

APPLICATION OF VIRTUAL PERSONAL ASSISTANT IN HIGHER EDUCATION

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ABSTRACT

With the advance of technologies, artificial intelligence can be utilized in education (e.g., grading and tutoring). Virtual personal assistants such as Siri and Google Assistant with artificial intelligence become valuable in teaching and learning. Besides the typical functions (e.g., answering simple queries), knowledge transmission of a particular domain can be implemented on a virtual personal assistant. This paper discusses the way of customization of Siri (as an example of a popular virtual personal assistant) to illustrate how it can present knowledge of marketing subjects at the university level. Exemplars of the usage of customized Siri in the classroom are provided. A total of 210 university students were invited to respond to a survey on the attitudes to the usage of customized Siri in marketing courses. According to the results, the virtual personal assistant is useful and easy to use. In addition, student ts engage in learning knowledge with it.

KEYWORDS: *Higher Education; Virtual Personal Assistant; Natural Language Processing & Artificial Intelligence*

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INTRODUCTION

From washing machine to language translation, there are many applications of artificial intelligence around us. Educators should be aware of things that are run by artificial intelligence and maximize their capabilities to help students get inspired for the future. There is a range of artificial intelligence tools and technologies used in schools. For example, Sway, a Microsoft tool supported by machine learning allows students to focus on forming relationships across disciplines and domains (Lardinois 2020). Tools like chatbots are already used commonly in daily life while Sesame Workshop is also using artificial intelligence to assist in vocabulary development (Harris, 2017).

Computer capacities and advanced technologies have impacts on the future of higher education. The new development of artificial intelligence provides challenges and possibilities in higher education. For the purpose of studying the impacts of artificial intelligence on education, artificial intelligence is defined to be computing systems that can engage activities such as synthesizing, learning, self-correction, adapting, and utilizing data for complicated tasks. Artificial intelligence now develops rapidly and impacts the deep nature of learning and teaching in tertiary education (Kaplan & Haenlein, 2019). The following are typical application examples of artificial intelligence in the educational context.

Grading

The advancements in artificial intelligence help teachers to grade so that they may spend more time with students and revise the curriculum to be more useful and relevant for classes. This electronic grading has been used for years in the form of computer tests and requires a constant connection with the Internet. It saves time in the classroom and makes for a remarkable grading tool.

Tutoring

The artificial intelligence tutors become important because teachers cannot be with students all the time. Working with such artificial intelligence tutors can help students with academic and social anxiety and increase their confidence to succeed in school. It has been well known that one-to-one tutoring is the most efficient teaching method. Early artificial intelligence researchers treated this as an opportunity to develop an intelligent tutoring system able to adapt and tailor instructions to a learner's needs individually. Now intelligent tutoring systems are widely used in colleges and enhance the learning experience of students. For example, some students in high or middle schools in the United States are using Carnegie Learning's Cognitive Tutor mathematics courses (Ritter, Anderson, & Koedinger, 2007). Better student learning is found after evaluation studies of the system.

Analytics

An artificial intelligence teaching assistant can adjust curriculum for classes and this creates an essential advantage for learners because their learning styles may be different and do not work cohesively. It can adjust these factors and ensure learners able to receive the most suitable teaching methods for their learning styles. For instance, Deakin University in Australia used artificial intelligence supported by IBM to offer student advice at any time (Winterford, 2014). This is altering the structure of its workforce and quality of services. A supercomputer can offer feedback at any time and reduce the requirement of employing administrative staff.

Trial and Error

Trial and error are the most intimidating parts of education. Artificial intelligence takes time-consuming problems and solves them. Taking the guesswork out of learning can save time and reduce the frustration levels of learners. While some artificial intelligence solutions rely on programming, some can learn and apply found patterns to a situation not covered or included by the original design.

Virtual Reality

Virtual reality can increase students' abilities to be immersed in a class entirely. A high price is still the biggest drawback. But it is anticipated that the longer these technologies, the lower the price will be. Virtual reality will likely be integrated more into classes.

Virtual Personal Assistant

Some research suggested the availability of mobile phones in the classroom decreases the achievement of students (Beland & Murphy, 2015). However, virtual personal assistants' functionality is increased recently in home devices and mobile devices. Siri gained attention and was an expansion target in Apple Worldwide Developers Conference in 2016 (Khosla, Huang, & Andrus, 2016) because it can be connected to applications of third parties after enhancements. The new functionality increased the presence of Siri on platforms of iOS and macOS and it became the critical component of the interface strategy of Apple. Google and Amazon followed and developed Google Now and Alexa for competition in the market. Even though there are unique features of each virtual personal assistant, the following are common functions of a typical virtual personal assistant.

- Manipulate devices on the Internet of Things like locks and alarms

- Perform basic mathematical calculations
- Set reminders, timers and calendar entries
- Answer simple queries like “What is the time now?”
- Make phone calls
- Read and send textual messages and emails

A virtual personal assistant can help teachers and students to manipulate routine tasks in classrooms (Yang *et al.*, 2019). For example, Siri can transform a regular speaking voice into a written note or email. Students dictate and Siri converts their spoken words into textual data. In addition, a virtual personal assistant can help you to check basic facts like what is the capital city of a country. Even though smartphones have been used widely for years, research on the usage of virtual personal assistants in education is limited. The number of users of virtual personal assistants is predicted to increase in the future. Apple, Microsoft and Google are the major providers and developing similar functions. For instance, Google Now tools anticipate the needs of a user based on his/her keywords used in searching while Cortana of Microsoft asks users for accessing information. Consequently, virtual personal assistants with voice control are the gateway to various devices (Waters, 2015; Zimmert, 2020).

With the advanced ability to interact with network-connected devices and integration with applications, virtual personal assistants become fundamental components of all smartphones (Mirbabaie *et al.*, 2021). Because technologies continue to evolve, teachers respond to how technology impacts education. This paper studies a virtual personal assistant as an educational technology to enhance the engagement of students in higher education. The application of a virtual personal assistant and the result of a survey on the students’ attitudes to it will be discussed in the rest of the paper.

APPLICATION OF VIRTUAL PERSONAL ASSISTANT IN CLASSROOM

Recently, smartphones have brought about an extraordinary level of ubiquity in communications and computing (Gaggioli, 2018). Teachers and students are able to access some types of virtual personal assistants on their smartphones (like Siri on iPhones, Google Assistant on Android phones) and computers (like Cortana of Microsoft and Alexa of Amazon). Smartphone users may not be aware of the capabilities of virtual personal assistants with a lot of memories and unlimited information. For example, a virtual personal assistant is usually good at word definition and this function is useful when students are not sure of the jargons in discussion. A virtual personal assistant can help a user to access software applications conveniently, and automate routine tasks (Kot & Leszczyński, 2020). For example, students use virtual personal assistants to streamline the note-taking process in which spoken words are transformed into text. It also helps in operating a phone in a hands-free manner. The virtual personal assistant opens apps by a teacher's voice and this saves time when the teacher is delivering a lecture. The usage of these applications in the educational context results in great changes to teaching. The teaching approach is changing from a focus on searching answers to analysis that draws conclusions. When students attempt to answer questions, smartphones may be used to find a solution. Lessons are designed to encourage students to take advantage of current technologies to build on prior knowledge (Hoy, 2018).

Natural language processing (NLP) is one of the important features of a personal virtual assistant. The usage of NLP in the educational context can enhance academic performance. Numerous linguistic approaches and grammatical rules like lexicon and corpus are used in NLP to ensure students able to understand the educational curriculum and materials.

There are various efficient approaches in NLP that assists in teaching and learning. A corpus provides a lot of data for written and spoken languages. For instance, the British National Corpus contains a huge data set of vocabulary usage (De Vries *et al.*, 2008; Liu, Hogan, & Crowley, 2011). Corpora provide an enormous collection of data about the usage of words that develop the academic skills of students. Furthermore, grammatical patterns and other linguistic approaches of NLP develop students' ability to recognize the relationships among words and use these words more effectively.

This paper will discuss the usage of NLP of a virtual personal assistant in a marketing course at a university. In reality, marketers have to communicate with clients. Siri of iPhone can be used to demonstrate how NLP can facilitate the development of students' relevant skills of communication with clients. NLP of Siri is originally developed and implemented on devices (like iPhones and iPads) of Apple Company Inc. Normally, Siri cannot be customized for any specific purpose. However, Assistant Extensions, a Cydia tweak, can remove limitations of Siri and allow users to modify NLP of Siri in jailbroken iPhones.

Assistant Extensions can be downloaded from BigBoss repository that is one of the default Cydia repositories. Once downloaded, it will prompt a user to reconfigure the phone and take Siri to a new level. It becomes possible to create customized Siri's responses. Users may use the original developers' aiml files (Artificial Intelligence Markup Language) to modify the XML codes to create their own versions. The aiml files can be found in the/Library/Assistant Extensions/aiml/ directory on the device. A user may copy an existing file and edit it like the following.

```
<aiml>
<category>
<pattern>Do you like using AI in marketing?</pattern>
<template>Yes, I like it</template>
</category>
</aiml>
```

User: Do you like using AI in marketing?

Siri: Yes, I like it.

The above example of conversation demonstrates the exact matching of a user's question and the predefined response. In fact, it is possible to use wildcards as follows.

```
<aiml>
<category>
<pattern>_Peter</pattern>
<template>Peter is a good guy.</template>
<category>
</aiml>
```

User: Do you know Peter?

Siri: Peter is a good guy.

User: How about Peter?

Siri: Peter is a good guy.

An aiml file may contain programming logics such as an if-then-else structure. This makes Siri more intelligent to respond to users' various types of queries. The following is an example.

```
<aiml>
<category>
<pattern>$IS <set>product</set> A PRODUCT</pattern>
<template>Yes,<star/> is our product. </template>
</category>
<category>
<pattern>$IS * A PRODUCT</pattern>
<template>No,<star/> is not our product.</template>
</category>
</aiml>
```

User: Is computer a product?

Siri: Yes, computer is our product.

User: Is mouse a product?

Siri: No, mouse is not our product.

Most importantly, a virtual personal assistant can learn like the following.

```
<aiml>
<category>
<pattern>I USE COMPUTER</pattern>
<template>I learnt that you use computer.
<learn>
</category>
<pattern>WHAT DO I USE</pattern>
<template>You use computer.</template>
</category>
</learn>
```

</template>

</category>

</aiml>

User: I use computer

Siri: I learnt that you use computer.

User: What do I use?

Siri: You use computer.

EXEMPLARS OF THE USAGE OF VIRTUAL PERSONAL ASSISTANT

A virtual personal assistant can be applied in the classroom for various purposes (Guzman, 2019). First, the customized Siri can provide the definitions of specific terms and jargons in a particular subject like marketing. The glossaries of textbooks usually provide good sources to enhance the capability of Siri to respond to a user's query on the definition of a term. The following are some examples.

User: What is market share?

Siri: Market share is the total percentage of sales one business or company controls in a market.

User: Tell me about voice of share.

Siri: Voice of share is a metric that gauges the percentage of conversations around a topic on a given platform.

To enhance the knowledge of a virtual personal assistant systematically, the revised Bloom's taxonomy provides a guideline for implementing NLP customization (Krathwohl, 2002). This taxonomy describes the seven levels of thinking skills (see Figure 1) learnt by students who use virtual personal assistants.

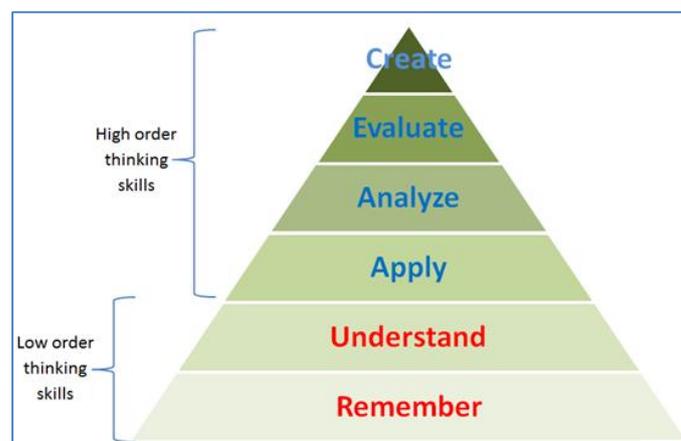


Figure 1: Revised Bloom's Taxonomy.

The first and lowest level of the revised Bloom's taxonomy is "remembering". Learners are expected to recall knowledge or retrieve information from their long-term memory. The second level is "understanding" where learners form meaning from the given information. Students are expected to build new connections in their minds. The third level is "applying", where learners are expected to follow certain procedures and/or steps to solve new problems. The fourth level

is “analyzing” where learners could recognize the whole system and break it down into elements and determine the connections among them. In other words, learners use lower-level thinking skills to identify key components and investigate them. The fifth level is “evaluating” where learners may examine and judge the work of others. At this level, learners demonstrate the ability to examine the quality of information sources and make decisions based on some criteria. The sixth and the highest level is “creating”. Here, learners demonstrate their ability to reorganize elements learnt earlier to form a new structure, structuring information in a different or new way. Thus, the cognitive process becomes increasingly complex and difficult as the level progresses. The following are some examples of conversation between Siri and a user that illustrates various levels of thinking skills.

Remember the basic facts.

User: What is the introduction stage in the product life cycle?

Siri: Introduce a new product.

Understand the meaning of a term.

User: Cost-based pricing is the same as what?

Siri: Cost-plus pricing.

Apply previously acquired knowledge.

User: What is a pricing strategy that sells two or more products at the same time?

Siri: Product line pricing.

Analyze the meaning of an idea.

User: Why a marketing campaign is not a sufficient condition of selling product?

Siri: Marketing exchange is the sufficient condition.

Evaluate the validity of an argument.

User: Is disintermediation possible on the Internet?

Siri: No, there are new intermediaries like Amazon on the Internet.

Create new ideas and knowledge

User: Any idea on new functions of a smartphone?

Siri: Improve with new technologies.

Besides answering students’ queries, a customized virtual personal assistant helps students to practise the skills of communication with prospects. For example, customized NLP of Siri is helpful for students to participate in some interactive communication exercises like the following.

Prepare three buyer–seller dialogues for objections in a role-playing game. Use a trial close to respond to each objection and determine if the seller overcomes the objection or not. Siri takes the role of the seller/buyer. Implement these dialogues in a customized aiml file and then update the file in an iPhone for demonstration.

Buyer's objection 1:

Seller's response 1:

Buyer's objection 2:

Seller's response 2:

Buyer's objection 3:

Seller's response 3:

In the exercise above, students may be divided into two groups. One group implements conversation patterns of sellers while another implements those of buyers. It is interesting for two customized virtual personal assistants to talk interactively to observe how they respond to each other and students may fine-tune their implementations for further improvement. In this exercise, students systematically learn how to deal with prospects' responses from both perspectives of sellers and buyers.

RESULTS OF SURVEY ON ATTITUDES TO VIRTUAL PERSONAL ASSISTANT

To evaluate the customized virtual personal assistant, 210 university students were invited to respond to questions of a survey on the attitudes to the usage of virtual personal assistant after learning customization of Siri and using it in exercises of marketing courses for a semester. The survey consisted of three sections: perceived usefulness, perceived ease of use, and student engagement (see Table 1). The questions in the first two sections were modified from the model of User Acceptance of Information Technology (Davis, 1989).

Table 1: Results of Survey on Attitudes to the Virtual Personal Assistant

Survey Questions 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree		Mean (n=210)
Section A. Perceived usefulness		
1.	My study would be difficult to perform without the virtual personal assistant.	3.8
2.	Using the virtual personal assistant helps me to control over my study.	3.5
3.	Using the virtual personal assistant improves my study performance.	4.2
4.	The virtual personal assistant addresses my needs of study.	3.9
5.	Using the virtual personal assistant saves my time.	4.3
6.	The virtual personal assistant enables me to complete tasks more rapidly.	4.0
7.	The virtual personal assistant supports essential aspects of my study.	3.9
8.	Using the virtual personal assistant allows me to accomplish more study than would otherwise be possible.	4.4
9.	Using the virtual personal assistant reduces the time on unproductive activities.	4.5
10.	Using the virtual personal assistant enhances my effectiveness on the study.	4.3
11.	Using the virtual personal assistant improves the study quality.	4.0
12.	Using the virtual personal assistant increases my productivity.	4.4
13.	Using the virtual personal assistant makes my study easier.	4.1
14.	Overall, I find the virtual personal assistant useful in my study.	4.3
Section B. Perceived ease of use		
15.	I usually do not get confused when I use the virtual personal assistant.	4.5
16.	I do not make errors frequently when using the virtual personal assistant.	4.5
17.	Interacting with the virtual personal assistant system is often not frustrating.	4.0
18.	I often do not need help when using the virtual personal assistant.	4.3
19.	Interacting with the virtual personal assistant system does not require a lot of my mental effort.	4.2
20.	I find it easy to recover from encountered errors while using the virtual personal	4.3

assistant.	
21. The virtual personal assistant system is flexible to interact with.	4.3
22. I find it easy to get the virtual personal assistant system to do what I expect.	4.0
23. The virtual personal assistant system often behaves expectedly.	3.9
24. I find it manageable to use the virtual personal assistant system.	4.5
25. My interaction with the virtual personal assistant system is easy for me to understand.	4.6
26. It is easy for me to remember how to perform tasks using the virtual personal assistant system.	4.5
27. The virtual personal assistant system provides helpful guidance in performing tasks.	4.0
28. Overall, I find the virtual personal assistant system easy to use.	4.5
Section C. Student engagement	
29. I engage in representing my concepts using the virtual personal assistant.	3.9
30. I engage in contrasting and comparing ideas and analyzing information using the virtual personal assistant.	3.8
31. I engage in discussion and interaction with my classmates using the virtual personal assistant.	4.2
32. I engage in reflecting on my learning using the virtual personal assistant.	4.4
33. I engage in constructing knowledge using the virtual personal assistant.	4.3

According to the survey results in Table 1, on the whole, the customized Siri is useful and easy to use. In addition, students engaged in learning activities with virtual personal assistants. The value-added role of a virtual personal assistant changes the learning and teaching processes.

Technologies increase student engagement. Most teachers' perceived level of student engagement is high when they might apply everything from an educational game to an interactive writing exercise (Hur, Shannon, & Wolf, 2016). The usage of electronic devices like tablets in the classroom offer access to various apps that provide electronic text that are able to engage highly in literacy instruction (Hutchison, Beschoner, & Schmidt-Crawford, 2012). Virtual personal assistants provide much more functions including access to databases and the Internet to enhance understanding of difficult concepts and increase accuracy and variety of answers (Sejnoha, 2013). Virtual personal assistants become ubiquitous when voice recognition technologies are more functional to smartphone users. Conversations with a virtual personal assistant are becoming human-like with natural language processing (Tuttle, 2015).

Teachers and students play different roles in the learning process. While teachers impart their knowledge to students, the latter learn and apply the knowledge acquired. Learning approaches may be teacher-centered or student-centered. In the teacher-centered approach, the teacher transfers the knowledge and information to students after he/she has decided what the students will learn, how they will learn it, and how the students' performance will be evaluated. The instruction development and the learning process are controlled by the teacher who is responsible for managing the learning environment (Wagner & McCombs, 1995). The learning activities are also designed for the class as a whole. In the teacher-centered approach, the teacher usually lectures and the students follow the instructions of the teacher and perform the same task simultaneously. This approach emphasizes the acquisition of factual knowledge and examinations are used to assess student learning. Critical thinking is not encouraged in the traditional teacher-centered approach.

Unlike the teacher-centered approach, the student-centered approach stresses the importance of students' self-learning. The experiences, skills and interests of a student are linked to learning practices to enhance motivation and academic achievements (McCombs, 1999). The American Psychological Association (APA, 1997) proposed 14 Learner-Centered Principles and also suggested that learners should be active, reflective and able to control their own psychological

factors internally. Knowledge is constructed by the learners as they relate what they have learnt to their own experiences. The role of a teacher is that of a facilitator who will guide this knowledge-building process (Bruning *et al.*, 2004). The emphasis here is on knowledge application and students learn through active learning, collaborative and cooperative learning and self-directed learning.

Students can use various learning tools (e.g. practicing on drills) to facilitate their learning and develop higher-order thinking. But such student-centered learning has its own drawbacks. The lack of face-to-face interaction causes frustration, anxiety and confusion (Johnson *et al.*, 2000). Students feel isolated and stressed because of asynchronous online communication of a text-based nature like email and discussion forum (Rovai & Jordan, 2004). Moreover, teachers usually need to spend more time preparing the online learning environment and its materials.

Now the usage of a virtual personal assistant combines the elements of the teacher-centered and the student-centered approach. The knowledge taught by a teacher can be converted into the interaction between a student and a virtual personal assistant. In the meanwhile, a student learns on his/her initiative through case studies, role-play, structured exercises, group projects and discussions and peer critiques (Brewer & Burgess, 2005). Students cooperate and learn from each other when working in a group.

CONCLUSIONS

The usage of virtual personal assistants provides greater flexibility and convenience (Brill, Munoz, & Miller, 2019). Learners can access more resources available on the Internet through the use of smartphones while the human components such as social interaction and face-to-face lectures are still retained. To appeal to students with various learning preferences and styles blended learning incorporates different online learning resources (Hanson & Clem, 2006). A virtual personal assistant can take an important role in blended learning. Students may have their own progress and the virtual personal assistant caters to the development and sharing of both explicit and tacit knowledge.

To transmit knowledge to students, teachers should make topics and instructions clear to students. Teachers prepare Q&A sessions and ask students to raise discussion questions. To engage students, teachers consider students' backgrounds and encourage their participation to facilitate interaction with students. Students are expected to comprehend debates about issues, acquire skills of presentation and implement good teamwork. To develop the learning independence of students, teachers should develop students' metacognitive awareness and consider their holistic development. Students are expected to be able to approach problems and deal with technical solutions and understand work requirements. Technologies like virtual personal assistants are important learning tools for independence development.

According to a constructive view of education, learning is learners' active knowledge construction through collaborative and authentic engagement in learning experiences generatively (Lutz & Culver, 2010). Furthermore, technologies enable constructivist-oriented learning (Kim & Reeves, 2007). The usage of these technologies only cannot guarantee constructive learning and it is necessary to design learning activities to ensure that students do in the learning process (Schmid *et al.*, 2009). A learning environment with suitable support and motivation is likely to help students to engage in self-regulated learning activities with independence and autonomy.

In a traditional learning environment, the instructor may not be able to interact with all students in the class and the communication is mainly one-way e.g. in a mass lecture. Learning does not need to be teacher-centered if technology is employed. Students can access online learning materials, construct knowledge by themselves and communicate with

teachers and peers synchronously through online communication tools (e.g. video conferencing) and asynchronously (e.g. chat rooms, blog and Facebook). In the online environment, the learning process is usually self-paced and cost-effective for learners. The increasing popularity of virtual personal assistants further enhances the flexibility of online learning (Lee & McLoughlin, 2011).

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