A Meta-Analysis on the process of how to understand Semantic Correlation Rules

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Abstract. The academic training of young professionals plays a particularly important role in the field of technical communication (TC). Since well-trained specialists are in great demand in this domain, it’s important for students to successfully learn semantic correlation rules. But there must be a good interaction between different parties because students face major challenges when it comes to TC topics such as content management, metadata management or semantic technologies. There are several challenges to understanding in the considered case of semantic modelling and technical communication in general. However, this paper does not just show different ways of bringing together the different perspectives of students, lecturers and institutions related to a specialized course on semantic correlation rules. Rather, it develops a new area of work that enables new collaborations and takes the field of technical communication to a new level.

1 INTRODUCTION

We report on experiences of a Master’s class in technical communication focussing on semantic modelling and the enhancement of intelligent content delivery. With our background in the field of technical communication in general and semantic modelling in particular, we are able to offer students and lecturers our perspective on successful learning and understanding of semantic correlation rules [1] [2] [3]. This paper tries to prepare students to understand topics such as semantic modelling. For example, what prior knowledge is necessary, what personal qualities are definitely an advantage and also what they will learn in the field of technical communication. Lecturer’s will also know what to look out for and what to focus on when they want to teach this field. They have the opportunity to find out from a student's perspective how they can support students in the learning process and thus also motivate them for the field of technical communication. Therefore we address the main question: What are the requirements and what support is needed for students to have an understanding of the core topic of the semantic correlation rules?

2 EDUCATIONAL INSTITUTIONS AND THEIR SIGNIFICANCE

The focus should initially be on educational institutions. They provide the infrastructure and various basic needs for students and lecturers. In particular, students should work with software that is both up-to-date and actually used in industry. This ensures that students are well trained for future work in technical communication.

The institution should provide good and modern workplaces. This means creating workspaces within the institution that are comfortable and allow for productive work. For example, with comfortable seating, monitors, power sockets at the workstation and fast wifi. In this way, an environment can be created for students in which they can work together productively and with the latest software.

Lecturers should also receive the best possible support from their institution. In order to ensure smooth operations, it is necessary to provide financial assistance to lecturers and to make this funding available as quickly as possible. This is essential, for example, when it comes to the specific provision of software, possible travel to scientific conferences and, ultimately, the professional development of lecturers. In addition, it is necessary for the lecturer to use cloud-based and redundant systems that are independent of the university. This
allows not only the lecturer but also the students to work independently of the institution's infrastructure. The institutions therefore play an important role here. They provide the basic framework for successful work on semantic modeling projects and the interplay between student and lecturer interests.

3 THE LECTURER'S ROLE

The following section focuses on what lecturers should pay particular attention to when teaching semantic modelling and hence semantic correlations in an advanced and graduate course. At the same time, important points are mentioned that are related to what lecturers can and should expect from students.

For the former, it is very helpful from the student's point of view if the lecturer tells them in advance which courses they should attend in order to understand the abstract construct of semantic correlations. Courses that teach students how to work with component content management systems and content delivery portals, and more generally, knowledge about information management in TC are helpful here. This ensures that the classification of modules and metadata is already understood and creates a basis for the graduate course.

Furthermore, from the student's point of view, it is very helpful for understanding if the teaching material is always based on real examples from companies. In this way, abstract constructs of ontologies and semantic models can be explained using real data. The construction of ontologies, and thus the creation of semantic correlations, can be understood much more quickly and thus has a direct practical application.

4 WHAT TO EXPECT FROM A STUDENT

On the other hand, what can lecturers expect from students if they want to teach semantic modelling and what can students expect to learn about semantic modelling?

Students should have some prior experience of information and metadata modelling and an understanding of these principles. Knowledge of programming languages such as HTML, XML, XSLT, XSL and editorial database languages such as SPARQL is also required to understand and build semantic correlations. This is accompanied by a high level of interest in knowledge management technologies and processes. This is important because without a certain passion for this complex and abstract subject, it becomes very difficult to understand semantic correlations.

As mentioned above, knowledge of certain programming languages is a prerequisite. However, this can be extended, as knowledge of systems integration, graph technologies and, in particular, API programming is becoming an increasingly important aspect (you can read more about this in the chapter "API Development as an Interface"). In general, all of these topics require a strong interest in computer science.

In addition to prior knowledge and useful prior skills, students should also have certain personal attributes that make it easier to understand semantic correlations. Students should have a very good knowledge of English, as programming and working with ontologies is done in English, as well as presenting and writing scientific publications and presentations. As working in teams is a prerequisite, the ability to work and communicate in teams is very important, as is the ability to communicate effectively. The student will be able to address challenges, problems or personal comments openly and directly and discuss them constructively.
Figure 1 summarises the previous points. Reading from top to bottom, the grey bubble lists what exactly is helping to pave the way for students to understand SCR’s. The yellow, blue and purple bubbles indicate what personal characteristics and prior knowledge are important for students to develop an understanding of semantic modelling. And also what students can expect professionally, i.e. what they are specifically trained and taught in.

Information on the structure of the student persona comes from informal surveys of Master's students in Communication and Media Management at Karlsruhe University of Applied Sciences. In this way, overlaps in the different experiences and opinions of learning SCR’s were identified and can be seen in figure 1. This diagram summarises the perspectives and provides an overview that is relevant for students and lecturers.
Figure 2. Structure of the main topics when understanding semantic correlation rules (Own representation).

Figure 2 illustrates the connection between different technical communication topics, ultimately leading to the intelligent linking of information and metadata through so-called semantic correlations.

From top to bottom, students need to develop a broad knowledge of technical communication. This includes knowledge of core concepts of information management in technical communication such as content delivery, content management and their relationship and context through metadata. More specifically, metadata is used to clearly label or identify information in component content management systems (CCMS) and content delivery portals (CDP).

Once information is uniquely identified in the CCMS and CDP, it is possible to create an ontology or knowledge management system. Ontologies play a crucial role in facilitating interoperability between different systems, as they provide a shared understanding of the meaning of data and enable more effective communication and reasoning about information in a given domain. They are also used to model the semantic relations between metadata and information.

With semantic correlation rules it is possible to model the intelligent linking of information and metadata. Ultimately, students with this knowledge are able to understand and develop exactly that: An intelligent linking of metadata, hence information, in order to provide exactly the required information where it is needed, regardless of which domain it comes from.
In addition, figure 3 makes it clear that there is some work to be done in a project like this when creating and forming semantic correlations. For example, there are the typical areas of work where thought is given to the general conceptualisation of the correlations and the creation of the graph. Here it is important to have an understanding of the existing and available information and to develop meaningful modelling for intelligent linking. It also makes sense to leave the testing to them, as they have a good idea of how the graph is structured and where a potential source of error might lie.

The data administration area also handles communication with databases, i.e. commands are entered in the SPARQL language and information is successfully integrated into the graph and thus into the database. In this way, metadata, and therefore the ontology, can be managed in a practical way.

It is also important to ensure that there is a smooth and transparent communication channel with the industry partner. The communications department ensures that this works and that use cases and test scenarios are developed with the industry partner to fully meet their needs and requirements. At the same time, a smooth flow of information can be achieved and an ontology and the intelligent linking of information within it can be successfully developed.

### 5 API DEVELOPMENT AS AN INTERFACE

**Figure 4.** Concept of the typical work areas and tasks in the field of technical communication with the new additional API Development (Own representation).
However, a modern interface, known via REST API development, has been available in class [4]. It allows graph database queries in the SCR, regardless of the portal (SPC, CDP, etc.), and returns the desired information from the respective portal. In figure 4, the API programming area has been added based on figure 3.

In this area, it is necessary to be familiar with the development of the OpenAPI Specification (OAS). This allows the API programmer to discover and understand the capabilities of the service without access to source code, documentation or by inspecting network traffic. When properly defined, they can understand and interact with the remote service only with a minimal amount of implementation logic. A server body can now be set up within this specification, which can be implemented using NodeJS or Python, for example. This means, that programming skills and experiences in JavaScript, as well as back-end languages such as Python, are a must. Overall, this has the advantage that the complete REST server environment does not need to be set up, but existing frameworks can still be used. The individual SPARQL queries are then implemented within this environment to finally integrate this specific logic via the endpoints of the API interface, which is used to search for metadata and information and their links within the graph database.

However, this also involves an additional task, which, usually, cannot be taken over by regular students of technical communication. Students from this area typically do not have the knowledge and experience of this programming and REST API development in general. It is simply not an essential part of the course. More specifically, it requires additional knowledge, which can be found in the field of computer science, as well as in-depth experience.

This provides an opportunity to combine the different fields of technical communication and computer science. Especially in Germany, there is a big gap between these two study fields. There are only a handful of universities that specialise in technical communication. Only 6 universities offer 8 courses in technical communication. In contrast, according to the German Federal Statistical Office, more than 257,000 students were enrolled in computer science at over 200 universities in the winter semester 2022/23 [5] [6] [7]. However, this gap can be bridged in such a way that both fields can benefit from each other.

6 OUTLOOK

Consideration could be given to an international research collaboration combining the two fields of technical communication and computer science. One way forward could be a research collaboration between TC students and the students of computer science even in an international field. The focus could be on the creation and management of semantic correlation rules and their further development, as well as the reliable provision of the API. The computer science partner would be responsible for programming the REST server and reliable provision of the API interface. This allows it to work closely with industry partners on real projects.

This also creates motivation and interest in learning and understanding SCR even for those who have never come into contact with technical communication before. Students can collaborate internationally with others and research on specific topics. In addition, exchange trips between the collaborating countries can be organised and facilitated to bring people closer to each other's cultures and countries. At the same time, this will motivate and interest students to enter the fields of technical communication and computer science, and provide them with specialised training.

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