SELECTED APPLICATIONS OF COPILOT FOR MATH TEACHING: MATERIALS AUTHORING, EXPLAINER VIDEOS AND SOLUTION EXPLANATIONS

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Abstract

Recent advances in large language models have opened new opportunities for supporting mathematics education through generative artificial intelligence tools. This paper examines selected applications of Microsoft Copilot in the preparation of teaching materials for quantitative methods courses, with particular attention to user prompts formulated in Czech. The analysis focuses on authoring learning materials workflow. A case example concerning the calculation of consumer surplus using a definite integral is used to illustrate Copilot's capabilities.

The tool generated learning objectives, alternative video titles, a structured script with visual suggestions, voice-over text, a numerical example, a graphical representation, and editable Python source code for the plot. It also provided an alternative intuitive explanation based on the area of a triangle for the case of a linear demand function. The results indicate that Copilot can support efficient preparation of mathematically and economically meaningful teaching resources. However, the outputs still require expert review, especially with respect to didactic appropriateness, and language quality, including grammatical correctness in Czech.

Key words: mathematics education, Microsoft Copilot, generative artificial intelligence

JEL Code: C80, C88

Introduction

The recent advances in large language models resulted in applications in many fields including education. This has been reflected in literature too. The applications of generative artificial intelligence tools based on large language models in education are discussed in (Ellis and Slade, 2023), (Lambert and Stevens, 2023), (Chan, 2023), (McIntire et al, 2024), (Chen et al., 2024), (Ülkü, 2023), (Pudasaini et al., 2024) or (Xing, 2024). Both the concerns about the risks of using such tools and the benefits they may bring in education are mentioned in the papers.

The recent paper (Víta, 2025) focuses on the applications of chatbots for education in mathematics in Czech language. The case study in (Kaspříková, 2025) presents the evaluation of a sequence of user requests centered around an application of directional derivatives in economics, including the discussion of an ability to provide a source code to be used in LaTeX typesetting system. Using generative artificial intelligence tools in education may bring benefits in terms of time or cost savings, possibility of differentiation and instant feedback.

This paper examines current capabilities of Microsoft Copilot to support mathematics education across core workflows such as authoring of teaching materials including the design of short explainer videos (learning objectives, scripts, storyboards, captions) and generation of step-by-step problem solutions with sound explanations. The focus is on solving tasks for courses in quantitative methods specified by users in the Czech language.

1 Generating teaching materials on consumer surplus calculation

The consumer surplus is a standard concept introduced in introductory courses in economics at university level. The mathematical tools used in calculating consumer surplus include definite integral. Let's inspect some of the possibilities of using Microsoft Copilot for preparing the teaching materials on this topic.

The response to the request to prepare an explainer video on the application of a definite integral to calculate consumer surplus started with a list of proposed goals, which included understanding the meaning of consumer surplus, why it equals the area between the demand curve and the market equilibrium price, how to calculate this area using the definite integral and how to proceed when solving a simple example numerical example. There were two alternatives for the title of the video proposed - „Jak určitý integrál pomáhá měřit spotřebitelský přebytek“ (How a definite integral helps measure consumer surplus) and „Spotřebitelský přebytek jako plocha pod křivkou poptávky“ (Consumer surplus as the area under the demand curve). Considering the aim and the contents of the teaching material, such titles may be considered good.

The response then proceeds with a proposal of the structure of the video starting with motivation, followed by the explanation of what is consumer surplus, then introducing calculation using definite integral and concluding with a numerical example. Each item in the proposed structure above is characterized by a proposed visual object (a picture or a plot), slide text and a comment, which can be used as the voiceover. A shorter version of the voiceover is proposed too. The proposed structure of the teaching material may be considered as well

balanced and accurate enough for elementary courses in applications of mathematics for economics students. The plot which the chatbot has generated to visualize the concept introduced in the presentation is shown in Figure 2. The plot is clear and illustrates the concept of consumer surplus well.

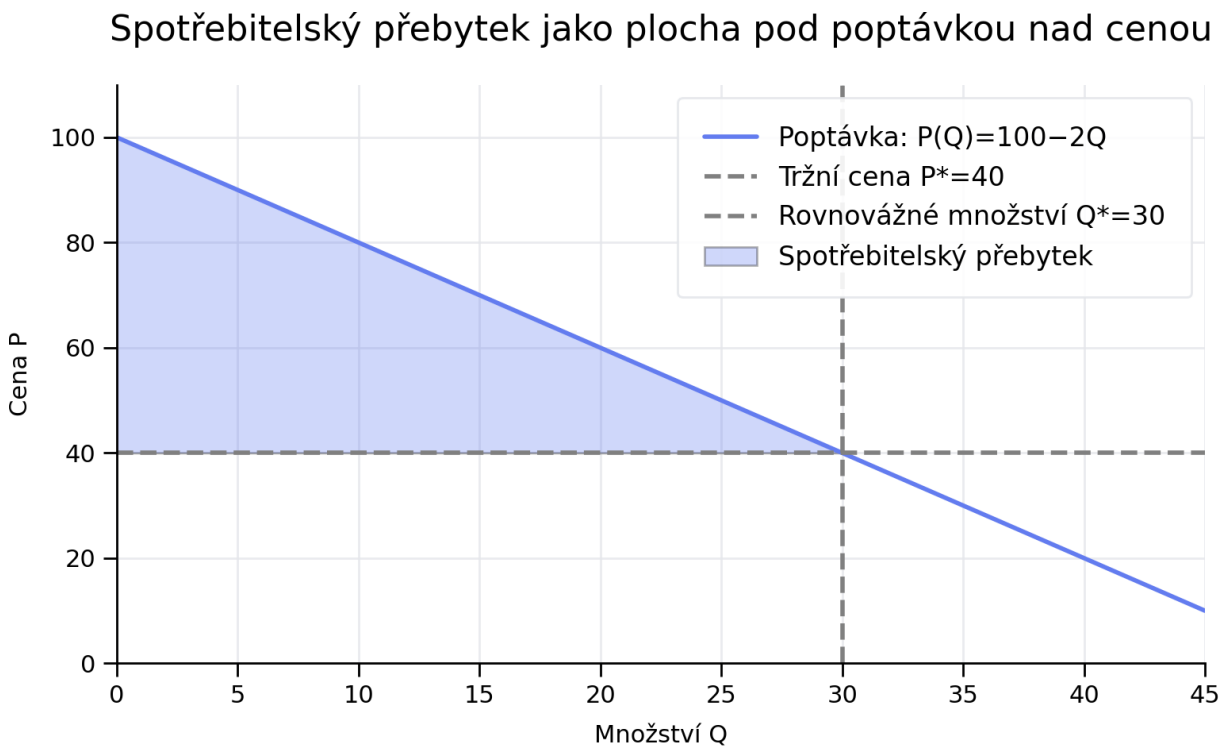
Fig. 1: Part of the response showing script of the proposed video

Scéna	Vizuál	Komentář
1	Zákazník a cenovka	„Když jsme ochotni zaplatit více, než skutečně platíme, vzniká spotřebitelský přebytek."
2	Jednoduchý příklad: ochota platit 100 Kč, cena 70 Kč	„V tomto případě je přebytek 30 Kč."
3	Graf poptávky	„Na trhu ale není jen jeden zákazník. Poptávková křivka ukazuje ochotu platit pro různé množství."
4	Vodorovná čára tržní ceny	„Tržní cena je stejná pro všechny nakupující."
5	Zvýrazněná plocha mezi poptávkou a cenou	„Tato plocha představuje celkový spotřebitelský přebytek."
6	Rozdělení plochy na proužky	„Každý proužek je malý rozdíl mezi ochotou platit a cenou."
7	Objeví se integrál	„Když tyto malé rozdíly sečteme, dostaneme určitý integrál."
8	Vzorec CS = ∫₀^{Q*} [P_d(Q) − P*] dQ	„Integrujeme rozdíl mezi poptávkovou cenou a tržní cenou."
9	Výpočet příkladu	„Pro poptávku P = 100 − 2Q a cenu 40 vychází Q* = 30."
10	Výsledek 900	„Celkový spotřebitelský přebytek je 900."

Source: Copilot chat

The plot has been generated using the Python programming language (Python Software Foundation, 2026) and it makes sense to ask for the source code so that the plot may be later modified if needed.

Fig. 2: Plot illustrating consumer surplus



Source: Copilot chat

The source code in Python programming language of the plot in Figure 2 obtained from Copilot is shown in Figure 3.

The source code is shown using syntax highlighting, which makes the code more clear and easier to read and modify. It is also possible to ask for a commented version of the source code.

This feature of the possibility to provide a source code for visual outputs may be considered highly valuable, since it makes the modifications of the plots much easier. As the Python programming language is a widely popular open-source programming language, which is rather easy to learn, the choice of producing the plots (as well as the calculations) in this language may be considered appropriate.

Fig. 3: Source for the plot

```
import numpy as np
import matplotlib.pyplot as plt

def demand(Q):
    return 100 - 2 * Q

P_star = 40
Q_star = 30

Q = np.linspace(0, 45, 500)
P = demand(Q)

Q_fill = np.linspace(0, Q_star, 300)
P_fill = demand(Q_fill)

plt.figure(figsize=(8, 5))

plt.plot(Q, P, label="Poptávka P(Q)=100−2Q")
plt.axhline(P_star, linestyle="--", label="Tržní cena P*=40")
plt.axvline(Q_star, linestyle="--", label="Q*=30")

plt.fill_between(
    Q_fill,
    P_star,
    P_fill,
    alpha=0.6,
    label="Spotřebitelský přebytek"
)

plt.xlabel("Množství Q")
plt.ylabel("Cena P")
plt.title("Spotřebitelský přebytek")
plt.legend()
plt.grid(True, linestyle=":")

plt.savefig("graf_spotrebitelsky_prebytek.png", dpi=200, bbox_inches="tight")
plt.show()
```

Source: Copilot chat

The user may ask for more examples for calculation of the consumer surplus as well as for a set of questions to check or support the understanding of the topic. Such additional material for testing is important for efficient learning not just in the self-study mode.

Considering the fact, that the demand function in the example proposed is just a linear function, the prompt to show also the more intuitive solution without using definite integral, just calculating the area of a triangle has been used. Providing such example may significantly support the students' understanding of the presented material.

The resulting output sample including the text for slide and a didactic comment is shown in Figure 4.

Fig. 4: Calculating consumer surplus if demand is a linear function



Source: Copilot chat

When evaluating the language quality of the outputs generated by the chatbot, it seems that there are still some issues, including errors in grammar which have to be corrected by the user. These problems included even a missing comma which should separate two sentences, when the generates output was “Spotřebitelský přebytek znamená výhodu, když spotřebitel platí méně než je ochoten zaplatit.” In this sentence, there should be a comma placed before the world “než” to make it compliant with the Czech spelling rules.

Conclusion

The paper shows that Microsoft Copilot can provide useful support for mathematics teaching. The case of consumer surplus demonstrates that Copilot is able to connect economic interpretation with mathematical procedures, generate didactically structured outputs, and even provide editable source code for visual materials. At the same time, Copilot’s responses still should not be used without expert review, as mathematical accuracy and pedagogical suitability

may require correction or refinement. Some improvements could be made in the language quality of the outputs, considering that the language quality is of high importance in materials to be used in education.

Overall, Copilot appears to be a promising tool for increasing efficiency in teaching preparation, but its outputs should be treated as draft materials that need a validation by the teacher

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