# Creating Computer Informatics Terms WordNet with Concept Maps and Student Opinions

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| Article Info | Abstract |
|---|---|
| | Concept maps are a visual tool that shows concepts and expresses their relationships, shows the connections between ideas and information, includes many cognitive processes, and is one of the ways to keep in mind and learn effectively. WordNet project is an ontological dictionary project, which links words into semantic relations including synonyms, hyponyms, and meronyms. To add new computer informatics terms to WordNet, word relationships must be created in advance. In this study, the concept maps created by students were used while creating computer informatics terms WordNet. Data was collected by the documentation method. Participants had prepared concept maps as homework to cover the subjects in the computer networks course to summarize their understanding, and these maps were used as data documents. Student opinions have been evaluated about concept map homework and usage of concept map homework for computer informatics terms WordNet initial dataset. |

# Kavram Haritaları ile Bilgisayar Bilişimi Terimleri WordNetini Oluşturma ve Öğrenci Görüşleri

| Makale Bilgisi | Öz |
|---|---|
| | Kavram haritaları, kavramları gösteren ve ilişkilerini ifade eden, fikirler ve bilgiler arasındaki bağlantıları gösteren, birçok bilişsel süreci içeren, akılda tutmanın ve etkili bir şekilde öğrenmenin yollarından biri olan görsel bir araçtır. WordNet projesi, sözcükleri eş anlamlılar, hiponimler ve ortak adlar dahil olmak üzere anlamsal ilişkilere bağlayan ontolojik bir sözlük projesidir. WordNet'e yeni bilgisayar bilişim terimleri eklemek için önceden kelime ilişkileri oluşturulmalıdır. Bu çalışmada, WordNet bilgisayar bilişim terimleri oluşturulurken, öğrenciler tarafından oluşturulan kavram haritaları kullanılmıştır. Veriler, dokümantasyon yöntemiyle toplanmıştır. Katılımcılar, bilgisayar ağları dersinde yer alan konuları işleyerek anladıklarını özetlemek amacıyla, ödev olarak kavram haritaları hazırlamış ve bu haritalar veri dokümanı olarak kullanılmıştır. Kavram haritası ödevi ve kavram haritası ödevinin bilgisayar bilişim terimleri WordNet ilk veri seti için kullanımı ile ilgili öğrenci görüşleri değerlendirilmiştir. |

## Introduction

Concept maps were developed by Novak and Cornell University graduate students in the 1970s to support the process of problem solving, understanding and thinking (Novak and Gowin, 1984). In order to promote conceptual understanding, concept maps are teaching tools that identify the concepts and the linking words, relations between them (Yilmaz and Korur, 2021). Concept maps are a visual tool that shows concepts and expresses their relationships, shows the connections between ideas and information, includes many cognitive processes, and is one of the ways of keeping in mind and effective learning (Yılmaz et al., 2009; Freeman and Urbaczewski, 2020). In concept maps, each concept should be used only once. Concepts of approximately the same importance are hierarchically at the same level. Two or more concepts are linked by linking words (Kinchin et al., 2000; Lachner et al., 2017). The structural features of the concept maps are similar to WordNet.

The WordNet project is an ontological dictionary project initiated by Miller at Princeton University Cognitive Science Lab in 1985. It groups words in synonyms and reveals the synonym relationship by making use of short, general definitions of words (Fellbaum, 1998). WordNet produces various meaningful association results such as lower-upper, synonyms and antonyms of the words it contains. With these features, WordNet enables semantic relationships of words in natural language processing research (Cai et al., 2018; Zhu et al., 2019).

Informatics terms increase in direct proportion to the development of technology, and every day new words are added to our language as informatics terms. Turkish WordNet studies (Stamou et al., 2002; Bilgin et al., 2004; Çetinoğlu et al., 2018) have been carried out, but WordNet, which is prepared to increase the success rate in natural language operations, needs to be fed with new words and meaning associations added to the language. WordNet word relationships can be created with the help of concept maps.

According to McClure et al. (1999) research, concept maps may be a valuable source of information about organization of students' knowledge, and allow teachers to identify and correct student misconceptions. Keppens and Hay (2008) researched concept map assessment methods; a qualitative simulation-based approach was proposed to assess student's knowledge. Lachner et al. (2017) developed a computer-based feedback tool that visualizes cohesion deficits of students' explanations in a concept map to support students in writing cohesive explanations. Mukhopadhyay et al. (2019) described concept mapping as a method that encourages the students to actively participate and get a comprehensive and accurate overview of the topic. So, concept maps can be use as assessment of students' knowledge as homework or exam.

The aim of this research is to create the computer informatics terms WordNet structure and reflect students' opinions about usage of concept maps for WordNet and homework. In addition to having artificial intelligence methods for creating WordNet, an initial data set must be created to run these methods. In this study, concept maps are used while creating WordNet. WordNet words and word relationships were determined as a result of the examination, evaluation and decision-making processes of concept maps developed by students.

## Method

In this study, the holistic single case study method based on qualitative research paradigm was used. In qualitative research, a situation or event (e.g. individual, school, object, event, etc.) Study in detail and understanding and interpretation within a limited sample is aimed (Yıldırım & Şimşek, 2000). In this study, the concept prepared by the students WordNet word structure was formed as a result of the processes of examining, evaluating and making decisions by field experts of the content of the maps. Also students' perceptions about concept map homework and developed WordNet word structure are examined.

### Collection of Data

The data were collected using the documentation method. "Document review, research analysis of written and visual materials containing information about the targeted phenomenon or facts covers" (Yıldırım and Şimşek, 2000). 126 students in the Computer Programming program had concept maps prepared as homework to cover the subjects in the computer networks course taught in the second semester and summarize their understanding, and these maps were used as data documents in the research (see Figure 1).
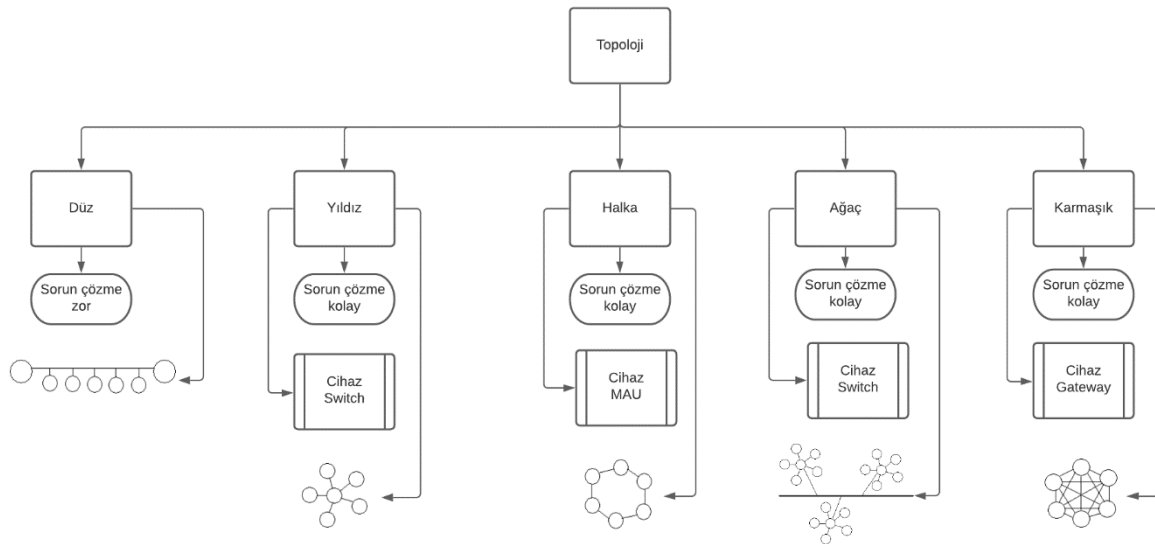


Figure 1. Concept Map Homework About Computer Network

The student perceptions data of the study were collected using the semi-structured interview method. The interview form used in the interviews is presented in Appendix A and includes two questions. The questions in the interview form controlled by lecturer and a field expert who teaches computer network. The interview form has been prepared, in order to provide information about the course and the homework of the course and to reflect student views. In accordance with the semi-structured interview method, the participants were asked additional questions in line with the course of the interview (Yıldırım and Şimşek, 2000). During the interview, voice recording was taken with the permission of the participants. The interviews lasted approximately 15-20 minutes.

**Analysis of Data**

In this paper, the concept maps of the computer network course prepared by the students as homework were examined by three field experts. Field experts evaluated the accuracy of the relationships in the concept maps, and the decision-making process for adding words as WordNet data was completed. Evaluation reliability in the analysis of the data was determined by calculating the agreement percentage suggested by Miles and Huberman (1994). For this purpose, after one of the concept maps was scored by the researcher, the same concept map was evaluated independently by another expert in the field of computer technologies. After calculating the consensus and differences between the two analyzes, the consensus percentage was determined as 91%. The data obtained from the interviews were analyzed using the content analysis method. The audio recordings obtained from the interviews were converted to text for analysis. The data translated into text has been coded by considering the word frequencies. After coding by the researcher, the same record is from another field expert independently from the researcher's record. Between two encodings consensus and differences were calculated. Also some exact versions of the expressions used by the participants were presented in the study.

## Results

This research was carried out with the aim of creating Computer Information Terms WordNet, and concept maps were used in creating WordNet. In the study, concept maps of computer network terms were given to students as homework. The last six weeks of the lesson are given as homework. The demographic characteristics of the students who participated in this study are presented in Table 1. All of the students who took the Computer Network course from the computer programming program of the computer technologies department participated in the study. 30% of the participants are female and 70% are male. 52% of the participants are daytime education and 48% evening education.

Table 1. Demographic Characteristics

| Demographic characteristics | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Female | 38 | 30 |
| Male | 88 | 70 |
| Education type | | |
| Daytime education | 66 | 52 |
| Evening education | 60 | 48 |

**Concept Map to WordNet**

Students were given a homework of creating concept maps of their conceptual understanding of the field of computer network. The homework was due on the last day of the course, allowing students six weeks to complete the homework using whatever resources and material they felt necessary, except for each other.

Concept maps developed by the students were examined by 2 information technologies and 1 educational technology experts. Scoring criteria were established to evaluate the concept maps developed by the students as a result of the examination (Table 2). Field experts scored the concept map homework according to evaluation criteria and percentage weight. The average of homework scores is 82.

Table 2. Scoring Criteria of Concept Map Homework

| Scoring criteria | Percent Weight |
|---|---|
| Number of concept | 15 |
| Relationship Number | 15 |
| Concept Accuracy | 35 |
| Relationship Accuracy | 35 |

Field experts worked together in the process of deciding on the concept and concept relations of the information technologies WordNet to be created. While the homework was given to the students by the field specialist, the units of the computer networks lesson were assigned to 9-10 people to each unit in a balanced way, thus ensuring that the concepts of the whole course were reached. However, in case some basic informatics terms are repeated in a few units, the informatics network terms were decided by eliminating them.

13045 informatics term concepts obtained from 126 concept maps developed at the end of a six-week long homework were linked to each other and added to the WordNet software. User interactive parts of WordNet software are realized by using .NET based Windows Forms infrastructure. Database design was made with MS SQL Server program. Coding of the software was carried out in C # .NET language in Microsoft Visual Studio environment.

**Students' Perceptions about Concept Map and developed WordNet**

In this research, computer informatics terms WordNet initial dataset was created by concept maps. To determine students' perceptions about concept map and developed WordNet, two basic questions given below and additional questions when necessary were asked to the students in the interviews:

What do you think about your concept map homework in computer network course?
What do you think about usage of concept map homework for computer informatics terms WordNet initial dataset?

When asked about students' concept map homework in computer network course, students stated the concept map homework as encouraging thinking (32%), encouraging regular study (23%) , providing understanding of the subject (19%), learning the relationships between subjects (8%), developing a holistic perspective (3%). Interview data;

P2: I thought a lot to create the concept map homework, I understood the topics and the relationships between them by reading over and over again

P64: I had to study regularly for concept map homework

P24: I learned the concepts and the relationships between concepts in computer networks lesson

P32: I learned the relationships between subjects thanks to the concept map homework

P119: I gained a holistic perspective while studying the chapter in the book, I can relate all concepts to each other.

According to interviews, created computer informatics terms WordNet initial dataset enabled students to prepare more elaborative homework (51%) and increase their motivation towards homework (%30). The homework serving a purpose as creating computer informatics terms WordNet initial dataset; It was determined that the homework was not just points, success or passing a lesson, but the students felt useful, happy, more self-confident and successful as the homework was functional. Participants' sentences are given below;

P1: I did my homework with much more care as I knew it would be WordNet

P92: My motivation for homework has increased since it will be used in the software.

P60: …. So I felt more confident and happy with this homework

P99: I consider myself successful and useful as it is a functional assignment.

## Conclusion

The strong similarity between the concept map and WordNet has been studied by researchers. WordNet is used for automated grading for online concept maps works (Harrison et al., 2004), and also to support interactive concept map construction (Cañas et al., 2003; Kornilakis et al., 2004). In this paper, conversely these researches, concept map is used to create WordNet for computer informatics term. Also, student opinions have been evaluated about concept map homework and usage of concept map homework for computer informatics terms WordNet initial dataset.

Thanks to the data obtained from the research, WordNet initial concepts has been created from computer network concept map homework. This WordNet contain 13045 computer informatics term concepts in Turkish and is realized by using .NET based Windows Forms infrastructure. Database design was made with MS SQL Server program. Coding of the software was carried out in C # .NET language in Microsoft Visual Studio environment.

The WordNet will be used for the development and update of the research (Yılmaz İnce, 2016; Ince and Kutlu, 2021) which software is developed as assessment of written exams in web environment with natural language processing methods and WordNet. Developed Turkish WordNet is important for Turkish studies in natural languages field to use as a Turkish word database application. According to students' interview data, students stated the concept map homework as encouraging thinking and regular study, providing understanding of the subject, and learning the relationships between subjects. The WordNet enabled students to prepare more elaborative homework and increase their motivation towards homework.

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