Intelligent Virtual Assistants and New Perspectives of Knowledge Acquisition

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Abstract: The objective of this article is to present a case of using artificial intelligence to support people from Generation Z in the process of assimilating knowledge. The AI-based tools aimed at improving language competence analyzed in the study included Intelligent Virtual Assistants (IVA): Google Assistant, Siri as well as web translators. The following research procedure was adopted: the experiment included an attempt to learn a foreign language using one of the IVAs or web translators. 251 Polish students decided to participate in the research. After the learning session, respondents completed a knowledge test concerning popular phrases in a given language. The results were related to the individual characteristics of the respondents and analyzed statistically. Interesting overall results were obtained. The data was also analyzed in subgroups, distinguished on the basis of gender, the tool used (web translator, IVAs: Google Assistant, and Siri) as well as the language chosen for learning a foreign language. The analyses were aimed at identifying differences conditioned by the gender of the learner. Another challenge was to identify the most effective tool and to determine which languages are the easiest and most difficult to learn using this method. In many cases, the acquisition of new vocabulary turned out to be very promising. This suggests that people's adoption of such an innovative form of learning is a rather individual matter, varying from person to person. The study is designed to show a new perspective on acquiring knowledge, improving competence and learning in an informal way. In this case, learners use artificial assistants based on artificial intelligence and learning algorithms. This is certainly a controversial issue at present, but it is likely to become a common solution in the near future.

Keywords: Intelligent virtual assistants, Intelligent personal assistants, IVA, IPA, Knowledge acquisition

1. Introduction

The representatives of Generation Z, also called "zoomers" (Dictionary.com), in the Western World are people born between the second half of the 1990s and 2010 (Words We're…, 2021). This generation currently represents a group of individuals entering the labor market. Also, Generation Z representatives use sources of knowledge which seem unconventional or non-obvious, particularly to older generations. It turns out that the young generations are very open to acquiring knowledge based on IT (Hilčenko, 2017). These digital natives, through constant contact with the virtual world and susceptibility to wide cultural changes, gain their own autonomy (Bassiouni, Hackley, 2014). Technologies are their natural environment (Dolot, 2018). On the other hand, accepting new values and understanding new patterns of behavior are very difficult for parents and teachers (Törőcsik, Kehl, Szűcs, 2014). This work has been began with the reference to generation Z, because this generation (and the next) already acquire and will probably acquire knowledge in a very different way than previous generations.

It is evident that members of Generation Z use websites, social networks and mobile applications. However, the topics discussed in this study may be somewhat controversial. The premise lies in the fact that artificial intelligence technologies can be effectively used in the field of education. Specifically, an algorithm integrated with a learning feature could support individuals in acquiring new knowledge. The study formulated a hypothesis: Can modern solutions related to artificial intelligence be used for learning foreign languages? The aim of the article was to verify this hypothesis. To verify it, an experiment was carried out, involving a brief attempt to learn words from foreign languages with the use of intelligent virtual assistants and web translators.

2. Literature Background

2.1 AI From a Historical Perspective

Artificial intelligence (AI) has its origins in the literary fiction of authors from the 18th, 19th and 20th centuries such as Mary Shelley (author of the novel about Frankenstein) and Karel Čapek (creator of the "robot" term). Later characters appeared such as: Tin Man from the Wizard of Oz and the humanoid robot that impersonated Maria in Metropolis. In the 20th century, however, artificial intelligence has become our reality.

In 1950, Alan Mathison Turing proposed that the possibility of pretending to be a human in a remote conversation should be considered a test of the intelligence of machines. This test was called the Turing test (Turing, 1950). And thus the story of Artificial Intelligence (AI) began. Here are its next milestones - see Table 1.

Table 1: The History of AI

Year	Event
1950	The Turing test idea
1956	The term "artificial intelligence" appears at the conference in Dartmouth
1966	Chatbot ELIZA can talk with the user, imitating a human.
1970	MYCIN analyzes blood disorders and suggests treatment methods.
1971	The first Standford Cart autonomous vehicle is built at Stanford University
1982	Dragon Systems enterprise is starting work on the first speech recognition system for commercial applications.
1993	The robot Polly shows visitors around the 7th floor of the MIT Building and communicates with visitors.
1997	RoboCup - 38 teams take part in the first world championship in robot football.
1997	The Deep Blue supercomputer defeats Garry Kasparov in a six-round chess match.
1998	40 million eared Furby robots are brought to Christmas trees. Plush animals learn English over time.
2009	The Wolfram Alpha search engine developed by Stephen Wolfram's team is the first semantic search engine
2011	IBM's Watson supercomputer beats the then champions in the "Jeopardy" game show, Siri (Apple) appears.
2012	Google's autonomous car is approved for traffic in the US state of Nevada.
2013	The Anki start-up presents models of autonomously controlled cars via an iPhone application, simulating the behavior of real rally drivers
2014	Chatbot Eugene Goostman - some regard as having passed the Turing test, Cortana (Microsoft) and Alexa (Amazon) release
2015	Google DeepMind's AlphaGo, a computer program that plays the board game Go, defeated various (human) champions
2016	Sophia – a humanoid robot from Hanson Robotics, the Google Home release and Google Assistant release
2018	The first version of GPT, which stands for Generative Pre-Trained Transformer was released, which is the basis of the chat bot Chat GPT

Source: own study based on (Anyoha, 2017; Artificial Intelligence, 2011; Historia sztucznej inteligencji 2013; History and Future…, 2023; Introducing Czat GPT; Reynoso, 2021; Tate, Lewis, 2014)

2.2 AI Currently

The ubiquity of artificial intelligence applications is becoming more and more real. In 2022, using car navigation, autonomous vacuum cleaners, language translators, and searching for friends on social media are completely natural activities. These digital activities have long ceased to be exclusive to individuals from the scientific community or enthusiasts of technological innovations. All these activities (and many others) are supported by the use of artificial intelligence algorithms.

As a result, a person unfamiliar with the city can now navigate it effortlessly, the apartment is automatically cleaned during our absence, a person with no prior knowledge of a foreign language is able to read the text written in it, and a long-lost friend reappears on our contact list. And this is only a small part of the possibilities created by today's artificial intelligence.

2.3 AI and Learning

AI can be used in the learning process as well (Druga et al., 2019; Renzella, Cain, Schneider, 2022). This means that individuals can learn on their own using AI tools (Ng et al., 2022). Zhou (2020) presented an example of how AI can serve as a language-learning tool. His research was primarily focused on developing an AI-based self-learning platform tailored for college-level English listening, aiming to improve students' daily self-learning

efficiency. Shu and Gu (2023) conducted an experiment in which they created a smart education model enabled by the Edu-Metaverse. They utilized the latest AI technologies and focused on teaching college English to 60 students to achieve better learning outcomes. The results showed that students who engaged in smart education using the AI-related model achieved higher scores in oral English, vocabulary and grammar, reading comprehension, English-to-Chinese translation, and writing than those who received traditional instruction (Shu and Gu, 2023).

It is worth noting that while several studies have examined the use of intelligent personal assistants for English as a foreign language learning, no study has investigated their application in the context of a non-English foreign language, as mentioned by Dizzon et al. (2022).

Recent research has indicated that the most popular AI tools for language learning purposes are web translators like Google and ChatGPT (Haleem et al., 2022; Shaji George and Hovan George, 2023).

2.4 Web Translators Versus IVAs – Intelligent Virtual Assistants

Intelligent Virtual Agents (IVAs), also known as Intelligent Personal Assistants (IPAs), gain a special place among the practical applications of artificial intelligence. Examples of such products include Google Assistant[1], Siri (Apple) [2], Cortana (Microsoft)[3], Alexa (Amazon)[4] and S Voice (Samsung). It is worth mentioning that, Google Assistant is indicated as more effective than its competitors and its predecessor: Google Now (Hachman, 2016; Koetsier, 2018; Google Assistant Beats…, 2019).

This paper examines the process of using intelligent assistants in improving competence and acquiring knowledge. The usefulness of the IVAs in terms of building language competence was compared with the application of popular online translators.

3. Research Methodology

The following research procedure was adopted: the experiment involved an attempt to learn a foreign language using one of the IVAs or web translators. Study participants were free to choose the tool they wanted to use. In fact, their choice was dictated by what was available to them at the moment. The participants were also asked to choose a foreign language, but the assumption was that it could not be a language they are already familiar with. Before learning, the participants of the study completed a pre-test, checking their initial knowledge. 255 Polish students decided to participate in the research process. After the learning session, respondents completed a knowledge test covering popular phrases in a given language.

3.1 Research Procedure

1. Respondents participating in the study were asked to choose the language. The language could not be their mother tongue or a language they had ever learned. Nor could it be the language of the country in which they stayed for more than a day as well. It could not have been English because students typically learn this language as part of the standard curriculum in Polish schools.
2. Respondents participating in the study were asked to choose a tool based on artificial intelligence. The tool of choice was IVAs: Google Assistant, Siri - operated from the phone or a web language translator (such as Google Translator) - operated by a personal computer/laptop.
3. Respondents joined the pretest, which aimed to verify whether the chosen language was indeed unfamiliar to them.
4. Then, respondents learned 20 selected phrases in a language they did not know. It took 20 minutes.
5. After the learning phase, respondents took the final test. The test checked how many phrases they managed to learn after 20 minutes of learning. The results were referred to the detailed information included in the survey questionnaire.
6. The results were related to the individual characteristics of the study participants and analyzed statistically.

During the analysis, an examination was conducted to determine the potential relationship between the results of the final test (i.e., the number of newly learned phrases retained) and variables such as the gender of the

[1] https://assistant.google.com/

[2] https://www.apple.com/siri/

[3] https://support.microsoft.com/en-us/topic/what-is-cortana-953e648d-5668-e017-1341-7f26f7d0f825

[4] https://apps.apple.com/us/app/amazon-alexa/id944011620

respondents, the specific learning tool used, and the selected foreign language. The obtained results were analyzed statistically. Descriptive statistics and calculations were used: minimum, maximum, arithmetic average and median. The obtained results were verified for statistical significance using the ANOVA ranks of the Kruskal-Wallis test and Mann-Whitney's U test.

3.2 Research Goal and Questions

The study formulated a hypothesis: Can modern solutions related to artificial intelligence be used for learning foreign languages? The aim of the article was to verify this hypothesis. In this particular case, the technologies included intelligent virtual assistants and online translators.

The following research questions were also posed:

- does gender have an impact on the final test result?
- does the choice of language determine the outcome?
- does the tool affect the result?

In order to achieve the intended goal and answer the questions asked, a statistical analysis was carried out.

4. Results

The study group was rather homogeneous, it consisted of 255 students, representatives of Generation Z (the majority of respondents were aged 19-22). Four questionnaires were rejected due to their incompleteness. Finally, 251 questionnaires were analyzed. The overall results are shown in Table 2. In the next step, data was analyzed according to :

- gender (Table 3),
- criterion of the selected language (Table 4),
- two groups of respondents: those who used IVAs in the study, and who used web applications for translating texts.

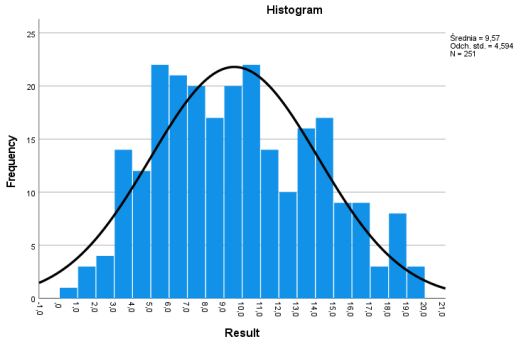
Table 2: Increase in the Number of Words Remembered for Whole Group

	Increase in the number of words remembered
scope (minimum-maximum)	From 0.5 to 20
average	9.6
median	9.0

Source: own study

4.1 General Observations

The maximum possible score to be achieved was 20, which was attained in individual cases. Conversely, the lowest score observed was one misspelled word. In the case of small errors in the answer, 0.5 points were awarded - hence the fractional results. The quantitative dispersion of the results is presented in the histogram (Fig. 1).



Source: Own study

Figure: 1. Histogram

4.2 Analysis of the Obtained Results Divided by Gender

Hypotheses:

H0: there are no statistically significant differences between men and women

H1: there are statistically significant differences between men and women

Table 3: Increase in the Number of Words Remembered According to the Gender Criterion

	number of respondents	minimum	maximum	average	median
female	144	2	20	9.9	10
male	107	0.5	20	9.1	8.5

Source: Own study

The author decided to use non-parametric tests for two independent samples (men and women). Mann-Whitney's U test did not show statistically significant differences between men and women in terms of the variables studied (asymptotic significance was 0.114). Thus, the H1 hypothesis was rejected and H0 was confirmed

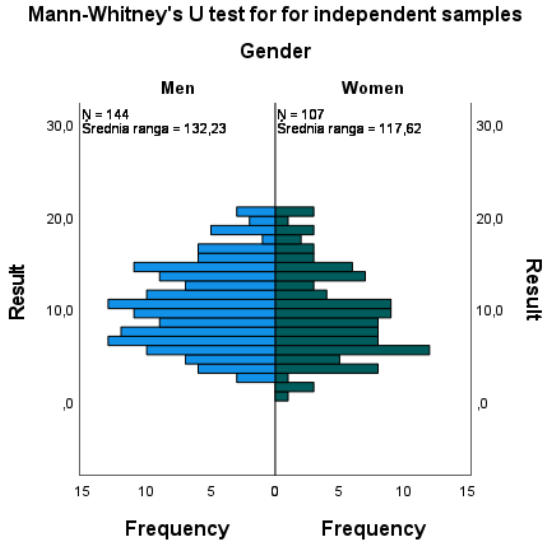


Figure 2: Mann-Whitney's U Sample Test for Independent Samples – Results Divided Into Genders

4.3 Analysis of the obtained results - the choice of the foreign language

Hypotheses:

H0: There are no statistically significant differences between results for different languages

H1: There are statistically significant differences between languages

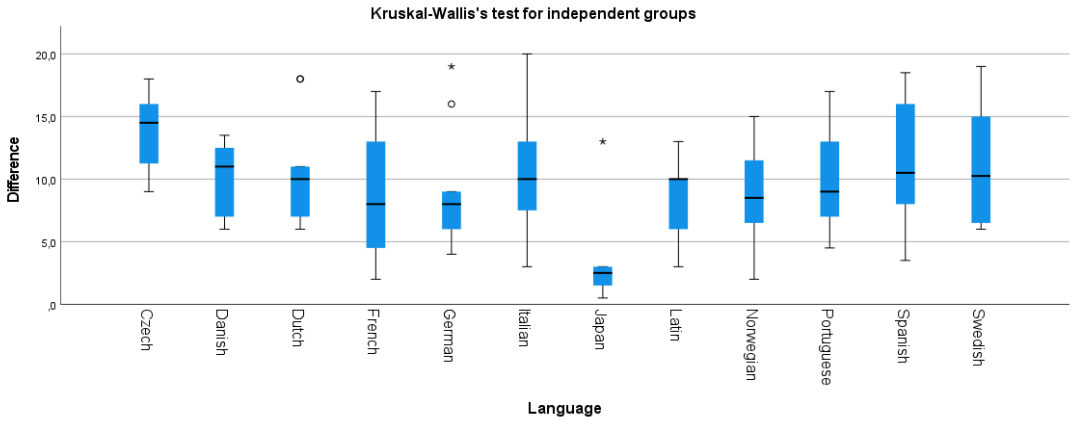
Differences were investigated using the Kruskal-Wallis ANOVA statistical test. Statistically significant differences have occurred ($p = 0.014$, i.e. $p < 0.05$). So the H0 hypothesis was rejected and H1 was confirmed.

Table 4: Increase in the Number of Words Remembered According to the Preferred Language

	number of respondents	minimum	maximum	average	median
Czech	8	9.0	18.0	13.8	14.50
Spanish	31	3.5	18.5	11.5	10.50
Swedish	14	6.0	19.0	11.0	10.25

	number of respondents	minimum	maximum	average	median
Dutch	9	6.0	18.0	10.8	10.00
Italian	45	3.0	20.0	10.4	10.00
Danish	5	6.0	13.5	10.0	11.00
Portuguese	13	4.5	17.0	9.7	9.00
German	9	4.0	19.0	9.2	8.00
Norwegian	18	2.0	15.0	8.8	8.50
French	38	2.0	17.0	8.6	8.00
Latin	5	3.0	13.0	8.4	10.00
Japan	5	0.5	13.0	4.1	2.50

Source: Own study



Source: Own study

Figure 3: Differences Between Languages

4.4 Analysis of the Obtained Results According to the Tools Used

Hypotheses:

H0: There are no statistically significant differences between learners using different tools

H1: there are statistically significant differences between learners using different tools

Table 5: Increase in the Number of Words Remembered Depending on the Tool

	number of respondents	minimum	maximum	average	median
Web translators	179	0.5	20	9.0	9.0
Google Translator	54	1.0	20	9.5	9.0
Siri	18	3.0	16	8.2	7.0
IVAs generally (Google Assistant & Siri)	72	1.0	20	9.2	9.0

Source: Own study

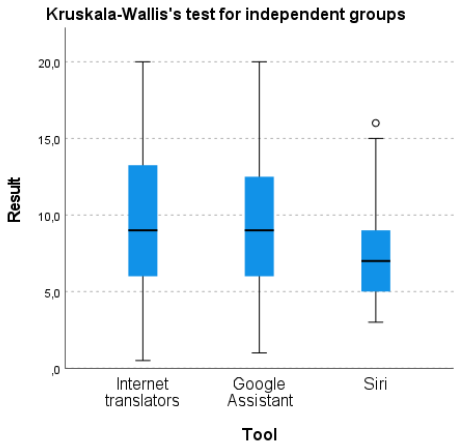


Figure 4: Differences Between Tools

Differences were investigated using the Kruskal-Wallis ANOVA test. There were no statistically significant differences found (asymptotic significance was 0.365). So, the H1 hypothesis was rejected and H0 was confirmed.

5. Discussion

The benefits of using artificial intelligence algorithms are undisputed. But there are many indications that people should be particularly careful in manipulating artificial intelligence. Not only Stephen Hawking pointed to AI as a threat that can destroy humanity. There were many outstanding minds who shared this opinion. This subject was also discussed by Antonio A. A. Casilli even referring directly to the IVA (*Casilli, 2019*). Examples of unsettling potential occurrences associated with artificial intelligence may include:

- agent becoming uncontrollable,
- autonomous military drones protested by many famous people, in 2015 Elon Musk, Stephen Hawking, and Steve Wozniak among 3.000 others signed an open letter banning the development and use of autonomous military weapons (Reynoso, 2021).
- an agent who created his own English language.

Perhaps the technological singularity - a hypothetical point in the future development of civilization, in which technological progress will become so rapid that all human predictions will become obsolete (Vernor, 1993) - will be achieved precisely through the development of AI.

Against the background of the above considerations, the proposition to employ artificial intelligence in the educational process is, on one hand, highly enticing, but on the other hand, it appears to be contentious, and perhaps even unsettling. In the context of the use of IVA, there is discourse surrounding the concept of the so-called “intellectual bubble”: fake news may be amplified and the phenomenon of an "echo chamber" may arise. Artificial intelligence has the potential to confine individuals within a very limited world of information by personalizing and filtering information in such a way that much information will not be available to the user at all.

However, there is no doubt that education will change radically in the coming years and this trend is prominently reflected in the extensive literature on the subject. The role of the teacher will be quite different from what we have been used to since ancient times. The teacher will not be the source of knowledge, but the one who uses the knowledge, and will not be the judge and oracle, but the one who can ask questions. The modern teacher will teach us exactly the same skills: searching for knowledge and asking questions. Should be the teacher replaced by AI and how perilous is this idea? This should be taken seriously into consideration.

6. Conclusions

The aim of the study was to check whether technologies based on artificial intelligence are useful in learning. In this particular case, the study concerned learning a foreign language and using web translators and intelligent virtual assistants. The considerations lead to an affirmative response in support of the research hypothesis. The

hypothesis: can modern solutions related to artificial intelligence be used for learning foreign languages has been confirmed, with the reservation that the efficiency of using AI in such a context may vary.

The results were diversified. The number of new words acquired in 20 minutes ranged from 1 to 20 (out of 20 possible). Descriptive statistics showed some differences in the results depending on gender, the tool used, and the language chosen by the study participants.

Women had slightly better results. The language translator turned out to be the most effective tool, but Google Assistant was not far behind it. However, in-depth statistical tests showed no statistical differences. However, such differences appeared in the case of selected languages.

European (Czech, Spanish and so on) languages turned out to be the easiest to assimilate with regard to the proposed method of quick learning. In many cases. the increase in knowledge of new words turned out to be very promising. This suggests that people's adoption of such an innovative form of learning is a rather individual matter.

6.1 Research Contribution

The study is designed to show a new perspective on acquiring knowledge, expanding competence and learning in an informal way. In this case, learners use artificial assistants based on artificial intelligence and incorporate learning algorithms. This is certainly a controversial issue at present, but it is likely to become a common solution in the near future.

So far, the research results described have predominantly focused on the study of the English language. This study involves learning languages other than English.

6.2 Limitations and Implications

The study involved students. The majority of the respondents, falling within the age range of 19 to 22, belonged to Generation Z. Also, it should be noted that the sample was predominantly Polish. So, they mostly speak Polish, i.e. a language from the group of Slavic languages.

It should be taken into account that the quality of translations offered by the presented tool. i.e. Google Translator, Google Assistant and Siri is improving. This affects the test results. The obtained results apply to the state of development of these tools at the turn of 2022 and 2023.

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