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IMPROVING SERVICE QUALITY IN HIGHER EDUCATION THROUGH NATURAL LANGUAGE INTERFACES

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ABSTRACT

Higher education institutions have a responsibility to perform research and produce well-educated graduates for a quality workforce. These outputs play an important role in nation's economic development and sustainability as they are inputs for the industry. This effect is also important for individuals to have satisfying careers and earnings, together with better employment prospects. Both nations' and individuals' interest led to an increase in the number of higher education institutions, and competition among them resulted in the need to improve quality of education and student satisfaction. One of the items that affects student satisfaction is the quality of student services. The objective of this paper is to perform a systematic screening, as a precursor to a review, of published literature on Natural Language Interface applications in the education domain in order to determine the recent trends in the area.

Keywords: Service Quality, Higher Education, Natural Language Interfaces

INTRODUCTION

Today, higher education is experiencing rapid changes as one consequence of globalization, and universities are undertaking broader socio-economic responsibilities with the education and research they provide. These responsibilities include, among others, training qualified labor force in accordance with the demands of global economy, being the trigger of national and regional economic development, and carrying out research that can be used in industry. It is necessary for higher education institutions to provide industry with practical technology and a qualified labor force in order for nations to achieve sustainable economic development. (Lv, 2018; Ma, Pender, & Welch, 2016) Furthermore, higher education is important for individuals to have satisfactory careers and earnings, as well as to increase their employment prospects. (Delavande & Zafar, 2019)

Higher education institutions need to improve the quality of education and student satisfaction in order to remain competitive in a globalized world. Achieving student satisfaction is of utmost importance in maintaining competitiveness. Student satisfaction means that a student's subjective assessment of various educational outcomes and experiences is positive. It is clear that student satisfaction in higher education is associated with various factors. (Weerasinghe, Lalitha, & Fernando, 2017) (Elliott & Healy, 2001) These factors range from academic issues to administrative issues, social environment and tuition fees. (Martirosyan, 2015) determined that the following factors contribute to student satisfaction.

- Faculty services
- Academic experience
- Student support facilities
- Campus life and social integration

On the one hand, while the studies on measuring student satisfaction are carried out, on the other hand, effort is made to develop metrics and measure the quality of higher education services. The HESQUAL scale was developed by (Teeroovengadam, Kamalanabhan, & Seebaluck, 2016) to measure the quality of higher education services. HESQUAL scale uses five primary dimensions with nine sub-dimensions.

- Administrative Quality (Attitude and Behavior of administrative staff and administrative processes.)
- Physical Environment Quality (support infrastructure, learning settings and general infrastructure)
- Core Educational Quality (attitude and behavior of the lecturers, curriculum of university, pedagogy of university and competence of lecturers)
- Support Facilities Quality
- Transformative Quality

In a typical higher education institution, the following services may be provided to students:

- | | | |
|-------------|----------------|-----------------------|
| • Admission | • Registration | • Course Registration |
| • Payment | • Orientation | • Academic Advisor |

- Lectures
- Study
- Examination
- Results
- Success Scholarship
- Graduation
- Qualified Lecturers
- Counseling
- Laboratories
- Library
- Health Center
- Student Clubs
- Sport Facilities
- Dormitory
- Internet
- Canteen/Cafeteria
- Social Events
- MOOC/Distance Learning
- Campus Activities
- Guided Search

Natural Language Interfaces (NLI) are tools that help users to interact with systems using natural languages. (Hendrix, Sacerdoti, Sagalowicz, & Slocum, 1978) In this study, when Natural Language Interface is mentioned, systems that the user communicates using Natural language are to be understood. Chatbots, Personal Assistants, Dialog Systems and Question Answering Systems are examples of Natural Language Interfaces.

The research questions addressed by this study are:

RQ1. How much research activity has been done with NLI in higher education?

RQ2. Which NLI methods are being addressed?

RQ3. Which student services are being addressed?

RQ4. What empirical evidence is there concerning the research trends of NLI in the higher education domain?

METHOD

A systematic literature review is a tool for identifying, evaluating, and interpreting all existing research related to a research question or subject area or related phenomenon. A systematic literature review can be used to summarize the available evidence of a technology. (Kitchenham, Barbara Charters, 2007)

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) provides a description of the components involved in the review and best practices for performing the job and publishing the results. (Moher et al., 2009).

As a precursor to a systematic literature review in the area of natural language interfaces in the higher education sector, in accordance with PRISMA recommendations for reporting in systematic reviews, the following 4 phases have been determined for systematic screening:

1. Publication Retrieval
2. Screening of Titles and Abstracts
3. Screening of Full Text
4. System Information Collection for categorization of papers

Database searched

Instead of searching multiple database and then dealing with duplicates and merging problems, Lens.org has been chosen as the electronic database since it provides results from 211,442,021 scholarly works with the following integrated data sources: (“The Lens - Free & Open Patent and Scholarly Search”)

- PubMed (“Home - PubMed - NCBI,”)
- Crossref (“You are Crossref - Crossref,”)
- Microsoft Academic (“Home | Microsoft Academic,”)
- CORE (“CORE – Aggregating the world’s open access research papers,”)
- PubMed Central (“Home - PubMed - NCBI,”)

Lens.org has a structured search feature and advanced filtering options with consistent link and “export as excel” feature. It also provides Collection feature with free registration.

Search terms

Search terms were determined after doing a preliminary search with “Higher Education” and “Natural Language Interface” to find out alternative terms. Both title and abstract of scholarly works were searched by combining <Domain alternative terms> and <Method alternative terms> and <“student” term> with AND operator (Figure 1). All alternative combined search queries were then combined with OR operator to form one query.

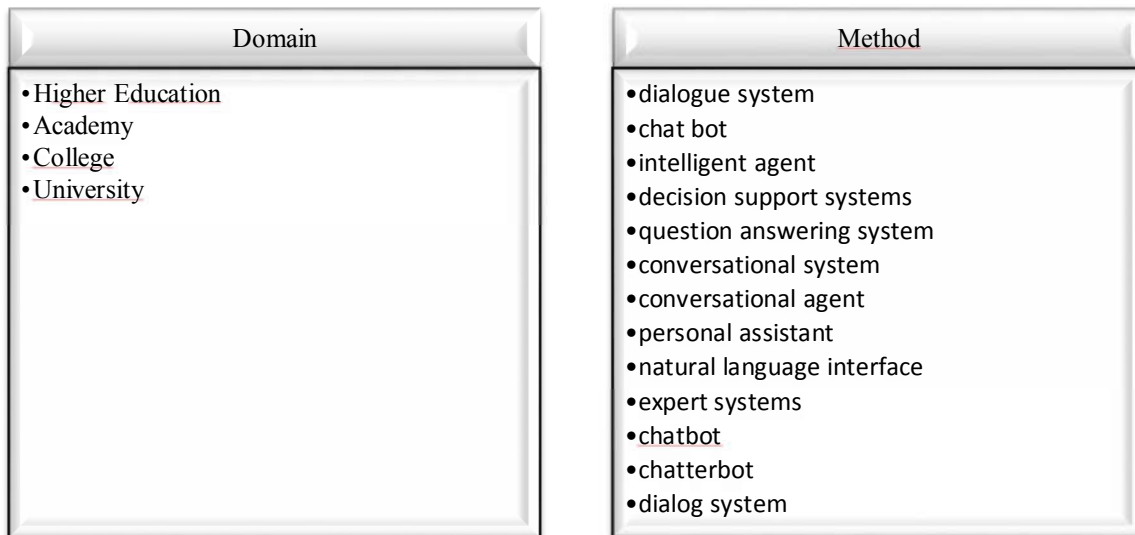


Figure 1: Search terms

Selection of papers

1,036 scholarly works were retrieved. 685 scholarly works were left after excluding duplicate entries, unrelated entries and books. Final selection was done by eliminating the scholar works that do not have natural language interfaces, resulting in 144 scholarly works with natural language interface being selected.

Categorization of papers

Summary of each scholarly work was reviewed. Each scholarly work was categorized by its “application area” and “method”. Categorized Methods were:

- Chatbot
- Conversational Agent
- Personal Assistant
- Question Answering System
- Dialogue System

FINDINGS

Figure 2 shows the number of NLI scholarly works published in each year. This figure is demonstrates the interest in NLI applications in higher education. 69 of 144 scholarly works have been published in the last 5 years.

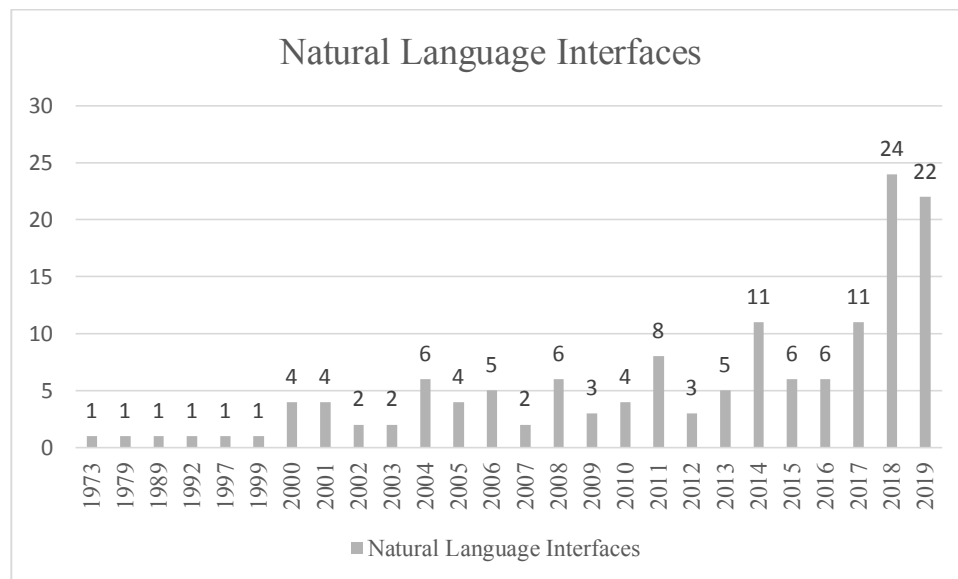


Figure 2: Scholarly works in years

It can be seen in Table 1 that most of the scholarly works use the Chatbot or Conversational Agent method. It should also be noted that 42 of 69 scholarly works in last 5 years use the Chatbot method.

Table 1: Number of scholarly works by method

Natural Language Interfaces						
	Chatbot	Conversational Agent	Personal Assistant	Question Answering System	Dialogue System	Total
Total	52	55	10	11	16	144
Last 5 Years	42	15	3	5	4	69

Table 2 shows the scholarly works categorized with their application areas. 98 of 144 scholarly works is gathered in 4 areas: Admission Information Retrieval, Guided Information Retrieval, Intelligent Tutor, and Supporting Learning. Interest on these areas continue in last 5 years, except Intelligent Tutor. Admission Information Retrieval and Guided Information Retrieval together with chatbot method is getting the most interest in NLI applications of higher education.

CONCLUSION

We performed a systematic literature screening, as a precursor to a full review, of published literature in the area of NLI applications in higher education in order to determine the recent trends. It is clear that NLI technology is already being used in wide range of application areas in the higher education sector, and it makes sense for higher education institutions to take appropriate actions toward improving service quality by using NLI.

Table 2: Application Areas of scholarly works

Application Area	Total	Last 5 Years
Academic Advisor	6	3
Academic Research	1	1
Admission Information Retrieval	11	8
Campus Activities	2	2
Counseling for Spiritual Guidance	2	1
Course Information Retrieval	6	2
Determining Illness of Student	3	3
Determining Interesting Topics for Students	1	0
Diagnosing Emotional States of Students	1	0
Elective Course Selection	1	1
Enhancing Student Engagement	5	4
Evaluating Applicants	1	1
Events Information Retrieval	1	1
Guided Information Retrieval	25	17
Handling Computer Laboratory	2	1
Help in Practicing a Language	1	1
Helping in Exam Stress	1	0
Helping in Library Search	2	1
Helping Students in Study Planning Problems	1	1
Intelligent Tutor	33	2
Perceived Student Experience with NLI	2	2
Recommendation of Career	1	1
Recommendation of Learning Material	2	2
Scheduling of Student Appointment	1	0
Supporting Collaborative Learning	1	1
Supporting Learning	29	12
Supporting Students with Physical Disabilities	1	0
Team Formation	1	1
Total	144	69

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