Iyer, S. et al. (Eds.) (2022). Proceedings of the 30th International Conference on Computers in Education.
Asia-Pacific Society for Computers in Education

Ask4Summary Automatically Responds Student's Question with a Summary Assembled from Course Content

Mohammed SALEH[a], Maiga CHANG[b]* & Maria F. IRIARTE[c]
[a,b,c]*Faculty of Science and Technology, Athabasca University, Canada*
*maiga.chang@gmail.com

Abstract: This work-in-progress paper presents a Moodle plugin that parses a Moodle course's text-based learning materials in various format (e.g., Microsoft Word DOCX file, Microsoft PowerPoint PPTX file, PDF file, web pages in HTML form) as well as a student's question posted on a discussion forum on Moodle with Natural Language Processing techniques (e.g., n-gram model) and search engine similarity calculation method (i.e., Cosine Similarity). The Ask4Summary acts like an online tutor can automatically answers a student's question with a summary assembled via matching and retrieving from the stored information. The research team has also planned an evaluation on using the Ask4Summary in a graduate level academic writing in English course and explained its details at the end of this paper. Last but not the least, the Ask4Summary could be an online representative not only for online learning but is also capable of helping users on their questions regarding products, healthcare, etc. if there are correspondent text-based materials existing for Ask4Summary to read in advance.

Keywords: Moodle, Plug-in, N-gram, Language Learning, Cosine Similarity, Discussion Forum

1. Introduction

The information overload caused by technological development might influence student's learning performance (Feroz et al., 2021). Natural Language Processing enables information extraction and automatic text summarization in the many fields (Bommarito II et al., 2018; Gambhir & Gupta, 2017). El-Kassas et al. (2021) suggest future research works focusing on multi-document, user-specific and innovative text summarization applications.

N-gram is a computational language model in NLP, is based on a Markov chain that only accounts for the sequence of n components of a text (Russell & Norvig, 2022). To reduce the ambiguity inherent in natural language, the n-grams can be grammatically classified and labelled the words according to their part of speech (PoS) tags (Wilks & Stevenson, 1998). This paper talks a work-in progress research project, Ask4Summary. The Moodle plugin adopts an open access web service of *N-gram & PoS Identifier and Verifier* that is trained with DBpedia (https://ngrampos.vipresearch.ca/) and implements a semantics based vector space model algorithm (Salton et al., 1975) as well as the cosine similarity method (Pal, Chang, & Iriarte, 2022).

Moodle is a widespread open-source learning management system used in diverse educational options (e.g., schools, universities) (Al-Ajlan & Zedan, 2008). Approximately, there are 172,000 registered Moodle sites in the world, 41 million courses and 327 million users, according to official statistics (https://stats.moodle.org/). The open-source plugin, Ask4Summary, can be considered as an online computerized tutor that can provide the summary of the course text-based learning content, in a timely manner, for a student's question posted in the discussion form. Ask4Summary can be download and installed in any Moodle course for free. Therefore, many learners can benefit from the research.

This paper is structured as follows: Section 2 introduces the Ask4Summary Moodle plugin and explains the configuration process for teachers. Section 3 describes how students ask question and what response they can see as well as how teachers can check what questions and the correspondent summary within the Ask4Summary plugin. Section 4 proposes an evaluation plan for assessing the usability of the Ask4Summay plugin and the perceived satisfaction toward the generated summary Ask4Summary Moodle Plugin

Online learning and teaching do not mean that putting course materials online and asking students to learn by themselves. It is important to provide students supports when they encounter questions about course content or materials. When students ask their question on a discussion forum in an online learning environment, sometimes there may have no one available at that time to help them due to time differences or study behaviors and needs – for instances some students may have family/children/baby and day job and they might not be able to do their study until late night or weekends. This leads to an obvious conclusion that if a system was in place to provide an automated summary, this could facilitate learning. Having an easily accessible system, which can quickly provide responses, allows students to get information that may have otherwise been difficult to find.

Ask4Summary is a block type Moodle plugin designed to provide summaries relating to a student's question (https://moodle.org/plugins/block_ask4summary). The details of its general process and workflow can be found at (Saleh, Iriarte, & Chang, 2022, 2022). Figure 1 shows the Ask4Summary block at the right-hand side on the Moodle course page after it is added into a course.

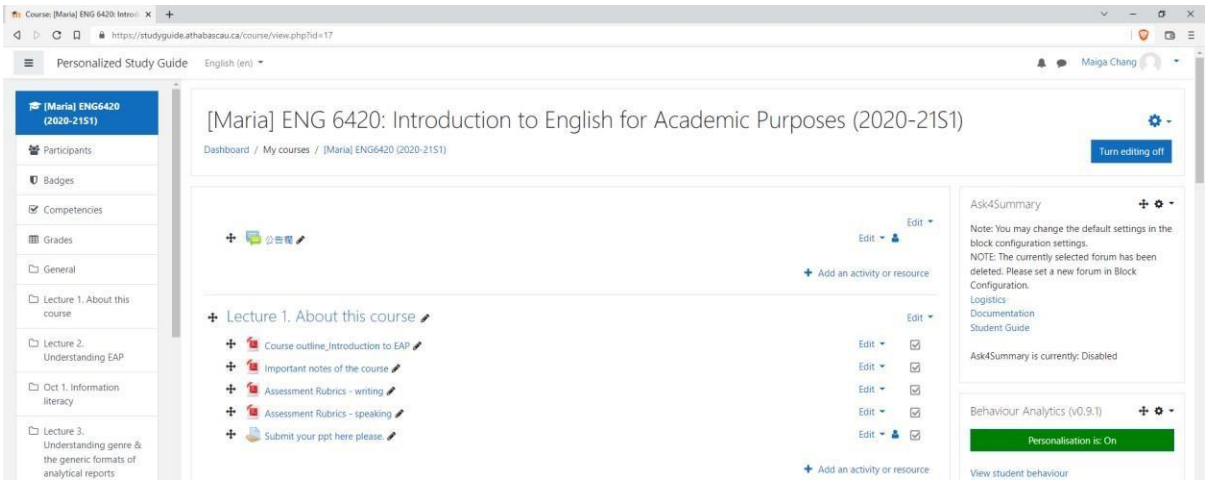

Figure 1. Ask4Summary plugin.

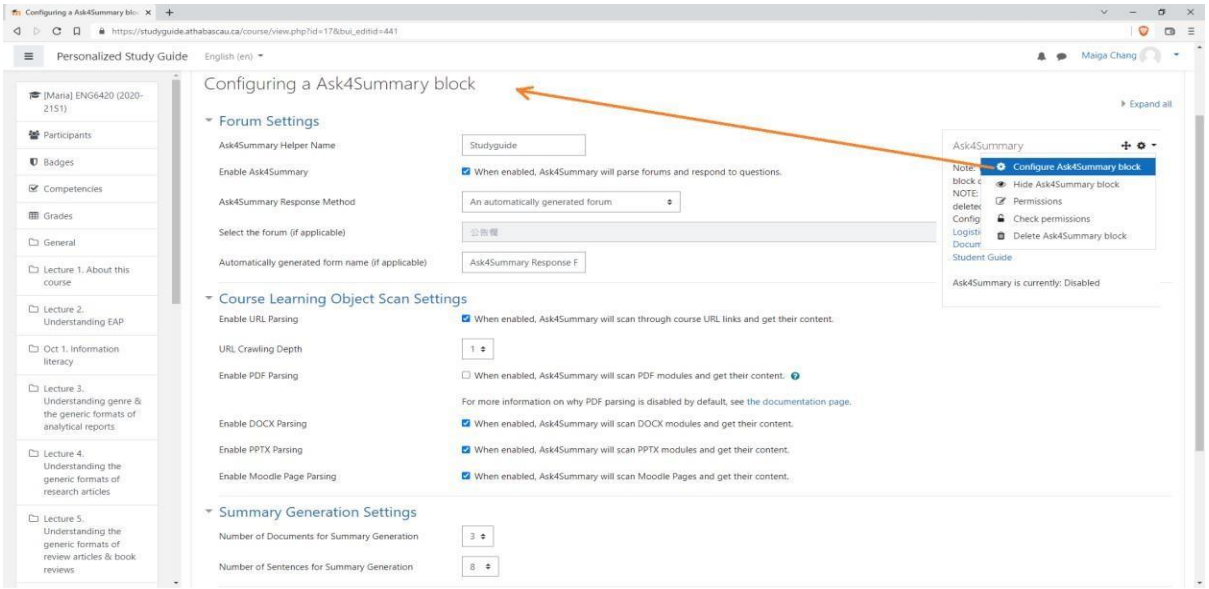

Figure 2. Teachers can change various settings on their own.

Teachers can configure the block in their courses by turning on the edit and then choosing "Configure Ask4Summary block" from the gear icon of the block as Figure 2 shows below. The first thing the teachers should change is the "Helper Name" and the "Ask4Summary Response Method". Ask4Summary will only respond student's question posted in the designated discussion forum that the teachers chose in the "Ask4Summary Response Method" and the posting contains the "Helper Name". The scenario in Figure 2 indicates that the Ask4Summary will scan the automatically generated forum for the postings where "Studyguide" is found.

Teachers can also select an existing discussion forum in their course for students to ask questions and for the Ask4Summary to scan and respond as Figure 3 shows. The next important setting that teachers should consider is "what formats of learning materials in a course they want Ask4Summary to read in advance for responding students' questions". Ask4Summary can read webpage in HTML format as well as documents in Microsoft Word/PowerPoint formats (i.e., DOCX/PPTX files). While it can also read PDF documents, the Moodle server needs to have application AbiWord pre-installed and setup by system administrator. Last but not the least setting that teachers should configure is "how many documents at the end and how many sentences in them the Ask4Summary should consider while producing the summary for student's question".

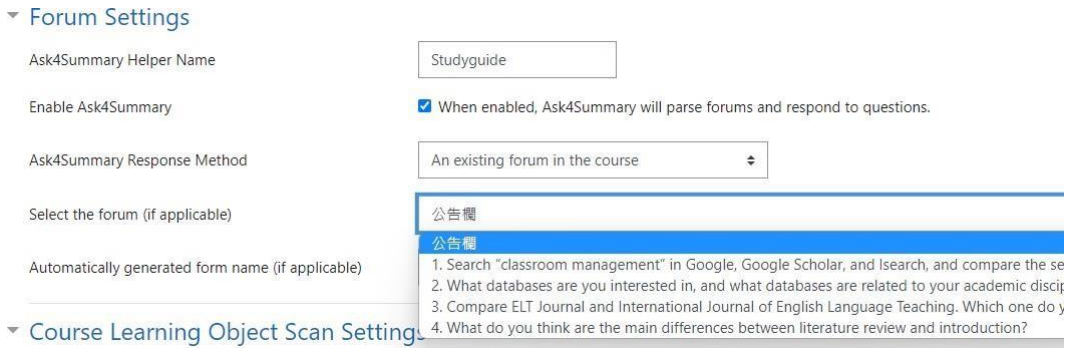

Figure 3. Teachers can choose an existing discussion forum for Ask4Summary.

Once the teachers complete the configuration and save the changes, the Ask4Summary will be enabled as Figure 4 shows. A discussion forum, "Ask4Summary Forum", is generated for students asking questions and for the plugin to scan and respond the questions. Students now can ask questions by posting in that particular forum.

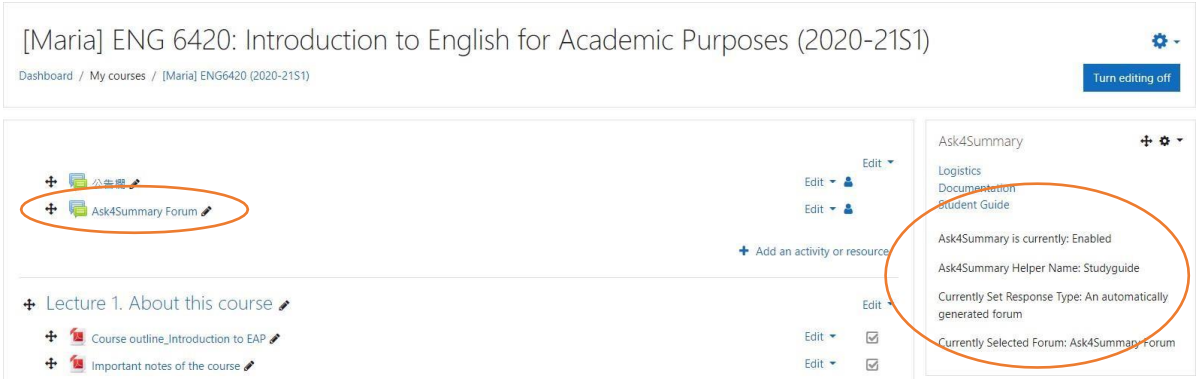

Figure 4. Ask4Summary plugin's status and info.

However, before the Ask4Summary can respond any student's question, it has to read all selected learning materials in the course. When the teachers click "Logistics" link in the block of

Ask4Summary, they can see Figure 5. The logistics page not only shows the numbers of learning materials in different formats that the Ask4Summay is processing but also show which unit or learning activity a document belongs to. Teachers can check its reading progress and know when their students can start asking questions for the Ask4Summary.

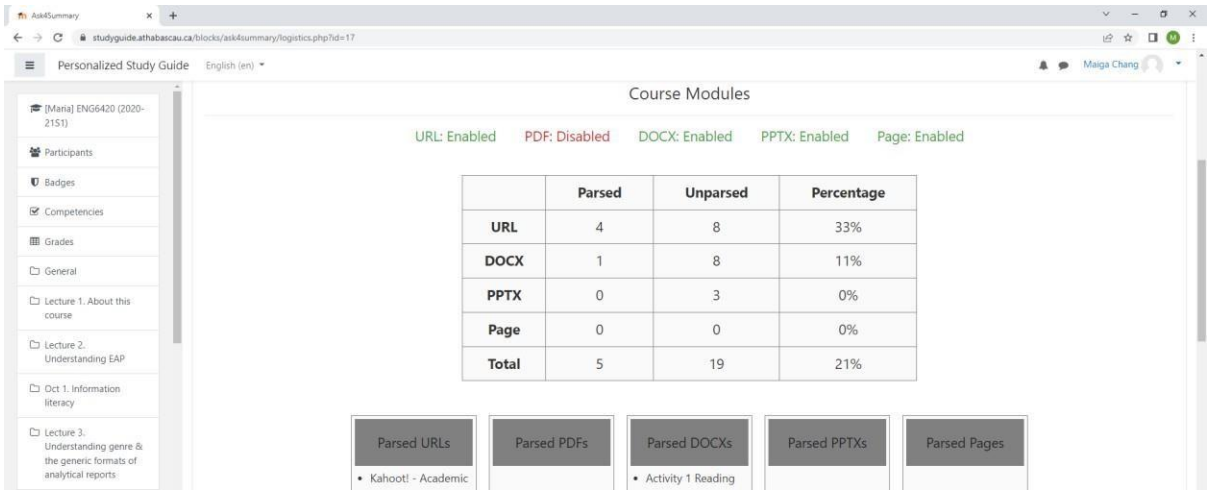

Figure 5. The Progress Table found in the Logistics Page.

In general speaking, a course like Figure 5 shows can be read and parsed quickly. However, Figure 6 shows that by default the Ask4Summary only scans all documents once a minute from the midnight to early morning at 6 AM, while it will scan for students' questions every 15 minutes – these settings are making sure the Ask4Summary will not slow the server down and cause problem for students' learning as most of students might not do learning activities in that period. Of course, the Moodle administrators can change the frequencies of scanning documents and discussion forums according to their institution needs at any time.

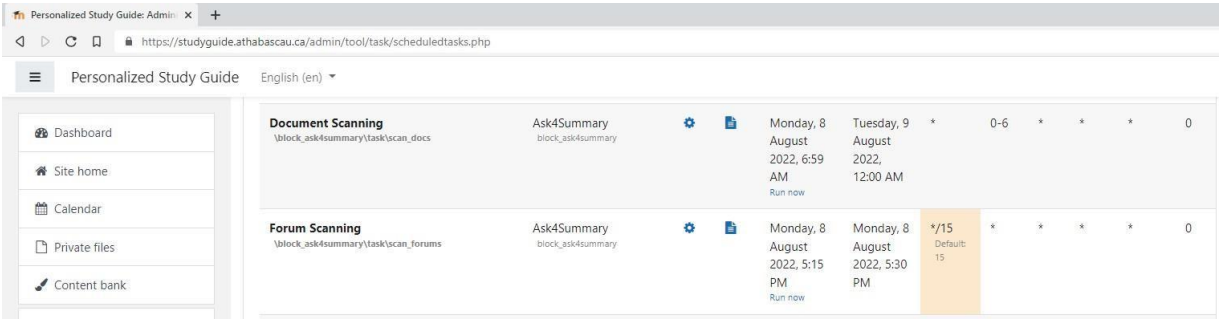

Figure 6. The Progress Table found in the Logistics Page.

2. Question Asking and Summary Generation

As been mentioned earlier (see Figure 6 above) every 15 minutes Ask4Summary begins its "Forum Scanning" task, it retrieves all the course's forum posts that contain the specified the Helper Name. Then, it follows the same process it reads and processes the course materials. Figure 7 below shows a student posting a question with the subject "Hi Studyguide" that contains the Helper Name and the question "what should I avoid when writing".

When Ask4Summary finds a question just posted in the last 15 minutes is like another question that it generated the summary and had responded before, then it will reuse the earlier generated summary to respond the question for time and effort saving purpose. Teachers can always check the Answered/Unanswered posts section at the bottom of the block's logistics page (see Figure 8 below). From the Answered Posts section, they can tell which questions were considered by the Ask4Summary

to be similar and what content the Ask4Summary included and generated for responding. The teachers can of course always respond the post and its replies to make further explanations and clarifications.

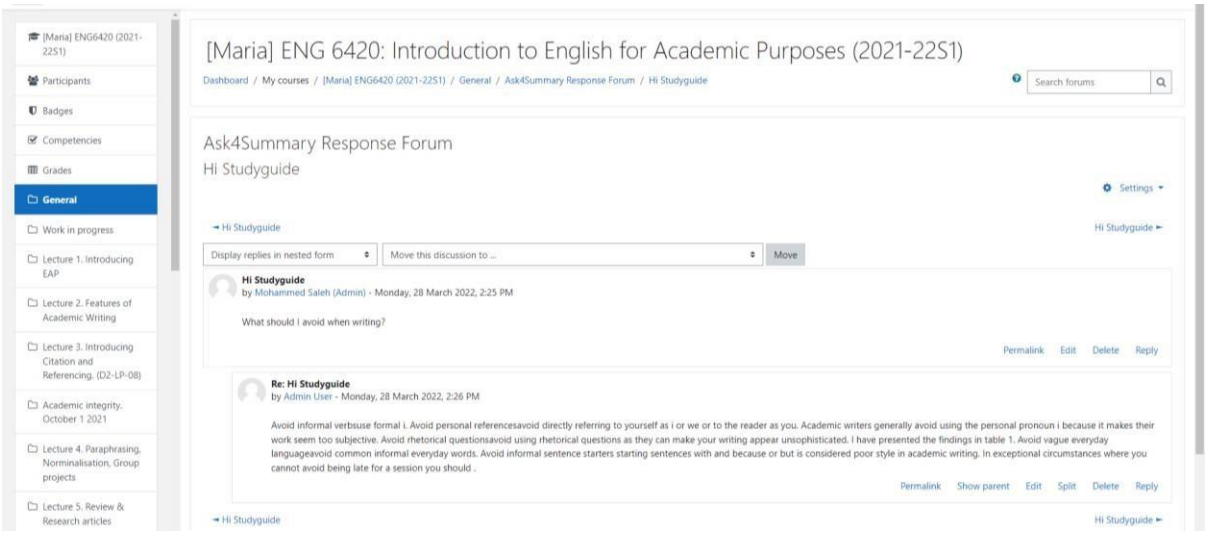

Figure 7. The posted question and the response from Ask4Summary with the generated summary.

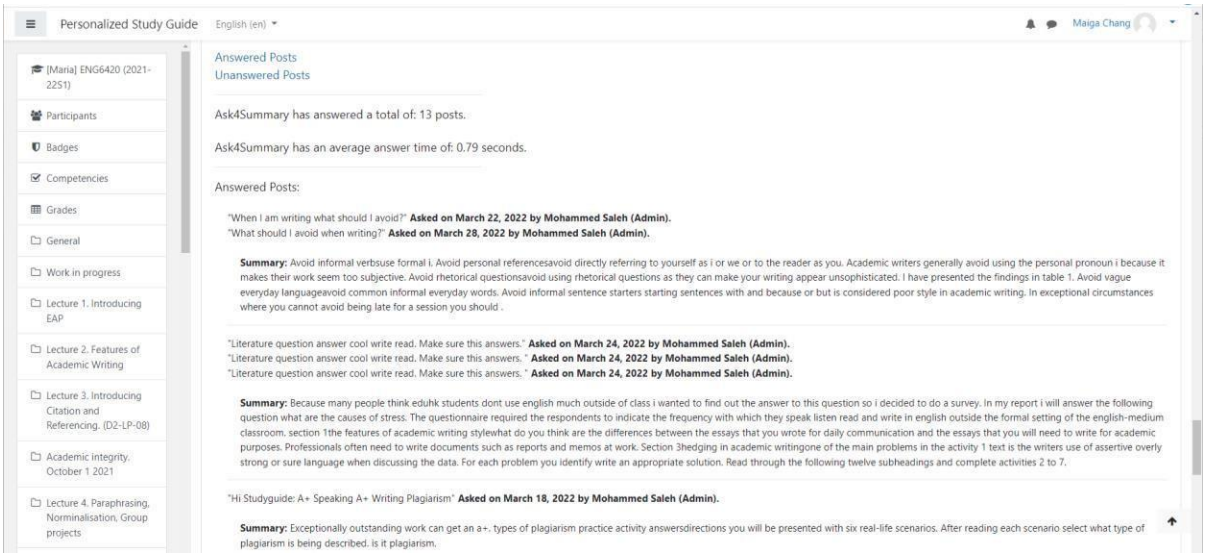

Figure 8. The teacher can check all summary generated and responded by Ask4Summary.

3. Evaluation Plan

Technology Enhanced Language Learning (TELL) originated in the 1950s with the first language learning programs for military purposes (Tafazoli et al., 2019). The introduction of technology in language learning has resulted in favorable outcomes (Ahmadi, 2018) and Heil et al. (2016) found that TELLs use a learner-oriented approach and explanatory feedback might perform better than rigid methodologies. Slavuj et al. (2015) consider that the use of NLP can make the TELL evolve from the corrective feedback to the interactive tutoring systems focusing on individual students' needs. Recent research confirms that automated personalized feedback provided by Intelligent Tutoring Systems (ITSs) promotes student knowledge acquisition (Al-Bastami & Naser, 2017; Kochmar et al., 2020).

The Ask4Summary Moodle plugin meets the trend in TELL research area because it acts as an online tutor that responds student's question in a timelier manner by generating a summary according to the course learning materials. To verify the usability and effectiveness of Ask4Summary, the research team has a plan to have the Ask4Summary plugin adopted and used in a graduate-level Academic English course through a partnership with an Asian university. A questionnaire following a common

procedure in information systems research (Recker, 2021) is designed. The questionnaire focuses on several aspects of the system: usability, perceived relevance and satisfaction.

The data analysis starts a review of the asked questions and the correspondent summary generated by Ask4Summary to check the teacher's perceived relevance and satisfaction degree. As students' perceived relevance and satisfaction toward the summary generated for their questions are also collected, the research team is going to study the relevance and satisfaction degrees (in score 1 to 10) respect to the summaries not only with the means of descriptive statistical analysis but also discuss with the teacher the potential reasons for (1) why students perceived that way if they disagree from the teacher's perception and (2) what are the problems a generated summary has. The potential problems identified by the teacher could help the research to change and improve Ask4Summary further.

References

Ahmadi, D. M. R. (2018). The Use of Technology in English Language Learning: A Literature Review. *International Journal of Research in English Education, 3*(2), 115–125. https://doi.org/10.29252/ijree.3.2.115

Al-Ajlan, A., & Zedan, H. (2008). Why Moodle. *2008 12th IEEE International Workshop on Future Trends of Distributed Computing Systems*, 58–64. https://doi.org/10.1109/FTDCS.2008.22

Al-Bastami, B. G., & Naser, S. S. A. (2017). Design and Development of an Intelligent Tutoring System for C# Language. *European Academic Research, 4*(10).

Bommarito II, M. J., Katz, D. M., & Detterman, E. M. (2018). LexNLP: Natural language processing and information extraction for legal and regulatory texts. *ArXiv:1806.03688 [Cs, Stat]*. http://arxiv.org/abs/1806.03688

El-Kassas, W. S., Salama, C. R., Rafea, A. A., & Mohamed, H. K. (2021). Automatic text summarization: A comprehensive survey. *Expert Systems with Applications, 165*, 113679. https://doi.org/10.1016/j.eswa.2020.113679

Feroz, H. M. B., Zulfiqar, S., Noor, S., & Huo, C. (2021). Examining multiple engagements and their impact on students' knowledge acquisition: The moderating role of information overload. *Journal of Applied Research in Higher Education, 14*(1), 366–393. https://doi.org/10.1108/JARHE-11-2020-0422

Gambhir, M., & Gupta, V. (2017). Recent automatic text summarization techniques: A survey. *Artificial Intelligence Review, 47*(1), 1–66. https://doi.org/10.1007/s10462-016-9475-9

Heil, C. R., Wu, J. S., Lee, J. J., & Schmidt, T. (2016). A Review of Mobile Language Learning Applications: Trends, Challenges, and Opportunities. *The EuroCALL Review, 24*(2), 32–50. https://doi.org/10.4995/eurocall.2016.6402

Kochmar, E., Vu, D. D., Belfer, R., Gupta, V., Serban, I. V., & Pineau, J. (2020). Automated Personalized Feedback Improves Learning Gains in An Intelligent Tutoring System. In I. I. Bittencourt, M. Cukurova, K. Muldner, R. Luckin, & E. Millán (Eds.), *Artificial Intelligence in Education* (pp. 140–146). Springer International Publishing. https://doi.org/10.1007/978-3-030-52240-7_26

Pal, S., Chang, M., & Iriarte, M. F. (2022). Summary Generation Using Natural Language Processing Techniques and Cosine Similarity. In A. Abraham, N. Gandhi, T. Hanne, T.-P. Hong, T. Nogueira Rios, & W. Ding (Eds.), *Intelligent Systems Design and Applications* (pp. 508–517). Springer International Publishing. https://doi.org/10.1007/978-3-030-96308-8_47

Recker, J. (2021). *Scientific research in information systems: A beginner's guide* (Second edition). Springer.

Russell, S. J., & Norvig, P. (2022). *Artificial intelligence: A modern approach* (Fourth edition, global edition). Pearson.

Salton, G., Wong, A., & Yang, C. S. (1975). A vector space model for automatic indexing. *Communications of the ACM, 18*(11), 613–620. https://doi.org/10.1145/361219.361220

Saleh, M., Iriarte, M. F., & Chang, M. (2022). Ask4Summary: A Summary Generation Moodle Plugin Using Natural Language Processing Techniques. In: *Proceedings of the 30th International Conference on Computers in Education, (ICCE 2022), Kuala Lumpur, Malaysia (Hybrid)*, November 28-December 2, 2022.

Slavuj, V., Kovačić, B., & Jugo, I. (2015). Intelligent tutoring systems for language learning. 2015 38th *International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, 814–819. https://doi.org/10.1109/MIPRO.2015.7160383

Tafazoli, D., Huertas Abril, C. A., & Gómez Parra, M. E. (2019). Technology-based review on ComputerAssisted Language Learning: A chronological perspective. *Pixel-Bit. Revista de Medios y Educación*, 54, 29-43. https://doi.org/10.12795/pixelbit.2019.i54.02

Wilks, Y., & Stevenson, M. (1998). The grammar of sense: Using part-of-speech tags as a first step in semantic disambiguation. *Natural Language Engineering, 4*(2), 135–143. https://doi.org/10.1017/S1351324998001946