DOI Number: 10.37506/v20/i1/2020/mlu/194512

Reorganization of Learning Objectives Using Ontology Technique

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Abstract

Background/Objectives: This study, the linkages between the educational curriculum were investigated by applying the ontology method to the learning goal in the field of clinical dental support among the learning goals of the department of dental hygiene.

Methods/ Statistical Analysis: In this study, the ontology was applied to the learning goals for clinical dental support field. In the basic design, the opinions on the area setting, usage purpose, provided information, and user-friendly design included in the ontology were collected. The ontology construction was developed using ASP, a web-based program and database construction was composed with MS-ACCESS 2010 version.

Findings: We have composed the learning goals of dental clinical field in the department of dental hygiene.

The dental clinical field is made up of a total of 7 subjects and classified into parts, chapters, and sections. From the learning goals, the contents that must be learned consist of priority A and the contents that should be learned optionally learn consist of B. Users can determine whether or not they can select the priorities and whether or not include chapters and sections. They can search by entering a specific keyword for the learning goals. The learning goal priority was set to 'A' and the learning goals were searched including 'chapter' and 'section'. As a result, the relevant learning goals in oral and maxillofacial surgery, conservative dentistry and orthodontics could be confirmed.

Improvements/Applications: This program will be able to be used usefully to set educational purposes and design appropriate education for it through the linkage between subjects.

Keywords: *Dental Field, Dental Hygienist, Learning goals, Learning Objectives System, Ontology, Reorganization of Learning*

Introduction

Ontology is an explicit formalization to conceptualize certain interest area and it can be a way of establishing knowledge systematically [1]. The formalization through ontology helps to find exact information by clearly defining and describing in detail the concept of the subject. Also, it has the advantage of linking flexibly with existing knowledge in case that knowledge is shared and new knowledge is added [2].

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In the present medical field, the studies on the shared decision support system development for treatment using ontology and domain-specific language have been reported [3-8]. In the field of dentistry, ontology is divided into data analysis and knowledge discovery, dental education and training, legal protection and compliance, evidence-based dentistry, information exchange and integration, and clinical decision support systems [9-13]. In terms of dental education and training, there has been the case that ontology has been used to produce augmented reality applications to educate students [2,14-15].

In South Korea, dental hygiene has been grown for approximately 50 years and has been looking for academic

change. American Dental Hygienists Association presents Standard of Applied Hygiene Practice, and is attempting to teach and nurture to progress systematic approach to dental hygiene knowledge and work and critical thinking, decision-making ability and problem-solving ability of dental hygienists. In South Korea, departments of dental hygiene have been established at 82 universities nationwide and about 5,000 hygienists have been graduated every year and education to produce highly competent dental hygienists has been devoted [16]. Furthermore, in order to train standardized dental hygienists who have dental hygienists' basic skills, learning goals have been set based on the core terminology draft for the development of national examination questions and learning goals [17] of the department of dental hygiene, and have been applied to the national examination of dental hygienists. The learning goals of the department of dental hygiene, as a guide about compulsory and optional contents in the curriculum of a wide range of academic subjects, are the first activities which should be performed at the beginning of education. Particularly, the collection of learning goals is used for various purposes such as suggesting directions for teaching design activities, inducing learners' motivation to be educated, determining criteria for teaching strategies, evaluating criteria for learners' achievement status, effective management of class time, and providing effective feedback, and moreover, it is used as the basis for the national examination criteria and examination questions development standards. In order to perform efficiently dental hygienists' jobs, the learning goals of the dental hygiene curriculum has in-depth relationships with the dental hygienists' jobs and the educational purposes should be set systematically, and the educational contents appropriate to them should be chosen and the organization and the evaluation method should be designed and provided [18,19].

Therefore, in this study, the linkages between the educational curriculum were investigated by applying the ontology method to the learning goal in the field of clinical dental support among the learning goals of the department of dental hygiene.

Method

The development of the ontology followed the ontology development methodology of previous studies [20-22] which is known widely and easy to understand. In this study, the ontology was applied to the learning goals for clinical dental support field (conservative dentistry, dental prosthetics, pediatric dentistry, orthodontics, oral and maxillofacial surgery, periodontology, dental materials).

In the first step, the domain and scope of the ontology was determined. For this, the basic design was completed in a brainstorming way by consisting of 1 ontology development expert, 1 domain expert and 4 service users and by holding a total of 4 meetings for a week. In the basic design, the opinions on the area setting, usage purpose, provided information, and user-friendly design included in the ontology were collected. Considering the characteristics of end-users, the vocabulary selection of concept and the classification of concept were considered.

In the second step, the important items of the learning goals used in the ontology were listed and main sentences were also listed. The chapters and sections of the learning goals were listed and the relationships between the learning goals were elicited.

The third step is to define the class, class hierarchy, and establish the class relationships.

In the fourth step, the concept was expressed by defining the class from the list of main items created in the third step and defining the relationship between the defined class hierarchy and classes.

The fifth step was to build the actual instance according to the ontology schema. It was checked and revised whether or not the necessary concepts were not left out and the concepts were not defined imprecisely.

In the final screen configuration, the learning goals were enabled to search for the learning goals including the chapters and sections and enabled to use the priority A and B items of the learning goals separately. The ontology construction was developed using ASP, a web-based program and database construction was composed with MS-ACCESS 2010 version. The data flow diagram is shown in Figure 1.

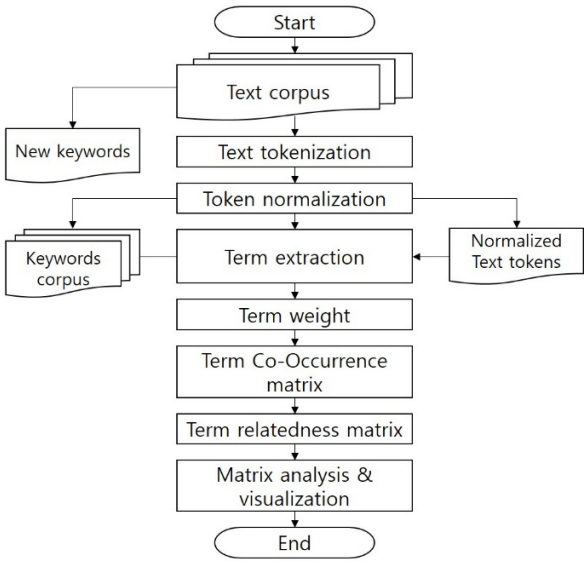

Figure 1. The data flow diagram

Result and Discussion

The composition of the learning goals of dental clinical field in the department of dental hygiene is shown in table 1. The dental clinical field is made up of a total of 7 subjects and classified into parts, chapters, and sections. From the learning goals, the contents that must be learned consist of priority A and the contents that should be learned optionally learn consist of B.

Conservative dentistry consists of 14 chapters. Priority was 69 for A and 64 for B. Dental prosthetics consists of 6 chapters in 2 chapters. Priority was 79 for A and 72 for B. Pediatric dentistry consists of 23 sections in 9 chapters. Priority was 61for A and 76 for B. Orthodontics consists 51 sections in 11 chapters. Priority was 75 for A and 126 for B. Oral and maxillofacial surgery consists of 37 sections and 9 chapters in 4 parts. Priority was 63 for A and 90 for B.

Periodontology consists of 32 sections in 10 chapters. Priority was 67 for A and 72 for B. Dental materials consist of 30 sections in 15 chapters. Priority was 61 for A and 104 for B.

Table 1. The composition of the learning goals of dental clinical field in the department of dental hygiene

Subject	Parts	Chapters	Sections	Priority	
				A	B
Conservative dentistry	-	14	-	69	64
Dental prosthetics	2	6	18	79	72
Pediatric dentistry	-	9	23	61	76
Orthodontics	-	11	51	75	126
Oral and maxillofacial surgery	4	9	37	63	90
Periodontology	-	10	32	67	72
Dental materials		15	30	61	104

User screen is shown in Figure 2. Users can determine whether or not they can select the priorities and whether or not include chapters and sections. They can search by entering a specific keyword for the learning goals.

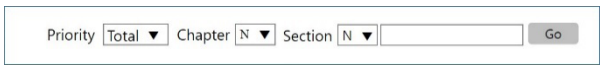

Figure 2. Oral and Maxillofacial Surgery Screen Configuration

The result screen of user search is shown in Figure 3. This is a screen configuration that shows the whole learning goals of oral and maxillofacial surgery.

Subject	Part	Title	Chapter	Title	Section	Title	learning goal	Priority
Oral and maxillofacial surgery	Part 1	Overview of Oral and maxillofacial surgery	Chapter 1	Dental hygiene in Oral and maxillofacial surgery	Section1	Overview of Oral and maxillofacial surgery	We can define the Oral and maxillofacial surgery.	B
Oral and maxillofacial surgery	Part 1	Overview of Oral and maxillofacial surgery	Chapter 1	Dental hygiene in Oral and maxillofacial surgery	Section2	Overview of Oral and maxillofacial surgery	We can list the major diseases of the Oral and maxillofacial surgery.	B
Oral and maxillofacial surgery	Part 1	Overview of Oral and maxillofacial surgery	Chapter 1	Dental hygiene in Oral and maxillofacial surgery	Section3	Overview of Oral and maxillofacial surgery	We can explain the principles of treatment for major diseases in Oral and maxillofacial surgery.	B
Oral and maxillofacial surgery	Part 1	Overview of Oral and maxillofacial surgery	Chapter 1	Dental hygiene in Oral and maxillofacial surgery	Section4	Overview of Oral and maxillofacial surgery	We can manage post-op patients.	B

Figure 3. whole learning goals of oral and maxillofacial surgery

Figures 4 shows searching for learning goals with the term 'Diagnosis' and shows the results of searching for learning goals with the term 'Diagnosis'. The learning goal priority was set to 'A' and the learning goals were searched including 'chapter' and 'section'. As a result, the relevant learning goals in oral and maxillofacial surgery, conservative dentistry and orthodontics could be confirmed.

In figure 5, the results obtained by applying the term 'diagnosis' to the ontology were expressed in an algorithm.

This program was designed to set educational purposes through the relationship between subjects and to use to design education suitable for it. The ontology was applied to help to find more accurate information by defining clearly and describing in detail the main concept of the learning goals of the national examination through the linkage between knowledge of the learning goals of the national examination of dental hygienists, in addition, it was applied to be used as basic data for defining the relationship between the learning goals and linking flexibly with existing learning goals in the creation of new learning goals. The linkage of learning goals with the term 'Diagnosis' was investigated after constructing the ontology and as a result, the relevant learning goals could be confirmed in oral and maxillofacial surgery and conservative dentistry. It has the advantage of obtaining easily knowledge that is difficult to find in case that it is composed of a collection of learning goals, also it helps to identify the linkage between learning goals at a glance. This helps to find more accurate information by defining clearly and describing in detail the concept of resources when analyzing between concepts through ontology, and additionally, this is a result that reflects the advantage of ontology that it is possible to share knowledge and infer new knowledge by clarifying the relationship between terms [10].

Oral and maxillofacial surgery

Subject	Part	Title	Chapter	Title	Section	Title	learning goal	Priority
Oral and maxillofacial surgery	Part 2	Practice of Oral and maxillofacial surgery	Chapter 1	examination and diagnosis	Section2	Meaning and Observation of Life-Symptoms	We can measure breathing.	A
Oral and maxillofacial surgery	Part 2	Practice of Oral and maxillofacial surgery	Chapter 1	examination and diagnosis	Section2	Meaning and Observation of Life-Symptoms	We can measure body temperature.	A
Oral and maxillofacial surgery	Part 2	Practice of Oral and maxillofacial surgery	Chapter 1	examination and diagnosis	Section2	Meaning and Observation of Life-Symptoms	We can measure the pulse.	A
Oral and maxillofacial surgery	Part 2	Practice of Oral and maxillofacial surgery	Chapter 1	examination and diagnosis	Section2	Meaning and Observation of Life-Symptoms	We can measure blood pressure.	A

Periodontology

Subject	Part	Title	Chapter	Title	Section	Title	learning goal	Priority
There are no matching terms.								

Orthodontics

Subject	Part	Title	Chapter	Title	Section	Title	learning goal	Priority
There are no matching terms.								

Dental prosthetics

Subject	Part	Title	Chapter	Title	Section	Title	learning goal	Priority
Dental prosthetics			Chapter 2	dental carotid disease, examination of subjects			We can explain how to test the pulp vitality test	A
Dental prosthetics			Chapter 2	dental carotid disease, examination of subjects			We can prepare instruments for cavity formation.	A
Dental prosthetics			Chapter 2	dental carotid disease, examination of subjects			We can prepare instruments measuring temperature change.	A
Dental prosthetics			Chapter 2	dental carotid disease, examination of subjects			We can prepare electric pulp test	A

Figure 4. the results of searching for learning goals with the term 'diagnosis'

Discussion

Specifically, in oral and maxillofacial surgery, 6 learning goals related to vital signs, systemic diseases, and dental treatment were presented. In conservative dentistry, 2 learning goals for the diagnosis of dental

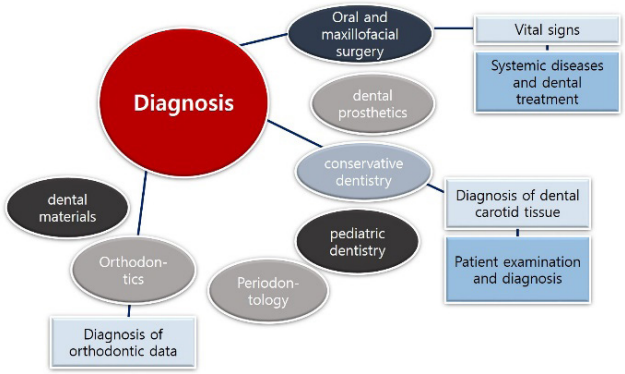

Figure 5. The results obtained by applying the term 'diagnosis' to the ontology

hard tissue and examination were suggested and in orthodontics, 1 learning goal for calibration diagnosis data was proposed. It presents a guide to prepare for learning by identifying the linkage of learning goals between subjects.

Moreover, the result of applying the ontology showed empty data values in some subjects. The empty data values were the values corresponded to 'part' and 'section', and the subjects were conservative dentistry, pediatric and adolescent dentistry, orthodontics, periodontology, dental materials, and practice. As a result of analyzing a collection of the learning goals to tackle this kind of problem, in oral and maxillofacial surgery and dental prosthetics, learning goals were presented by consisting of 'part', 'chapter' and 'section', and furthermore, in pediatric adolescent dentistry, orthodontics, periodontology, dental materials, and practice courses, they were presented by composing of 'chapter' and 'section'. Lastly, in conservative dentistry, the learning goal was presented as 'chapter'. Therefore, as learning goals were not composed in the same environment, there was a difference when the learning goals were described. It is considered that it will be necessary to be discussed to clarify the criteria that compose the learning goals when they are revised in the future.

Conclusion

The first thing to be done in the process of the preparation of learning is to select learning goals. Learner's prior knowledge should be identified, the depth of learning should be defined, and learning goals should be chosen, organized and evaluated in consideration of the linkage with subsequent studies. In that point, this program will be able to be used usefully to set educational purposes and design appropriate education for it through the linkage between subjects. Also, it helps to find more exact information by defining clearly and describing in detail the main concept of the learning goals of the national examination through the linkage between knowledge of the learning goals of the national examination of dental hygienists, and additionally, it will be able to be used as a basic data to define the relationship between the learning goals and to link flexibly with existing learning goals when new learning goals are created.

It is considered that differences in the expression of terminology which is the problem derived from the result of the study, in other words, the part in which the same concept is described in different terms, should be fully discussed when the learning goals are revised. In the future, if the system of overall learning goals is established by extending and applying this program to whole learning goals, it is believed that this program will serve as an opportunity to prepare guidelines for defining concepts between learning goals and designing lessons.

Ethical Clearance: Not required

Source of Funding: Self

Conflict of Interest: Nil

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