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Proceedings of the World Conference on Education and Teaching
Vol. 3, Issue. 1, 2024, pp. 68-76
DOI: https://doi.org/10.33422/etconf.v3i1.613

ISSN: 2783-7807 online

Diamond Scientific Publishing

Health Informatics Curriculum Implication Development and Trend

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Abstract

In Mongolia, about twenty IT departments operate in level I, II, and III hospitals. Mongolian National University of Medical Sciences (MNUMS) has already released 14 IT classes, and as a result, we propose to study the effectiveness and implementation of the program. They were asked questions on workplace weaknesses and strengths, employment requirements, compatibility, or evaluation of the specialist's knowledge and skills, the specialist's market demands, and future attitudes in the survey. A database was created for the satisfaction survey and other questionnaires, and its cluster analysis was conducted using MS Excel. Five satisfaction levels were utilized to assess responses: "excellent," "good," "moderate," "bad," and "very bad.". The program's graduates were surveyed using a simple random sampling method. The 84.5% of graduates, according to the labor market share study, are employed by the Department of Health, hospitals II and III levels, and other academic institutions. Additionally, 68% of graduates are employed in jobs related to informatics, health specialists, and network engineering, respectively. The 85 percent of employers expressed satisfaction as "excellent" or "good." In terms of how well they match market demands, acquired knowledge and skills, and contemporary development trends, 53% of all courses have an average level of satisfaction, and 47% have a level of satisfaction that is below average.

Keywords: health informatics curriculum, satisfaction survey, cluster analysis

1. Introduction

Health information technology adoption in the healthcare industry has many benefits, such as improved quality of care, lower costs, uniform access, prompt service, better administrative efficiency, and a significant reduction in paper documentation. The advancement of information technology will be aimed at fully meeting the needs of the health sector in terms of providing health care services to people with uniform access and prompt distribution. The health information technology sector engages in the analysis, selection, modeling, creation, and utilization of databases containing large amounts of medical and health-related data. It also ensures the security of this information and facilitates extensive information exchange among healthcare providers, clients, and organizations, all within the boundaries of the law.

It is critical that security and privacy be maintained when storing and sharing health information digitally. Big data analysis in clinical biology has emerged as a vital component of healthcare research in the current era of evidence-based medicine.

Countries like England, Canada, China, and India are currently at the forefront of health technology development. As these countries progress, the need for IT specialists in the healthcare industry is growing. According to the US Bureau of Labor Statistics, there will be a projected 20% increase in employment for health information professionals from 2016 to 2026 (Bureau).

According to the statistics from the Health Department Center, a complete system of 21991 computers has been established in level II and III hospitals in Mongolia. Moreover, more than twenty specialized IT personnel have been deployed to manage this system effectively (Development, 2019). The "Approving Procedures for Information Technology" Order No. 140 of the Ministry of Health mandates that a single IT employee be assigned to a work environment comprising forty computers (Health, 2013). As per the 2019 report by the Health Department Center, the current workforce comprises 238 IT specialists in the nation, while the health sector anticipates a future demand of 550 specialists. Hence, considering the high demand for informatics and health professionals, a study was conducted to assess the implementation and growth patterns of informatics and health programs.

Researchers are focusing a great deal of attention on the development of new technologies and methods for processing, analysing, modelling, evaluating, and predicting patterns and patterns gathered in various scientific fields, including society, technology, nature, health, and climate.

Data mining is the systematic exploration of extensive data sets to uncover concealed patterns and significant associations. It involves utilizing database systems, mathematics, statistics, and modelling techniques to acquire knowledge. Data mining, to put it another way, is a process utilized to extract the most valuable insights from a database. One area of research in this area is called "data mining" (Han et al., 2011; Hand, 2007; Mining, 2006; Sarangerel, 2013; Witten & Frank, 2002).

Throughout the data mining process, classification and clustering techniques are employed to identify the key features of the massive amounts of data that are gathered, examine correlations between the data, group the data according to shared characteristics, generate predictions based on specific indicators, and distinguish between disparate data sets (Dabbura; Kaufman & Rousseeuw, 2009).

2. Methodology

A satisfaction survey was undertaken to assess the graduates of the employer organization during the examination of the outcomes and efficacy of the health informatics curriculum. Additionally, a cluster analysis was performed on the collected data (Data et al.; Hartigan & Wong, 1979; Likas et al., 2003):

Weaknesses and strengths in graduate employment and workplace

Job requirements, compatibility, or specialist knowledge

The needs of the specialist market and future trends. Also, the success of the workplace and its contribution to the development of the professional sector were explored.

Satisfaction was evaluated on five levels: "excellent," "good," "moderate," "bad," and "very bad."

3. Results

Based on an analysis of the labor market, of the 190 graduates from the informatics and health programs, 84.5% are employed at the moment.

In the survey, 20 employers from 14 organizations were surveyed with 37 questionnaires with three groups of questions. It includes:

Group I: 10 questions about the general information of the research participating organization and the employer's weaknesses and strengths in the workplace of the graduate.

Group II: 22 questions to assess the requirements and compatibility of the specialist's job or the specialist's knowledge in the survey.

In the third group of questions, a survey was conducted with five questions about the needs of the specialist market and future attitudes.

This study included 20 employers from a total of 14 employer organizations that hired graduates trained by the program. In terms of the employer organizations surveyed, state-owned entities comprise 90% of the total, while non-governmental organizations affiliated with the school through the provision of student internships, grants, research opportunities, and joint project work account for the remaining 10%.

At these institutions, 58% of graduates from informatics and healthcare programs are employed as IT professionals, 10% as network engineers, and 85% of graduates are rated as excellent or good (Figure 1).

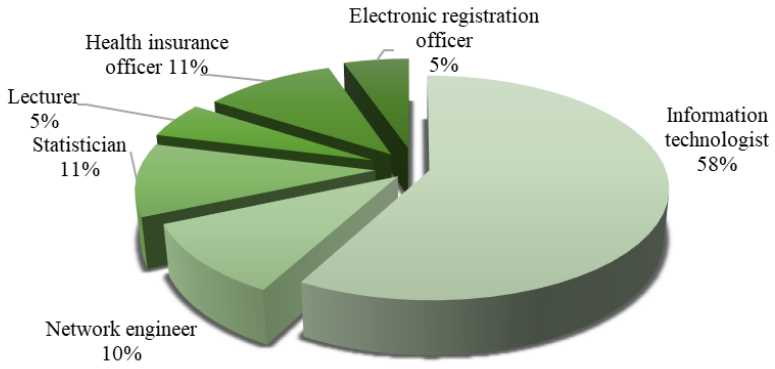

Figure 1. Graduate's positions

3.1. Job requirements, compatibility, or specialist knowledge

The results are displayed in Table 1 and indicate that the employer's evaluation of the general knowledge and skills of informatics and health professionals yielded an average satisfaction score of **3.93,** which means ***'good'*** (Table 1)**.**

3.2. Weaknesses and strengths in the workplace of a specialist

Figure 2 shows the strengths and weaknesses of graduates as assessed by employers.

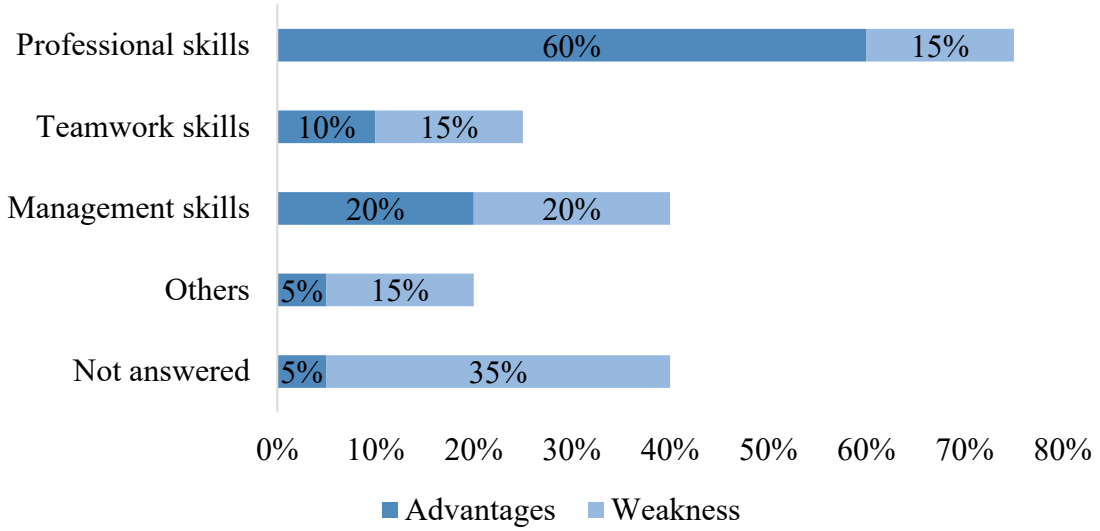

Figure 4. Advantages & weakness

3.3. Professional market needs and future trends

Out of 41 students who graduated from the Informatics and Health program, the program's market needs and future trends.

I question: whether the content of the courses meets market requirements,

II question: whether the basic theoretical knowledge acquired in the course meets the requirements,

III question: whether the skills acquired in the course meet the requirements,

IV question: how well the course is in line with modern development trends,

V question: in terms of knowledge and skills, a questionnaire was collected with 5 questions about whether they are competitive with other vocational schools, and a database was created.

Table 1. Evaluation of Graduates satisfaction

Questions	Satisfaction level	Satisfied "Good"	Satisfied "Moderate"	Satisfied "Bad"
General knowledge and abilities of the specialist				
How do our graduates meet job requirements?	3.9	85%	15%	0%
To what extent does the level of his theoretical knowledge meet the requirements for working in his profession?	3.5	50%	45%	5%
How qualified are our graduates in terms of professional skills?	3.65	65%	30%	5%
Can our graduates perform their work in accordance with modern development trends?	3.8	70%	30%	0%
Rate our graduates' knowledge and skills compared to professionals from other schools.	3.8	75%	20%	5%

Questions	Satisfaction level	Satisfied "Good"	Satisfied "Moderate"	Satisfied "Bad"
Knowledge and Skill				
Attitude	4.1	85%	15%	0%
Work planning and organization	3.85	85%	15%	0%
Use time wisely	4.05	85%	15%	0%
Team working ability	4.15	95%	5%	0%
Problem solving and responsibility	3.95	80%	20%	0%
Ability to learn new things	4.1	95%	5%	0%
Ability to generate new ideas and initiatives	3.85	80%	20%	0%
Knowledge of foreign languages	3.35	45%	45%	10%
Work in the Internet environment	4.25	100%	0%	0%
Office programme usage	4.1	85%	15%	0%
Ability to use professional software	4.2	90%	10%	0%
Self-reliance	4.1	95%	5%	0%
Ability to adapt to new environments	3.95	80%	20%	0%
Share your knowledge	4.05	90%	10%	0%
Personal development of the specialist	3.8	73%	26%	0%
Ability to develop yourself	4.05	85%	15%	0%
Average	**3.93**	**80.62**	**18.14**	**1.19**

A cluster analysis was conducted on the satisfaction evaluations of the 17 basic, 22 professional, and 16 professional courses included in the program. In the cluster analysis, the level of satisfaction was divided into two clusters: middle cluster I and lower middle cluster II (Table 2).

Table 2. Cluster analysis results

Cluster	Average evaluation				
	I	**II**	**III**	**IV**	**V**
Cluster I	3.35	3.21	3.15	3.11	3.10
Cluster II	2.89	2.94	2.87	2.80	2.80

Cluster I, a moderate level of satisfaction group, included 29 subjects, accounting for 52.7% of all subjects. **Cluster II,** the group **with a medium to low level** of satisfaction, includes 26 subjects, accounting for 47.2% of all subjects. Since this group includes general basic courses, it is necessary to improve the curriculum and increase the skills of the teachers who teach the courses.

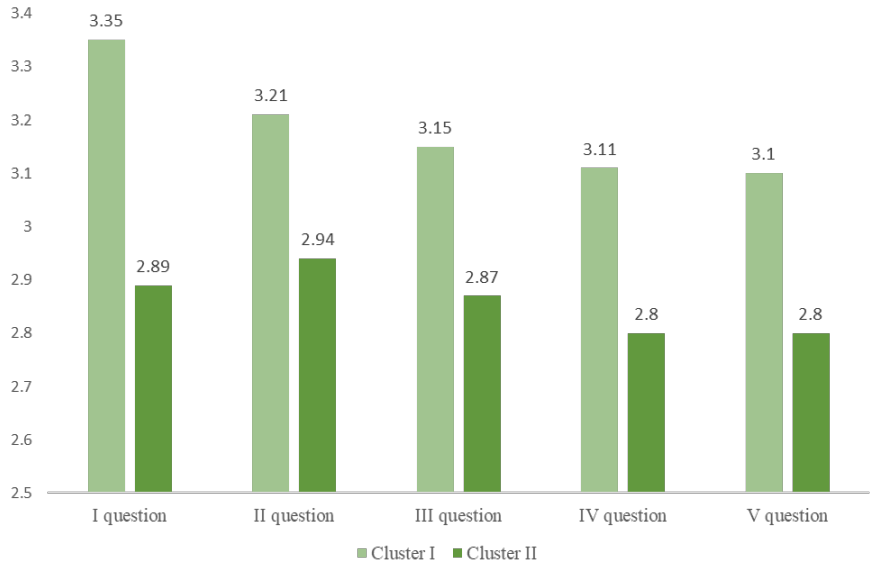

Figure 3. Cluster summaries of program market needs and suitability

4. Conclusion

According to the study of the basis of the participation of graduates in the labor market, 84.5% of all graduates are employed, and according to the evaluation of the employer's organization, the satisfaction level of 85% is rated as very good or good.

In academic institutions, provincial and regional Diagnosis and Treatment Centers, the Department of Health, and II and III-level hospitals, 68% of the graduates are employed as informatics, health specialists, and network engineers.

In the satisfaction survey's cluster analysis, 53% of all courses scored in the medium satisfaction category, and 47% fell into the lower-than-medium category based on how well they matched market demands, acquired knowledge and abilities, and contemporary development trends.

Postgraduate education was pursued by 23% of all graduates, with master's degrees being obtained by 11.5% of them.

The study indicates that to go further, graduates should be included in master's programs and post-graduate professional development training, both in-person and online. This is especially true when developing joint programs with other universities.

This health informatics curriculum has been nationally accredited twice by the Mongolian National Council for Educational Accreditation.

5. Discussion

The Department of Physics & Informatics at the School of Biomedicine, MNUMS which implements the program, has expanded to a team of professors specializing in information technology since 63% of the lecturers have academic degrees.

Research shows that 11.5% of all graduates have received a master's degree, which means that it is important to open and develop further programs for graduates to continue their studies (post-graduation professional development courses, master's and doctorate courses) (Ajnai, 2022).

In 2015, the "*Development Policy* (2015-2030)," a strategic document defining the development principles and implementation activities of MNUMS was discussed and approved

by the "*Board of Representatives."* 84.6% of graduates of this Informatics and Health profession get jobs, which is 2.1% higher than the employment rate of graduates, an indication of "Development Policy (2015-2030)". "Development Policy" states that employment is anticipated to reach 90% by the time the employment survey is conducted again in 2024 (*Development policy (2015-2030)*, 2014).

According to the findings on the strengths and weaknesses of the specialist's workplace, employers prefer to hire graduates who have professional foreign language skills, teamwork skills, good interpersonal skills, ethics, and the ability to work independently (Galbadrakh, 2022). As a result, instead of a foreign language option, the curriculum now includes two courses: Academic English IELTS (EAP-IT12) and English for Special Purposes (ESP-IT11). The elective course "Personal Leadership (LED-IT21)" is provided, which aims to equip professionals with a positive attitude toward relationships and ethics.

The results of the cluster analysis of the program's requirements and market demands indicate that it is important to consider the degree of compatibility the course has with contemporary development trends as well as its ability to compete with other vocational schools in terms of knowledge and skills.

The curriculum of informatics and health has been studied by similar programs abroad, including those of the Asia Pacific University, as well as the recommendations contained in the Information Technology Curriculum Guide 2017 (Mihaela Sabin, 2017). The following changes have been made in comparison.

Professional basic courses: Mathematics -2 from professional basic courses, Applied Mathematics, Professional Introduction course, Health Information Technology, Database Organization course, by combining the contents of Database System, Algorithm Basics, and Programming Language basics courses and changing the name to Algorithm and Programming Basics. updated and improved in terms of content. The mathematical programming course has been removed.

As a result, we are trying to enhance the course material, strengthen the connection between theory and practice, and enhance instructors' ability to teach. In the framework of this work, some practice courses have been turned into seminar courses, and manuals have been released. For example, database systems, medical physics, and bioinformatics course manuals have been published and are being used in training.

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Professional courses: recent development and advancement trends of information technology entering the health sector, Bachelor of Advanced Computing/Bachelor of Science (Health) at the University of Sydney Australia, which prepares specialists in the field of health information technology, Oregon Tech University in the United States, A comparison was made with Health informatics programs at Montana Tech University in the United States and the University of Gondar in Ethiopia (*Bachelor of Advanced Computing/Bachelor of Science (Health)*; *Bachelor Sceince in Health Informatics, Oregon Tech Institute of Technology*;

Healthcare Informatics, B.S, Montana Tech - The University of Montana; Tilahun et al., 2014). Thus, new courses were added: Cell Biophysics, Database Application, Fundamentals of Artificial Intelligence, Biological Modelling and Simulation, Biochemistry and Biodata.

A study of employer satisfaction and graduates of the Health Informatics Program was done in 2015 by M. Solongo et al. 51 employers and 119 program alumni took part in it. Employers in this research gave graduates a 3.71 "above average" satisfaction rating. As can be seen, this figure is 0.22% less than what our investigation found. In addition, 67% of graduates from Health Informatics programs find work. In our research, it's 84.5%, or 17.5% higher. This demonstrates that informatics school graduates have satisfied companies' employment needs. As a result, job opportunities have expanded (Solongo, 2015).

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