

MY ChatGPT TEACHER. TOWARDS A METHODOLOGY FOR USING ARTIFICIAL INTELLIGENCE IN SELF-DIRECTED LEARNING

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Abstract: *Language is the distinctive feature separating humans from the rest of the animal world. Therefore, throughout history, inventions and technologies that changed the way we use language have been crucial turning points. These include the invention of writing, which allowed the communication across space and time, the printing press, which facilitated the rapid and widespread dissemination of knowledge, and the advent of the Internet and mobile phone technology, which resulted in an explosion of communications and faster diffusion of knowledge. The latest revolutionary innovation in the field of language processing is ChatGPT, a generative AI model launched by OpenAI in November 2022, which produced spectacular results in natural language processing (NLP). It appears to be one of the most significant milestones in this field and has the potential to produce major changes in numerous domains, particularly in education. Starting from the available literature and from several experiments with ChatGPT, this paper outlines the main methodological requirements for using this instrument as an aid for self-directed learners.*

Keywords: *education, self-directed learning, ChatGPT, natural language processing, meta-cognition, meta-ignorance.*

1. INTRODUCTION

One of the most important assets to succeed in this fast changing world, flooded with information and highly competitive is the ability to learn continuously and independently. This skill (and the associated processes) received various names in the literature: self-education, self-teaching, autonomous learning, self directed learning, self regulated learning etc. The first attempt to approach scientifically the topics related to self education can be traced back to 1975, when Knowles ([1]) coined the term *self directed learning (SDL)*, defined as a process wherein “individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes”. More recently, in 2002, Zimmerman ([2]) introduced the concept of *self regulated learning (SRL)*, and placed the focus on the metacognitive monitoring and control of the learning process.

The differences between the concepts of SDL and SRL are subtle (for a detailed discussion on this topic see [3]), but, in summary, SDL is a broader concept that encompasses SRL, as it involves taking control of the entire learning process, from identifying learning needs to evaluating progress. SRL focuses more specifically on the process of monitoring and adjusting one's own learning behaviors in order to achieve the

learning goals. A comprehensive review of the literature on SDL and SRL is available in [4] and [5].

Currently, most researchers agree that the essential abilities of a self directed learner are:

- The ability to assess learning needs and to establish learning goals,
- The ability to select learning strategies,
- The ability to monitor the progress and to adjust the behavior towards the desired learning outcome.
- The ability to identify and efficiently use learning resources.

Note that the first three abilities listed above are intrinsically metacognitive, which suggests the existence of a strong correlation between metacognition and SDL (see [6]).

In what concerns the educational resources, a new tool, recently launched, based on emerging technologies sparked the interest of the educators, researchers and of the general public. It is called ChatGPT – a conversational robot (chatbot) equipped with artificial intelligence, capable to understand and generate natural human language in at least 95 languages ([7]). It has been trained using a huge dataset of texts from books, web pages, news archives, scientific articles, and it is capable to generate complex answers to questions on almost any topic.

Of course, ChatGPT is not perfect. A SWOT analysis of its performances is available in [8]. It may not be able to make accurate economic and stock market forecasts, but – at least for education – it seems to be an invaluable tool. This paper is about how to use efficiently this tool for self directed learning.

2. HOW TO KNOW WHAT WE DON'T KNOW

ChatGPT is designed as a conversational robot and therefore the initiative of the dialogues always belongs to the human operator, who must ask questions and issue prompts. In order to get useful answers, the questions must be clear and specific and provide a context, so that ChatGPT can understand the background and the purpose of the inquiry.

For self directed learners this may be a major issue because – as David Dunning noticed in [9] – “there are questions that people do not know enough to ask”. Dunning coined the term meta-ignorance to describe the “unknown unknowns” – the gaps of knowledge that people are not aware of. On the other hand, ignorance is often obscured by misbeliefs that people mistake for valid knowledge.

It appears that meta-ignorance is the most important obstacle in using ChatGPT by self directed learners. Therefore, the dialogues should start by prompting ChatGPT to outline the educational path towards the assumed goal and to propose a table of contents of the course.

3. CASE STUDY. HOW A TOTAL NOVICE CAN USE ChatGPT TO LEARN A PROGRAMMING LANGUAGE

During my formal education as a psychologist, I have never had the opportunity to write computer programs and I am totally ignorant in the field of programming languages. I learned about Python by asking Google to provide examples of modern programming languages, and from the list presented by Google I chose Python because it is said to be easier to learn by beginners. With this background, I prompted ChatGPT to design a course to help me learn Python. The dialogue is shown in Table 1.

Table 1. Initial dialogue with ChatGPT

Assume that you are an expert teacher, and I am a totally novice in programming languages of any type. Please design a course structure for me to learn Python as fast as possible: where to start, what are the basic concepts, how to install the programming environment for exercises.

Sure, I'd be happy to help design a course structure for you to learn Python as quickly as possible! Here's a suggested course outline:

Week 1: Introduction to Python and Installation

- Introduction to Python and its history
- Installing Python on your computer (Anaconda or other distributions)
- Installing an Integrated Development Environment (IDE) for Python (e.g. PyCharm, Jupyter Notebooks, Spyder)
- Creating your first Python script

Week 2: Basic Programming Concepts

- Understanding variables and data types (integers, floats, strings, booleans)
- Operators (arithmetic, comparison, logical)
- Basic control structures (if-else statements, loops)

Week 3: Functions and Modules

- Writing your own functions
- Built-in functions in Python
- Importing and using external modules

Week 4: Working with Data

- Reading and writing data from/to files (text, csv, binary)
- Working with lists and dictionaries
- Introduction to NumPy and Pandas for working with arrays and dataframes

Week 5: Object-Oriented Programming

- Understanding classes and objects
- Creating your own classes
- Inheritance and polymorphism

Week 6: Advanced Topics

- Exceptions and error handling
- Regular expressions
- Debugging and testing
- Introduction to popular Python libraries and frameworks (e.g. Matplotlib, Flask, Django)

Throughout the course, you should also work on small projects and exercises to reinforce your learning and apply the concepts you have learned.

This looks pretty close to the table of contents of some popular textbooks on Python programming (e.g. [10]) with the obvious advantage that ChatGPT offers an interactive course, answers additional questions, may change the order of the presentation upon request, provide as many code examples as needed, and can even ask multiple choice questions to verify the progress of the learner.

The most important feature of this table of contents is that it allows the learner to circumvent his own initial meta-ignorance and lets him ask meaningful questions. Table 2 contains shows how the dialogue with ChatGPT continued.

Table 2. Excerpt from the dialogue with ChatGPT

Now, let's start with the first lesson: Introduction to Python and its history. Please include a story about people who created Python.

Python is a popular high-level programming language that was created in the late 1980s by Guido van Rossum, a Dutch computer programmer. Van Rossum created Python as a side project while working at the Netherlands Centrum Wiskunde & Informatica (CWI), a Dutch national research institute for mathematics and computer science.

The language was initially conceived as a successor to the ABC programming language, which was designed to be easy to use and learn. Python, like ABC, was designed with simplicity and ease-of-use in mind, and has since become one of the most popular programming languages in the world. The name "Python" was chosen by van Rossum as a tribute to the comedy troupe Monty Python, which he admired. In fact, some of the original Python documentation even includes references to Monty Python sketches and characters.

Python has been continuously developed and improved over the years, with a large and active community of developers contributing to its growth and evolution. Today, Python is used for a wide range of applications, from web development and scientific computing to machine learning and data analysis. Its popularity is due to its simple syntax, readability, and ease-of-use, making it a great language for both beginner and advanced programmers alike.

Besides simplicity, what are other reasons for choosing Python? Compare it with other popular programming languages.

In addition to its simplicity, Python has several advantages that make it a popular choice for many applications:

1. Versatility: Python can be used for a wide range of applications, from web development and scientific computing to machine learning and artificial intelligence.
2. Readability: Python code is easy to read and understand, thanks to its clean syntax and use of whitespace.
3. Large Community: Python has a large and active community of developers who contribute to its development, create libraries and tools, and offer support to other developers.
4. Cross-platform compatibility: Python code can run on multiple platforms, including Windows, macOS, and Linux, making it a versatile choice for software development.

When compared to other popular programming languages, such as Java, C++, and JavaScript, Python stands out for its simplicity and ease of use. It requires less code to accomplish many tasks, and its syntax is designed to be easy to read and understand. Additionally, Python's wide range of libraries and tools make it a popular choice for data science, machine learning, and artificial intelligence applications.

Note that I asked ChatGPT to include stories in the presentation because stories are likely to elicit emotions and provide anchors that link the new information to my prior knowledge. Also, by asking details about the advantages of Python, I had the chance to improve my motivation for learning and identify possible applications of the new information in my activity.

CONCLUSIONS

It is now possible to formulate a few methodological guidelines for using ChatGPT by self-directed learners:

- Always start by asking ChatGPT to present a list of what is important to know about <topic>, and provide a rationale for its recommendations.
- Continue by asking details on the advantages and benefits of gaining knowledge about <topic>.
- Prompt ChatGPT to place the information provided in a larger (historical, technological, social) context. Ask it to tell stories about the people who contributed to the <topic>.

- Start by clarifying the basic concepts and the terminology specific to the <topic>. Ask as many questions as needed. Request details on the differences between the new concepts and other related or similar terms.
- Ask for examples whenever is needed.
- Ask ChatGPT to summarize the ideas discussed.
- Prompt ChatGPT to create multiple choice questions to verify the progress of the learner.
- Be aware that ChatGPT is not infallible and sometimes it makes mistakes.

By following these simple rules, it is easy to create a personalized learning experience and tailor the educational content according to individual needs and interests. This can help learners to stay engaged and motivated, and to make progress at their own pace.

Moreover, ChatGPT can provide learners with a sense of autonomy and control over their learning, which can help to reduce anxiety and stress. Knowing that help is always available can also help learners to feel more confident and capable.

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