tasks as class exercises

Practical tasks for exercising are necessary for programming classes. It should be noted that ChatGPT generated many examples with programing code as a part of the lesson plan.

ChatGPT created examples for students to practice in class – for each data type along with programming code shown on Figure 3. The examples fully corresponded to the learning content and were correct.

```cpp
#include <iostream>
using namespace std;

int main() {
    int a = 100;          // Standard integer
    short b = 200;        // Short integer
    long c = 30000L;      // Long integer
    long long d = 4000000000LL;// Long long integer
    unsigned int e = 500U; // Unsigned integer

    cout << "int: " << a << ", size: " << sizeof(a) << " bytes\n";
    cout << "short: " << b << ", size: " << sizeof(b) << " bytes\n";
    cout << "long: " << c << ", size: " << sizeof(c) << " bytes\n";
    cout << "long long: " << d << ", size: " << sizeof(d) << " bytes\n";
    cout << "unsigned int: " << e << ", size: " << sizeof(e) << " bytes\n";

    return 0;
    }
```

Figure 3. Practical task, generated by ChatGPT

MagicSchool created tasks that cover declaration, manipulation, conversion, and practical application of different data types (Figure 4). The solutions (C++ code along with brief explanations) were given after additional prompt and they were correct. Some of the tasks were more difficult and required the use of more complex constructions and algorithms, such as conditional and loops operators.

There were similarities in the practical tasks generated by the AI-based tools, accompanied by annotations and programming code. ChatGPT had added the necessary comments. Some of the tasks were more difficult and required the use of complex constructions and algorithms. The students are not familiar with them since they will be studied in the next lectures. The teachers should critically evaluate the proposals for practical tasks, taking into account the current level of students' knowledge and skills.

```
Data Type Exploration:
Write a program that declares variables of each primitive data type (int, short, long, float, double, char,
bool). Use the sizeof() operator to print the size of each variable. Compare the results and discuss the
differences.

#include <iostream>
using namespace std;

int main() {
    int i;
    short s;
    long l;
    float f;
    double d;
    char c;
    bool b;

    cout << "Size of int: " << sizeof(i) << " bytes" << endl;
    cout << "Size of short: " << sizeof(s) << " bytes" << endl;
    cout << "Size of long: " << sizeof(l) << " bytes" << endl;
    cout << "Size of float: " << sizeof(f) << " bytes" << endl;
    cout << "Size of double: " << sizeof(d) << " bytes" << endl;
    cout << "Size of char: " << sizeof(c) << " bytes" << endl;
    cout << "Size of bool: " << sizeof(b) << " bytes" << endl;

    return 0;
    }
```

Figure 4. Practical task, generated by MagicSchool

After an additional prompt, ChatGPT created three additional practice tasks and their solutions for students who work faster (*Data Type Calculator, String Analyzer, Number System Converter*). The tasks were of a higher degree of complexity and require the use of more complex constructions and algorithms (operators for multivariate choice, conditional and loops operators), which were not suitable since students haven't studied them yet.

3.4. Creating homework assignments

Both tools had included in the lesson plan homework assignment, which is a common practice in teaching.

ChatGPT offered 3 tasks to create C++ programs (*Temperature Conversion Program, Simple Interest Calculator* and *ASCII Value Finder*). For each tasks, ChatGPT gave a specific description of what the program should do, requirements (what data types to use, how to derive the result and formulas), and sample code. Homework assignments are fully aligned with the lesson topic (Table 2).

MagicSchool offered 3 tasks (*Data Type Calculator, String Analyzer and Number System Converter*), giving detailed instructions on what the program should do (Table 2). After an additional prompt, solutions can also be obtained. It is noteworthy that the homework assignments were of a higher degree of difficulty, but they were in line with the practical tasks that were presented during the lesson. However, they are not very suitable to the current level of students' knowledge.

Table 2. Creating homework assignments

ChatGPT
Homework Task 1: Temperature Conversion Program **Description:** Write a program that converts temperatures between Celsius and Fahrenheit. The program should prompt the user to enter a temperature in Celsius and then display the equivalent temperature in Fahrenheit. Additionally, it should prompt the user to enter a temperature in Fahrenheit and then display the equivalent temperature in Celsius. **Requirements:** - Use `float` or `double` for the temperature variables. - Use appropriate typecasting if necessary. - Display the results with a precision of two decimal places. **Formulae:** - Celsius to Fahrenheit: $F = C \times \frac{9}{5} + 32$ - Fahrenheit to Celsius: $C = (F - 32) \times \frac{5}{9}$ **Example Code Skeleton:**
MagicSchool

Task 1: Data Type Calculator
Create a program that acts as a data type calculator. The program should:
  1. Ask the user to input two numbers of any primitive numeric type (int, float, double, etc.).
  2. Allow the user to choose an operation (+, -, *, /).
  3. Perform the operation and display the result.
  4. Show the data type of the result (use typeid().name()).
  5. Allow the user to perform multiple calculations in one session.
Bonus: Implement error handling for division by zero and invalid input.

MagicSchool has given much more complex homework assignments compared to ChatGPT. It is desirable the complexity of homework assignments to be tailored to the topic under consideration. Teachers should adapt the proposed assignments to the current students' level of knowledge so they can practice what they have learned during the classes and gain confidence in their abilities.

3.5 Creating quiz questions

Including quizzes to test acquired knowledge and skills by students is a good pedagogical practice. Quizzes and questions can be used in the closing part of the lesson or for self-assessment. Both tools were prompted to create 5 multiple-choice questions on the topic Primitive data types in C++.

ChatGPT generated questions and indicated the correct answer.

MagicSchool platform offers the tool Multiple Choice Assessment for creating multiple choice questions. The questions were generated, each with 4 possible answers. MagicSchool suggested the correct answers, warning teachers to review the generated answers for accuracy.

The generated questions reflected the topic and were tailored to the students'

basic level of knowledge (Table 3). The question answers were correct, as well as the distractors were appropriate. Two of the questions were identical.

Table 3. Examples of generated questions

ChatGPT	Magic School
### Quiz: Primitive Data Types in C++ #### Question 1: Which of the following is not a primitive data type in C++? A. `int` B. `double` C. `string` D. `char` **Correct Answer: C. `string`**	**1. Which of the following is NOT a primitive data type in C++?** a. int b. float c. char d. string Answer Key (**Always review AI generated answers for accuracy - Math is more likely to be inaccurate**).

Creating learning resources using the capabilities of AI-based tools is a complex and responsible process. It is necessary teachers to refine the prompts, specify certain aspects and details, verify the credibility and correctness of generated information. Based on the current research, it can be noted that ChatGPT provided many examples with programming code, accompanied by comments and guidance for teachers, thereby emphasizing the practical orientation of the topic. MagicSchool, after each response to a users' prompt, made suggestions for follow-up clarifying questions, such as *Perhaps you have questions about the teaching methods of this topic?*. The emphasis is on teaching and not so much on the learning content.

4. Conclusion

AI has the potential to change teaching and learning significantly. AI can reduce the workload and burden on educators in developing learning content and preparing learning activities. AI is a tool that supports the work of educators, but they have priority role in teaching and learnings and cannot be replaced (Fitria, 2021). Educators have a rich variety of AI-based tools at their disposal. To maximize the benefits of using AI-based applications in the field of teaching, it is necessary to create clear prompts - to specify the topic of the learning plan or content, the degree of difficulty, the duration of the lesson and all aspects related to the current level of learners' knowledge.

For teachers with extensive teaching experience, AI-based tools can provide new ideas for diversifying their teaching methods and additional examples and tasks to be included in classes. For young educators with less teaching experience, AI-based tools can be a valuable aid in developing lesson plans, generating learning content, examples and assignments, and quizz questions. Regardless of their teaching experience, educators must critically evaluate and verify the content authenticity and quality, generated by AI in order to match the learning goals, the students' level of knowledge and learning style, as well as their educational needs.

The teachers' role in learning is leading. Modern technologies can only support, diversify and turn learning into an active, intriguing and motivating process.

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