

# Informational support of the process of mastering the ontology design tool

Anastasiya Malochkina  
Aircraft design department  
Samara University  
Samara, Russia  
malochkina.anastasia@gmail.com

Nikolai Borgest  
Aircraft design department  
Samara University,  
ICCS RAS  
Samara, Russia  
borgest@yandex.ru

**Abstract**—This paper gives information about implementation of information support both for students and teachers of the discipline "Ontology of production sphere". The goal is to introduce methods of ontology creation into the process of airplane design to teach student find best solutions of design tasks. Vital part of information support is an effective communication between teacher and student. Usage of information support helps to reduce time for performing routine tasks. Much attention is given to content of this course. That provides a maximum level of adoption in electronic view.

Methods and tools of ontology creating are described, recommendations for information support content are given. Developed data source is proposed to use as information support in Samara University.

**Keywords**—ontology, information support, education, aircraft

## I. INTRODUCTION

At the first stage of the aircraft design, an analysis is made of the already existing parameters and characteristics of the aircraft. Analysis of the experience of predecessors helps determine the characteristics of the new aircraft. This reduces the time and money spent on design and production.

An ontology is an explicit specification of a conceptualization. The term is borrowed from philosophy, where an ontology is a systematic account of Existence. For knowledge-based systems, what "exists" is exactly that which can be represented [1].

As the toolkit is developed to create ontologies, students can create their own ontologies for solving complex problems. This is made possible by the fact that the discipline "Ontology of the production sphere" provides key knowledge in the field of artificial intelligence, data representation models and the opportunities provided by modern ontology editors. Thus, information support is used as a monitoring tool for the teacher and a source of information for the student.

## II. DESCRIPTION OF THE SUBJECT AREA

### A. Course Content

Ontologies can be used in any branch of science. They can be used to describe the subject area. Ontologies can also contain a thesaurus, necessary for studying the conceptual apparatus of the domain. The purpose of creating a thesaurus is to create a semantically integrated basis for creating an ontology. Its implementation allows, at least reduce, and

sometimes avoid problems associated with the ambiguity of the interpretation of one term in different spheres [2]. Reasons for creating ontologies:

- For shared usage by people and software agents each;
- Improving the perception of information through its formalization;
- Identification of the assumptions in the domain;
- Review of accumulated knowledge.

### B. Review of the article and review of other ontological editors

Students in the course are given a list of philosophical works, from which they must choose one article and to work with her. The work consists in:

- Forming a student's personal view of the article;
- Summing up and conclusions about the read;
- An explanation of how this article relates to the understanding of ontology by a student.

A review of other ontology creation products gives learner a more complete understanding of the possibilities for construction of ontologies.

### C. Practice

Practice in this course is carried out with the help of the editor of ontologies "Magenta" [3]. Objectives of practice:

- Studying fundamental concepts that show how multi-agent systems help in designing;
- Studying the principles of building multi-agent systems for representing the functioning of a complex system;
- Mastering ontology tools;
- Assimilate approaches to design;
- Developing technologies to solve more complex problems.

Figure 1 shows the results of one-way matching. The ontology in this case contains the main characteristics of the prototypes and the requirements for the new aircraft. Figure 1 shows how they will relate to each other.

The possibilities of two-way matching on the example of solving the logistics problem are presented in Figure 2. The aircraft have a certain capacity, departure time and departure point. Each cargo has its mass and its delivery time. According to these data, cargo is distributed to aircrafts.

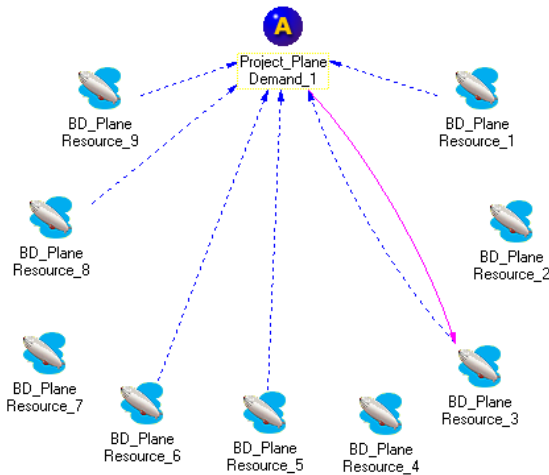


Figure 1. One-way matching.

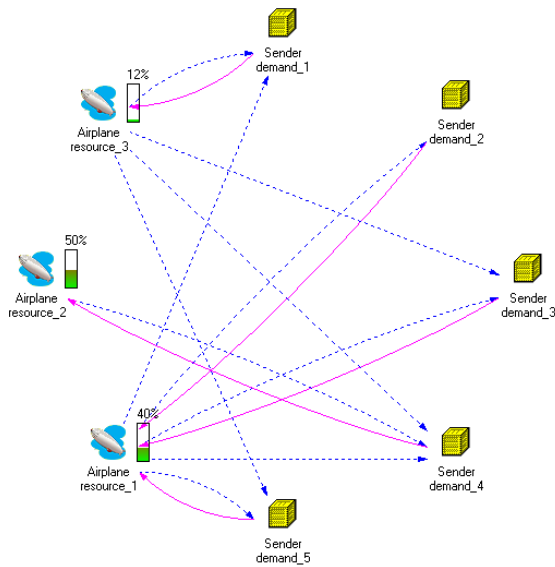


Figure 2. Two-way matching.

A piece of the practice is performed in the SmartSolutions software. It allows you to describe knowledge about the subject area, build conceptual models of enterprise activity, and also create situations models (scenes) used for situational management in intelligent decision support systems of a new class based on multi-agent technologies based on the principles of self-organization and evolution.

### III. FORMALIZATION OF THE SUBJECT AREA

#### A. The formalization model

The aim of the training is to assimilate the knowledge accumulated in the studied subject area and the skills necessary for solving problems in this area. Information support is a "database" in which accumulated data is kept. To represent

them in a form understandable to students, the scheme shown in Figure 3 is used.

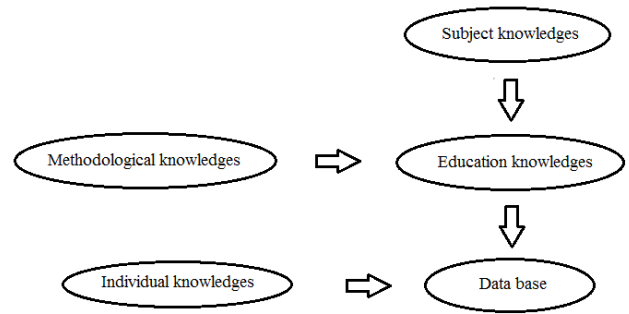


Figure 3. Composition data base scheme of information system.

Subject knowledge is an expert's knowledge about content and structure of teaching material. It is developed by teacher in accordance with state standard and his or her practical knowledge. Education knowledge reflects regularities of a certain subject educational process and content subject and methodological knowledge. Methodological knowledge is knowledge about adopting of subject knowledge. Individual knowledge belong to student, this term used to name experts' representation about students [4].

#### B. Subject area formalization

To visualize the content of the course "ontology of the production sphere" with the help of the ontology editor Fluent Editor [5], which uses "controlled English" to create ontologies, the course content is formalized. Visual representation helped to divide information into topics and create course scenario. Diagram created in Fluent Editor for the discipline "Ontology of production sphere" is presented in Figure 4.

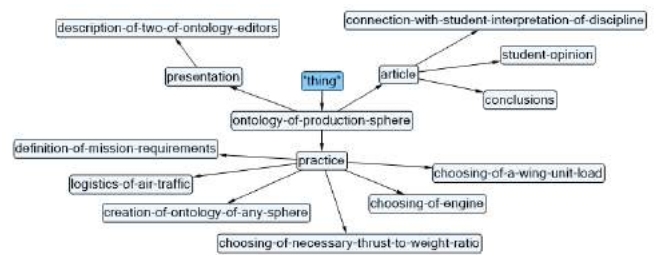


Figure 4. Diagram for the discipline "Ontology of production sphere".

## IV. APPROBATION

#### A. Description of the tool

To design information support, a distance learning system Moodle was chosen. Its advantage is a free distributing and an open system code, which gives great opportunities for creating a course [6]. The training course consists of tests, databases, forums with frequently asked questions and glossaries with

the possibility of adding new terms. Grades are set in semi-automatic mode (automatically based on the test results and manually when checking written assignments). A separate rating scale is defined for each kind of tasks. When creating the system, according to Figure 3, various types of knowledge were introduced into it. Let us consider in more detail:

- Subject knowledge - tasks descriptions and comments for each section.
- Educational knowledge - the experience of teaching the course is reflected in dividing the course into sections located in a certain order.
- Methodical knowledge - the first lecture in simple language and examples from life gives complex definitions and forms an approximate idea of the subject area.
- Individual knowledge - the answers to questions in the test have a variation on the correctness, which can be confusing if the understanding of the material is insufficient.

In addition, introductory testing has been introduced to help identify gaps in previous training, which are impeding successful completion of the course.

Statistics of student errors can be used to further optimize the course. Such information support stimulates students to self-preparation. The information is divided into parts in a certain way, each of them has its own time frame to stimulate preparing of everything on time. The end dates for studying the segments are indicated in the "calendar" block. Notifications about the end of the course are included by default. Figure 5 shows the division of the course into sections.

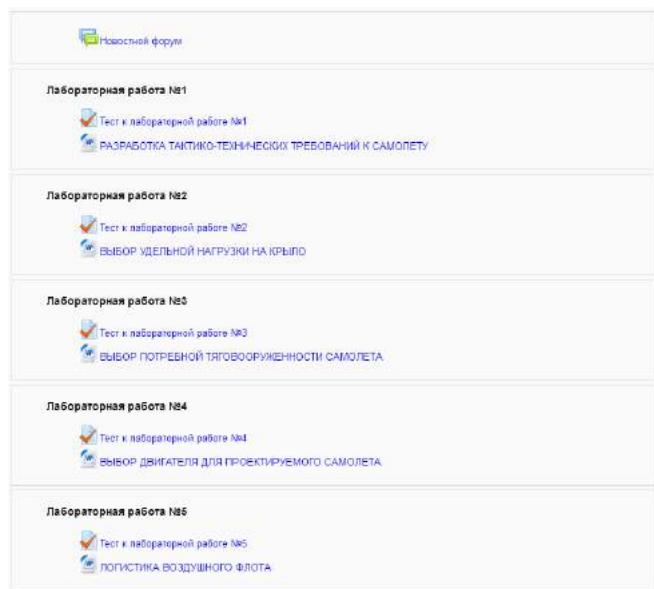


Figure 5. Course interface.

### B. Newness

The use of information technology defines a new approach to the learning process. For the design of this course, ontology

creation technologies were used [7]. This helped to highlight the main characteristics of this discipline. Students also have access to ontology. The capabilities of the Fluent Editor not only helped visualize the data, they allow you to ask ontology questions about its content. For this, you need to know "controlled English".

Ontology has become a tool for solving some problems that arose at the design stage of information support of the educational process:

- Lack of an acceptable classification of knowledge of the subject area and ambiguity of terms;
- The invariance of the presentation models and the review of the expert's ambiguous knowledge of the learning process.

### C. Results

At first stage elements of control of knowledge were implemented. Within the course each element is defined with its own scale of assessment, but the success in mastering the course is estimated on a 100-point scale. Also, it is possible to see success level of every test in percent form. Visual results are given in figure 6. Moodle gives statistic data such a number of attempts, percent of right answers, marks median, etc.

Implementation of information support in an education process gives opportunity to analyze statistical data to reveal poor questions and replace it [8]. All the statistic can be downloaded as an Excel file. Next advantage is a control of an individual knowledge. System presents person's right and wrong answers for certain test. It put into practice individual training. In addition, teacher is able to see how much time student have spent on test fulfillment. Cheating become obvious. Review of students' right and wrong answers is presented in figure 7.

Фамилия	Имя	Тест к лабораторной работе №3	Тест к лабораторной работе №4	Итоговая оценка за курс
1		4,00	4,00	80,77
2		4,00	4,00	80,77
3		5,00	5,00	100,00
4		5,00	5,00	92,31
5		5,00	5,00	100,00
6		5,00	5,00	92,31
7		4,00	4,00	80,77
8		4,00	5,00	94,52
9		5,00	5,00	92,31
10		-	-	-
11		4,00	5,00	92,31
12		4,00	4,00	80,77
13		5,00	5,00	92,31
14		1,00	2,00	38,46
15		4,00	4,00	80,77
16		4,00	4,00	75,68
17		-	-	-
18		4,00	4,00	76,92
19		-	-	-
Общая среднее		4,11	4,38	93,68

Figure 6. Representation of marks.

Адрес электронной почты	Состояние	Тест начат	Завершено	Затрачено время	Оценка/5,00	В. 1 /1,00	В. 2 /1,00	В. 3 /1,00	В. 4 /1,00	В. 5 /1,00
z	Завершено	9 Ноябрь 2017 12:37	9 Ноябрь 2017 12:37	18 сек.	1,00	× 0,00	× 0,00	✓ 1,00	× 0,00	× 0,00
o	Завершено	21 Декабрь 2017 08:56	21 Декабрь 2017 08:57	1 мин. 55 сек.	3,00	✓ 1,00	✓ 1,00	✓ 1,00	× 0,00	× 0,00
s	Завершено	21 Декабрь 2017 09:08	21 Декабрь 2017 09:08	24 сек.	4,00	✓ 1,00	✓ 1,00	✓ 1,00	× 0,00	✓ 1,00
p	Завершено	25 Декабрь 2017 08:38	25 Декабрь 2017 08:39	63 сек.	5,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00
c	Завершено	25 Декабрь 2017 08:39	25 Декабрь 2017 08:39	51 сек.	5,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00
n	Завершено	25 Декабрь 2017 08:48	25 Декабрь 2017 08:50	1 мин. 53 сек.	4,00	✓ 1,00	✓ 1,00	✓ 1,00	× 0,00	✓ 1,00
e	Завершено	25 Декабрь 2017 08:48	25 Декабрь 2017 08:51	1 мин. 32 сек.	5,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00
q	Завершено	25 Декабрь 2017 08:54	25 Декабрь 2017 08:55	1 мин. 25 сек.	4,00	✓ 1,00	✓ 1,00	✓ 1,00	× 0,00	✓ 1,00
r	Завершено	25 Декабрь 2017 08:56	25 Декабрь 2017 08:56	1 мин. 3 сек.	1,00	× 0,00	✓ 1,00	× 0,00	× 0,00	× 0,00
t	Завершено	25 Декабрь 2017 08:56	25 Декабрь 2017 08:57	42 сек.	4,00	✓ 1,00	✓ 1,00	✓ 1,00	× 0,00	✓ 1,00
b	Завершено	25 Декабрь 2017 09:01	25 Декабрь 2017 09:01	1 мин. 56 сек.	5,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00	✓ 1,00

Figure 7. Representation of marks.

## V. CONCLUSION

At present, artificial intelligence is widely available, capable of learning and adapting in computer systems [10]. The software for e-learning helps to find new solutions to improve the learning process. E-learning is continuously developing, which allows you to get knowledge at any convenient time of day and in any convenient place. Adaptation of the studied material in this work is done using ontology technology. They provide a lot of opportunities in any branch of science. The information support created for the course "ontology of the production sphere" in Samara University is just one example of their application. Successful mastering of this discipline helps in the study of other disciplines. Upon completion of the course, students can apply the acquired knowledge in practice: formalize the design (development) process, think through descriptions of ontologies and create their own ontologies.

## REFERENCES

- [1] Thomas R. Gruber, A Translation Approach to Portable Ontology Specifications, *Knowledge Acquisition*, 1993, vol. 5 (2), pp. 199-220.
- [2] N.M. Borgest and M.D. Korovin, Ontologii: sovremennoe sostoyanie, kratkii obzor [ONTOLOGIES: CURRENT STATE, SHORT REVIEW]. *Ontologiya proektirovaniya [Ontology of Designing]*, 2013, vol. 2 (8), pp. 49-55.
- [3] MagentA. Multi-Agent Applications. Version 2/0 build 2.23. 2002. Available at: <http://www.magenta-corp.com/> (accessed 2017, Dec)
- [4] I.Yu. Denisova and P.P. Makarychev, Matematicheskie modeli ontologii bazy znaniy informatsionnoi obuchayushchei sistem [MATHEMATICAL MODELS OF ONTOLOGY KNOWLEDGE BASE OF INFORMATION TRAINING SYSTEM]. *Ontologiya proektirovaniya [Ontology of Designing]*, 2012, vol. 3 (5), pp. 62-78.
- [5] FluentEditor 2014. Available at: <http://www.cognitum.eu/semantics/FluentEditor/> (accessed 2017, Dec)
- [6] Moodle. Available at: <https://moodle.org/> (accessed 2017, Dec)

- [7] I.Yu. Denisova and P.P. Makarychev, Ontologicheskoe issledovanie protsessa elektronnoho obucheniya i proektirovanie sredstv podderzhki [ONTOLOGICAL RESEARCH OF E-LEARNING PROCESS AND DESIGN SUPPORTS]. *Ontologiya proektirovaniya [Ontology of Designing]*, 2012, vol. 4 (6), pp. 61-72.
- [8] S.A. Nesterov and M.V. Smetanina, Otsenka kachestva testovykh zadaniy sredstvami sredy distantsionnogo obucheniya MOODLE [QUALITY MEASUREMENT OF THE TEST TASKS IN THE LEARNING MANAGEMENT SYSTEM MOODLE]. *Nauchno-tehnicheskie vedomosti SPbGPU*, 2013, vol. 5 (181), pp. 87-92.
- [9] K. Baclawski, M. Bennett, G. Berg-Cross, D. Fritzsche, T. Schneider, R. Sharma, Ram D. Sriram and A. Westernin, ONTOLOGY SUMMIT 2017 COMMUNIQUE - AI, LEARNING, REASONING AND ONTOLOGIES. Available at: [https://s3.amazonaws.com/ontologforum/OntologySummit2017/Communique/OntologySummit2017Communique\\_v13.pdf](https://s3.amazonaws.com/ontologforum/OntologySummit2017/Communique/OntologySummit2017Communique_v13.pdf) (accessed 2017, Dec)
- [10] A. Malochkina, N. Borgest, Information support in education process of an ontology design, Proceedings of the IV International research conference "Information technologies in Science, Management, Social sphere and Medicine" (ITSMSSM 2017), vol. 72, 2017, pp. 404-407.

ИНФОРМАЦИОННАЯ ПОДДЕРЖКА ПРОЦЕССА  
ОСВОЕНИЯ ИНСТРУМЕНТА  
ПРОЕКТИРОВАНИЯ ОНТОЛОГИЙ  
Малочкина А.В., Самарский университет  
Боргест Н.М., Самарский университет, ИПУСС РАН

В статье описаны пути реализации информационной поддержки для дисциплины «Онтология производственной сферы», предназначенной как для студентов, так и для преподавателей. Цель данной работы внедрить инструменты для создания онтологий в процесс проектирования самолета с целью научить студентов находить наилучшие решения конструкторских задач. Информационная поддержка должна обеспечить эффективное взаимодействие студентов и преподавателя. Использование информационной поддержки снижает временные затраты на рутинные задачи. Большое внимание уделяется содержанию данного курса с целью максимально адаптировать его для представления в электронном виде. Здесь описаны методы и средства создания онтологий, выдвинуты рекомендации к содержанию информационной поддержки. Разработанная поддержка будет использоваться как информационный ресурс для вышеупомянутой дисциплины в Самарском университете.