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**Cooperative Translation in Virtual Seminars:**

**Patent Translation as a Case Study**



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## **Cooperative Translation in Virtual Seminars: Patent Translation as a Case**

### **Study**

**Abstract:** The following research is focused on a web-based approach to cooperative translation as practiced within the framework of virtual translation seminars. After presenting essential background on cooperative translation and e-learning, we introduce collaborative learning and online communication platforms that make cooperative translation feasible and productive in this unique learning environment. Our study presents the practice of translating general-language texts in a virtual group setting and further illuminates findings of our case study on the technical translation of patents. Special attention is given to the overall translation process and online research as its underlying requirement.

**Keywords:** constructivism; cooperative translation; online cooperation; virtual seminar; e-learning; patent applications; technical translation; online research; learning platform.

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## 1 Introduction

The information age and its supporting technologies have brought significant changes, both in the professional life of the translator (see Austermühl 2001) and in the learning environment of higher education. Besides providing a sophisticated linguistic background, translator training now aims to mediate soft skills, including communication, social competence and media capability.

The twentieth century witnessed numerous and drastic changes that transformed an industrial era society into a new information age. As learning theories evolved, education also experienced a paradigm shift away from behaviorism, first to cognitivism, and more recently to constructivism. The latter has had a significant impact, and has inspired teaching methods such as Problem-Based Learning (PBL), and consequently, the cooperative translation method (see Orbán 2008).

Operating within the framework of developing innovative virtual seminars at the Institute of Translation and Interpreting at the University of Heidelberg, this paper presents the underlying research supporting the constructivist method of cooperative translation in a web-based learning environment. The focus lies on designing virtual seminars, incorporating and evaluating a variety of electronic tools in a virtual group setting, as well as creating a cooperative translation-specific learning environment. In addition to translating general-language texts about a multitude of topics, these virtual seminars confront students with the unique technical challenges associated with the translation of patents.

## 2 Cooperative Translation

Considering the accelerated pace of globalization and technological changes and developments in the European higher education system (see w<sup>1</sup>), new learning and teaching concepts were necessary to provide students with the relevant skills and knowledge needed to work in a competitive and complex working environment. The shift from behaviorism to constructivism and the reformed curricula in translation studies laid the foundation for

introducing a dynamic learner-centered teaching method that is now known as cooperative translation.

This cooperative translation method is based on the constructivist principles of Problem-Based Learning (PBL) and has already been applied to numerous courses in translation studies. The PBL method is essentially learner-centered, practically-oriented, transferable, and sustainable, and thus it fosters integrated skills and competency acquisitions, including interdisciplinary thinking, analytical capability, autonomy, teamwork and communication skills, life-long self-directed learning, and media skills (Weber 2004, pp. 22-23).

The PBL model in translation training aims to develop these skills within a realistic working context corresponding to the specific needs of translation didactics. “What is novel about this approach is the fact that each participant is involved in the entire process, constantly exchanging thoughts and negotiating a solution that is acceptable to all parties” (Stewart et al. 2010, p. 9). Rather than working individually on producing a rough translation, and then presenting single solutions so that one model translation can be formulated in class, the PBL scenario features peer groups working with authentic texts in a problem-based setting in which individuals openly exchange ideas, discuss their varying translation proposals, and are encouraged to use electronic tools and share resources (see Orbán 2008 for a detailed description of the research conducted, and Orbán, Kornelius 2008, or Stewart et al. 2010 for more findings).

In contrast to traditional translation exercises, the advantages of the cooperative translation method are shown in the following table.

<b>The classic translation exercise</b>	<b>Cooperative translation</b>
problem-solving strategy specified by the instructor	independent negotiation of a problem-solving strategy
bidirectional exchange between the students and the instructor	multidirectional direct exchange among the students
negotiation of one "model translation"	diverse translation proposals
inauthentic reduction of reference resources	authentic reference resources
translating in a situational vacuum	operating in working contexts
artificial segmentation of the source text	working with functional translation units

protracted discussions of different translation solutions	short decision-making process
Instructor commentary on and evaluation of contributions	impartial exchange of ideas
linking individual proposals together	translating "all at one go"
submission to authority	independent critical judgment
limited understanding of the text due to one-dimensional perspective	deepened understanding of the text thanks to multidimensional perspective
uncertainty in dealing with questions of formulation, tendency toward literal translations	bold translation decisions, free and creative translation solutions
limited potential for creativity and variation	great potential for creativity and variation in text production
danger of mental blocks	translation process continues to flow
translator limited to individual prior knowledge, extensive research work required	collective knowledge pool, decreased additional research workload
careful proofreading required afterward	error prevention and quality assurance during the translation process
routine-based thought processes and problem-solving strategies	stimulation of creative thought processes and unconventional problem-solving approaches
lack of motivation	high motivation and work enjoyment
fatigue effects, declining concentration, and potential frustration	highly dynamic translation process and constant level of concentration
little readiness for risk-taking due to sole responsibility for translation decisions	greater readiness for risk-taking due to shared translating responsibility
solitary translator interacting alone with media	cooperation and communication, diverse interpersonal interaction processes
zero or negative dependency on classmates, competitive situation	positive dependency within the translator group, emergence of team spirit and a pronounced solidarity

Table 1: Classic translation exercise vs. cooperative translation exercise

Considering these findings, a new challenge arises for educators to make this approach didactically and technically feasible for virtual translation seminars.

### 3 Creating Cooperative Virtual Translation Seminars

Twenty-first century information and communication technologies play pivotal roles in both our everyday and professional lives and shape the way we communicate, while simultaneously providing an impetus for new and further developments. Correspondingly, new media has become an integral part of university teaching and research. Virtual seminars

represent a valuable addition to traditional classroom training by promoting competency acquisition, such as media and research skills. With the omnipresent availability of the Internet and new web-based communication technologies, real-time cooperation and online teamwork are feasible and convenient. E-learning can assist students in refining their professional social competencies while providing the much-needed flexibility and mobility desired by learners and teachers alike.

### 3.1 Background in Creating Virtual Seminars

The Institute of Translation and Interpreting has a comparatively long history in the field of creating virtual seminars. Initial trials in e-learning were carried out during the winter semester of 1998/99, when a newly-implemented translation course allowed students who were studying abroad to complete a translation course requirement. Following their enthusiastic response to this pilot project, a project group was established: *CVS : Creating Virtual Seminars*. Since 2000 virtual seminars have become an integral part of the regular curriculum.

Our CVS project group was a collaborative effort involving research assistants, lecturers, students in advanced semesters, and PhD candidates. Within the scope of this project, various virtual seminars were created and integrated into our virtual classrooms. They range from cultural studies subjects like life in New Zealand to technical translation topics, including topics in medical technology, communication media, and patents. Several highly successful virtual seminars were published in the series titled *Lighthouse Unlimited* (see w<sup>2</sup>).

Virtual seminars have been designed, offered, and continuously improved alongside traditional courses dealing in general and technical translation. The more flexible structure of the new Bachelor and Master programs allows for the integration of e-learning in the curricula of the degree programs *BA/MA Translation Studies* and *BA Translation Studies for Information Technologies*. The initial development, design, and successful realization of virtual translation seminars at the English Department of the Institute of Translation and Interpreting are shown in detail in the publications *Virtual Seminars: Designing ESP Translation Classes* (Connelly et al. 1999) and *Developing e-learning translation modules: A preliminary case study* (Connelly et al. 2000).

Establishing a design for e-learning in translation training became the foundation for further research and improvements in our conceptions, such as incorporating innovative electronic tools and continuously improving their didactic quality. In the following chapter, the design of cooperative translation in a web-based environment is described.

### **3.2 Designing Cooperative Virtual Seminars**

On the basis of the established design of virtual translation seminars and the cooperative translation method, a new cooperative approach is being applied to e-learning in Translation Studies. Course content and structure are optimized for teamwork, with electronic tools supporting learning and collaboration processes.

The basic content of an online seminar consists of teaching modules distributed online every two weeks. A module is comprised of various tasks that require students to research and apply linguistic principles, as well as information from cultural studies sources. One learning module includes writing a formal and content-based text analysis, conducting a research task, or composing abstracts, glossaries, and terminology and/or collocation lists. All of these pre-translation activities become the foundation for the centerpiece of the course, the translation itself (see Artmann 2008 and 2016 for a detailed description of the didactic design and tasks).

At the beginning of the semester, the virtual seminar starts with an introduction held in a real classroom. The structure and content of the seminar are explained in detail, and a thorough discussion is provided about learning and communication tools. Participants can select their own group and all of their questions and concerns are addressed. Students studying abroad can find the necessary information on the internet learning platform. Usually these distant learners remain socially in contact with their classmates. The following figure depicts the e-learning seminar as it unfolds over the course of a semester.

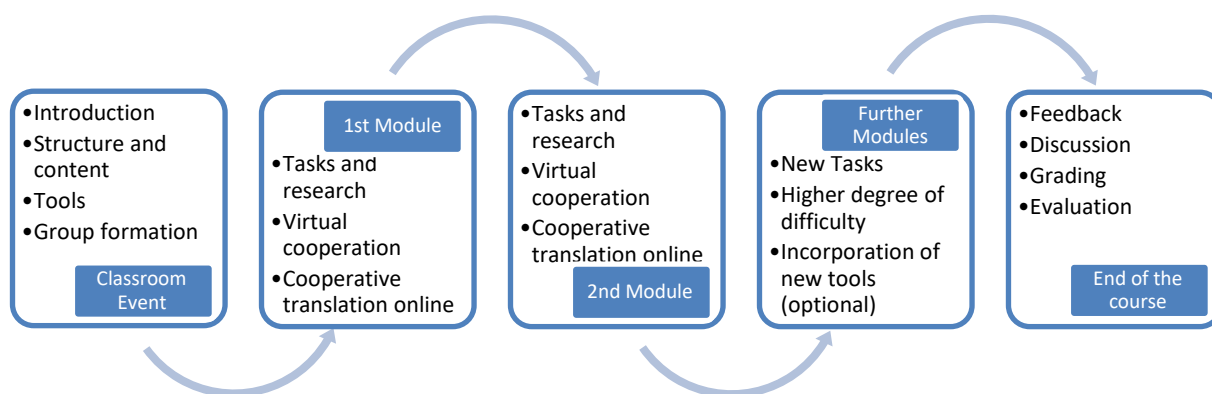


Figure 1: Cooperative virtual translation seminar over the course of a semester

To meet the specific demands of cooperative translation, we investigated various aspects of the learning platform and additional communication tools, both synchronous and asynchronous. Cooperation and knowledge-sharing are incorporated at an early stage, enabling students to break free from individual work. In this way, face-to-face communication is replaced by virtual cooperation. Each member researches a specific aspect or works on translation tasks, and all of their combined work is shared among all members on the e-learning platform. While translating in a small group, the participants interact in an online environment using synchronous and asynchronous communication tools that enable each translator to contribute to the overall team effort and their final translation solution. We continuously incorporate new tasks, which are then tested and evaluated. In one bold initiative, students were asked to make use of cognitive techniques such as mind-mapping as a tool to organize their research and construct a base of knowledge. They incorporated software for individual mind-maps as well as web-based tools for mind-maps that were created in groups (see Artmann 2016 for further details of the experimental investigation). The modular structure of the virtual seminar is both versatile and adaptable. An instructor can incorporate new tasks and topics according to the desired learning goals and the special needs of learners. The general stages of the process in a translation module and the roles of the instructor and students are shown in Figure 2.

The essential concepts underlying a cooperative virtual translation seminar include fostering acquisition of key translation skills alongside soft skills. Following a constructivist and

competence-based approach, the virtual seminar is designed to promote and facilitate online collaboration throughout the semester as students work with authentic translation exercises in a complex learning environment that simulates a professional translation practice.

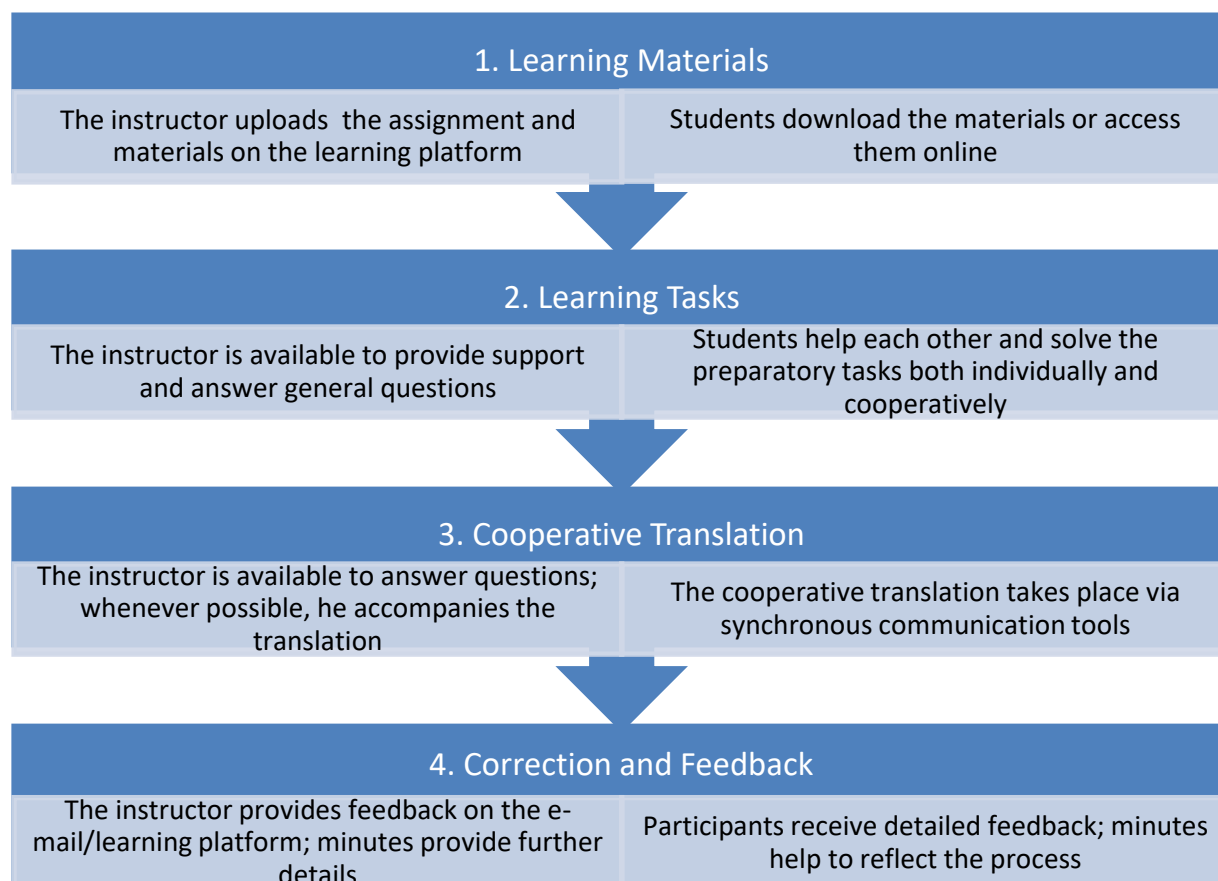


Figure 2: The stages of a cooperative translation module

#### 4 The Cooperative Web-Based Translation Seminar

Within our e-learning seminars, cooperative translation methods are combined with web-based technologies. Students in our *BA Translation Studies* and *BA Translation Studies for Information Technologies* who participate in our seminars are at different stages in their studies, from beginners to advanced. Students translate from German into English as well as the reverse, from English into German. We vary and test module components and learning scenarios, and then evaluate our results so that we can refine and improve our course offerings.

Online learning and communications tools are briefly introduced in the following chapter. This is followed by a description of the cooperative translation method as applied in a virtual learning environment. Following a discussion on the practice of translating general-language texts, chapter 5 describes a case study in patent translation and draws some conclusions.

#### **4.1 An Internet Learning Environment**

The design of virtual translation seminars heavily relies on the learning tools available online. In the wake of new media and Web 2.0, communication platforms have become enlivened as well, incorporating interactive and social aspects such as user collaboration, user-generated content, and online communication. Knowledge resources, including dictionaries and information databases, are constantly updated and continue to expand their offerings. Translation learners must gain experience in dealing with the flood of information and then decide which tool or resource is appropriate for the desired purpose. Quickly, our student learns that there is more than one tool available to satisfy all the needs of a translator's learning and working environment.

Currently Web 2.0 technologies are widely used in e-learning, which is often referred to as E-Learning 2.0. The learning environment of E-Learning 2.0 is more than a data storage: it guides the user and interacts as a gateway to the Internet. In addition to that, it provides its own content and tools (Kerres 2006, p. 6). During a translation seminar, the learning platform named *Moodle* provides the course material and is the central point of administration, exchange, and a passport to further resources and tools. Technically adequate applications make communication and cooperation feasible for virtual group translation and all of its accompanying tasks.

##### **4.1.1 The Learning Platform Moodle**

The central learning platform of the University of Heidelberg is *Moodle* (acronym for: *Modular Object-Oriented Dynamic Learning Environment*). It is a free and open-source learning management system, and thus is widely used in the education sector. Its design and development follow a social constructivist approach (see w<sup>3</sup>). "The focus isn't on delivering information; it's on sharing ideas and engaging in the construction of knowledge" (Cole, Foster 2007, p. 5).

The *E-Learning Center* of the University of Heidelberg (w<sup>4</sup>) centrally manages the *Moodle* platform for all faculties. Besides fostering its use in teaching and research, the center provides general as well as individual support for e-learning.

In *Moodle's* virtual classrooms, teachers and students can locate general course information, resources, learning activities, communication means, and links to external resources and tools.

The screenshot shows a Moodle course interface. At the top, it says 'RUPRECHT-KARLS-UNIVERSITÄT HEIDELBERG' and 'Sie sind angemeldet als Carina Artmann (Logout)'. The course title is 'Virtual Seminar Artmann'. The main content area is titled 'Willkommen zur gemeinsprachlichen virtuellen Übersetzungsübung Englisch-Deutsch'. It contains a welcome message and a list of resources including 'Nachrichtenforum', 'Das E-Learning-Seminar', 'Konventionen', 'Das eLearning-Protokoll', 'Tipps zum Ausfüllen des Protokolls', 'Beispiel: Ausgangstext EtherPad', and 'EtherPad Screencast (Quick Tour)'. There is also a section for 'Das Erstellen einer ZIP-Datei' with a 'ZIP-Datei' resource. On the left, there are navigation menus for 'Navigation', 'Personen', 'Einstellungen', and 'Aktivitäten'. On the right, there are sidebars for 'Neue Nachrichten', 'Aktuelle Termine', 'Neue Aktivitäten', and 'Kursabschnitte'.

Figure 3: Course presented on *Moodle*

*Moodle* provides the features that are required to create a learner-centered environment. Even so, its range of functionalities is limited and various communication and Web 2.0 tools have not been integrated. In the context of cooperative translation, it is necessary to make use of synchronous tools such as audio communication and collaborative text editing. To fulfill this need, selected external tools are used in addition to *Moodle*. The learning platform thus serves as a starting point, primarily useful for course management and administration, as well as calling student attention to new resources.

#### 4.1.2 Skype: face-to-face online communication

The communication tool *Skype* is a free application for voice and conference calls. In addition, it supports video conference calls, text and video messages, screen sharing, and file exchange. "It is [...] like having e-mail, IM [abbr. of Instant Messaging] and a high-quality

phone connection combined in one programme, which operates over the Internet through peer-to-peer networks” (Mason, Rennie 2008, p. 105).

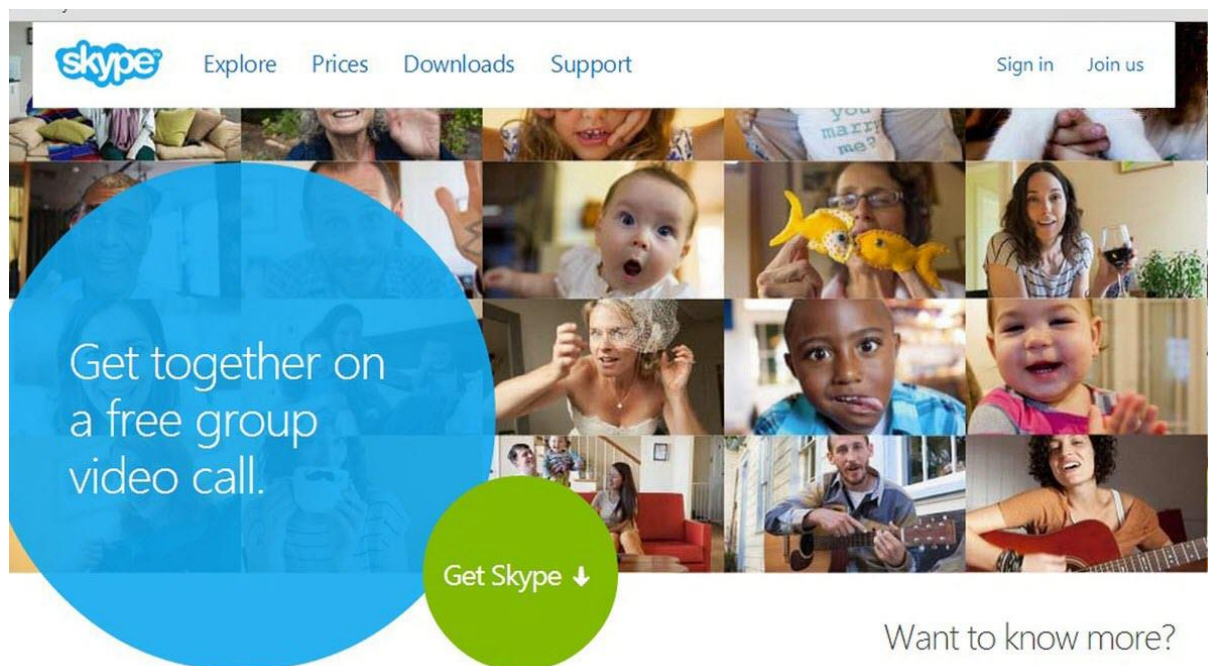


Figure 4: Skype Website

One of the advantages of *Skype* is its relatively simple and intuitive usability. It is platform-independent (available for different operating systems), and allows for conference and video calls with a minimum of technical equipment or expertise. Moreover, *Skype* provides a secure environment, and its standard functionalities are free of cost. Even so, there remain some disadvantages to relying on VoIP applications. Technical defects such as overloading, interruptions, and acoustic delays may occur. The troubleshooting process can be rather time-consuming and interrupt the overall workflow.

In our virtual seminar, *Skype* is the key to online communication because it allows students to interact and cooperate synchronously. Peer groups use the group call feature to discuss the text and translate it together. In this way, they can share their research, ideas, proposals, and findings to produce one translation as a team product. Our students tested the video group call while translating, and as a new task used *Skype* to communicate while creating cooperative mind-maps using an internet mind-mapping tool (see Artmann 2016, pp. 314-321 for further details).

Beside the group call function, students can make use of text-based communication via integrated chat. They can exchange hyperlinks to share resources, propose translation solutions, discuss organizational matters, and communicate when the voice call is interrupted. Additional functions allow the user to send data files, such as text files, presentations, or pictures, and share them with group members.

At this point, not all details of *Skype* and its various functions can be covered (for details see *w*<sup>5</sup>). Besides the virtual seminar, *Skype* software can be adapted to translation or interpreting studies in other contexts and has proved to be effective in knowledge research (see Bilić et al. 2009) and in the practice of interpreting (see Korak 2010).

#### 4.1.3 Internet Text Editors EtherPad and Google Docs

Another component that students can access to create their virtual learning environment and make online collaboration feasible is an internet-based collaborative text editor. This allows several people to edit a text document simultaneously while they are at their computers in different locations. To produce the translation text for our virtual seminar, the real-time text editors *EtherPad* (*w*<sup>6</sup>) and *Google Docs* (*w*<sup>7</sup>) are used for working collaboratively. These-internet-based applications provide the necessary features so that documents can be created and edited in real-time.

*EtherPad* is now an open-source software that focuses solely on editing text documents. Its simplicity, reduced functionalities, and clear display of participant contributions make the initial phase of online collaboration comparatively easy. *Google Docs* provides a wide variety of features for text-editing, spreadsheets, and presentations, and is similar to an office suite. When considering online cooperative translation use, it is essential that collaborative text editors have the following characteristics:

- Simultaneous (real-time) cooperation
- User-friendliness (intuitive handling)
- Basic word processing tools
- Clear display of authors and their contributions or changes
- Import and export capability

- Application stability and compatibility
- Security options
- Chat capability

Additional capabilities can facilitate the work process or data management, though they are not essentials in online cooperation (the functional range of *EtherPad* and *Google Docs* is described at  $w^6$  and  $w^7$ , respectively).

Members of translation groups can use the web-based editor in combination with the group voice call. In summary, online cooperation in the virtual translation seminar consists of these two components that lay the technical foundation for an internet-based cooperative translation process.

#### 4.2 Translating General-Language Texts

Initially we tested and evaluated cooperative translation in a virtual environment with small peer groups of advanced students. After gaining some early insights and incorporating improvements, a series of empirical investigations were carried out to further examine the cooperative translation process in this unique new setting. Our focus was on general-language texts that were translated from German into English and from English into German. Some of these online meetings were attended by the instructor, and, for further analysis, monitored by the screen recording program *Camtasia Studio*.

This series concentrated on several research questions:

1. What is the nature of virtual cooperative translation using the selected communication platforms?
2. What are the differences between cooperative translation in a classroom setting and a virtual setting?
3. How do students interact in the virtual learning environment?
4. How do skills such as translation and research competence develop during the course of the semester?
5. Does the virtual cooperative translation method result in quality translation?
6. What role do technical aspects play?

The methodological-didactical design of the course consists of several interconnected translation modules that build on each another, with each consisting of specific tasks and the cooperative translation. The various linguistic and research-based tasks are introduced sequentially according to the prior knowledge of the participants. Each member of the team deals with a different type of task and shares his result or research with the team on the learning platform. These preparatory tasks are conducted to foster various types of translation-relevant skills, including abstract writing, creating collocation lists, and conducting intense online research. As seen in the translation—the centerpiece of the learning module—the translation process benefits from each of the task results and the acquired background knowledge.

Cooperation in the seminar occurs via various means. Each participant has a role within the team that requires him to take part actively, to communicate with the group from the beginning, and he is asked to conduct research individually or cooperatively, and share his results with the team or course group. An ideal group for translating online consists of four participants: three translators and one minute-taker who records the entire process. Even though the minute-taker might seem to be in the background during the online meeting, he is analyzing and reflecting on the translation process, noting problems as well as solutions, and he will also contribute to the team effort when necessary.

The cooperative translation itself is scheduled to take place at a predetermined date and time. At this time, the group members log onto the communication platform *Skype* and begin a group conference call. Usually, the project manager of the team sets up the conference call and provides the source text in the internet-based text editor. Student voice communication takes place via *Skype*, while the text editor is the main tool for producing and editing the text. Each participant can write or edit the text at the same time. Our experience has shown it to be more efficient if one translator takes over the writing, thereby reducing possible confusion when the same text passages are edited synchronously. In addition, the team can make use of the chat window of either *Skype* or the text editor to share links, propose translation solutions, or just communicate via text.

Students encounter each other in a setting that requires online collaboration, group interaction, online research, problem-solving, and finally translating the assigned text. Independently, students incorporate additional knowledge tools that they deem adequate, and thus create their own learning environment.

The results of the cooperative virtual translation exercise based on general texts can be summarized as follows:

1. Students deal with the method in an unbiased manner, are willing to adjust to the new experimental setting, and are eager to accomplish the translation as a team product. During their discussions, they strive for the best outcome and use the various electronic tools at their disposal. Using the communication platform *Skype* proved to be intuitive, whereas students needed more time to familiarize themselves with the online text editor and its functions. Working with these tools has been shown to be efficient and productive for this purpose. In this type of translation seminar, they are indispensable for collaborative text production and online communication.
2. Traditional cooperative translation method is being simulated, and this becomes more authentic by using the selected technologies. Previous experiences with the method in other courses has a positive effect on cooperative interactions, since cooperative processes have already become a habit. One major difference lies in the use of Web 2.0 communication tools, which make it feasible to work together on one document in real-time. Every group member is involved in text production while also conducting research and solving translation problems. Additional functions of the web-based editor allow us to track different versions of the target text and to visualize the text creation process. In comparison to the traditional classroom setting, social interaction processes among peers take place in a similar manner. Group dynamics may also impact the work process in either a positive or negative way, such as seen in productive discussions or disagreements. Even though learning processes are similar, online communication cannot completely compensate for the personal

contact and a face-to-face exchange. In addition, technical difficulties may potentially represent a serious obstacle that could interrupt the translation process.

3. Student peer groups work together as part of a network while performing multitasking in their own learning environment. Each group develops its own translation strategy as well as group dynamics. In general, participants are intrinsically motivated and benefit from an active exchange of knowledge. Ideally, every member participates and verbalizes ideas spontaneously, makes translation proposals, discusses other solutions, shares his opinion and research, and takes part in the writing and editing processes. The problem-solving process is supported by the knowledge tools available and information can be shared in an instant.
4. Over the course of the semester, most groups developed their professional skills, such as translation and research competence. Usually, first-year students showed an open attitude towards virtual learning and experienced the greatest skill development. This learning scenario allows each participant to profit from the multidirectional exchange and to construct knowledge while also contributing their own individual strengths. Surprisingly, our observation and evaluation revealed that the research capability of our students is already at a high level. In addition to accessing commonly-known search engines and dictionaries, they also used alternative search engines, language corpora, and digital newspaper archives.
5. Our assessment of the completed translation demonstrates that peer groups generally produce translations of high quality. The translation process itself is accompanied by quality control from all team members throughout the process. While the target text is being produced, students continuously contribute improvements or detect mistakes. Questions regarding the content at the sentence, or word level can be readily clarified within the group. In addition, the wide array of online resources helps the translators to verify their choices.
6. Technical aspects play a vital role during the translation process. Foremost, the selected platforms and communication tools create the learning environment, and students can rely on them for online collaboration. Unfortunately, this environment

can easily be disturbed by technical malfunctions. These may be minor problems such as time delays or major faults like recurring disconnections. While some problems can be easily repaired, others may persist and interrupt, inhibit, or even terminate the translation process. Processes can run smoothly only if the technical requirements are met by all group members. From the very beginning of the seminar, students must be aware of these factors and advised to create a stable environment with the adequate hardware. This is the only way that initial problems can be prevented. Despite all efforts, interferences resulting from the internet-based applications cannot be avoided completely, and thus remain a risk.

## 5 Patent Translation as a Case Study

Cooperative translation of general language texts in the framework of virtual seminars was successfully carried out. A further challenge for our methodical research concentrates on the technical translation of patent texts. Participants taking this translation course are usually in their advanced studies and have experience in translating general-language texts as well as working cooperatively. Our research question was: When translating language for specific purposes (LSP) such as patent applications, would students face special obstacles?

We use the communication platforms VoIP software *Skype* (see chapter 4.1.2) and the internet-based text editor *Google Docs* (see chapter 4.1.3). To incorporate face-to-face communication, students are encouraged to use their webcams and group video calling on *Skype*. In our previous evaluation and feedback sessions, translation groups expressed that they missed body language in virtual seminars, things such as facial expressions and gestures. In a further attempt, the available technology could help us to enhance a group call with simultaneous video transmission. Curiously, after our first trials, all groups decided not to use this feature anymore. In their opinion, it did not improve communication and had a negative impact on the translation process, including time-consuming setup, interruptions from the group call, slow video transmission and general distraction. Thus, we discovered that video features can be considered either optional or omitted entirely. In the cooperative patent translation exercises described they were omitted.

## 5.1 Characteristics of Patents

A patent is an official document granted according to patent law that describes the exclusive rights for an invention to a person or company for a certain period of time. Patent texts belong to the genre of legal normative texts; its communicative function aims to create a legal basis or a clear reference (Göpferich 1995, p. 125). Thus, patent applications present various challenges for translators, since they are an interface between law and the field of science and engineering.

Generally, the recipient group for patent texts is limited, rather homogenous, and this group has the appropriate professional expertise. This results in a standardized special language that is mainly used internally for professional communication between experts in the field of science and research (see Göpferich 1998, p. 93 and Arntz 2001, p. 134). Due to formal and content-related guidelines determined by patent law, the macrostructure as well as the microstructure of patent texts are highly standardized, the latter especially in the text portion containing the patent claims. Yet, the text genre of patent applications can be clearly identified by its macrostructure (Göpferich 1995, p. 307). The textual and linguistic conventions are reflected in the text structure, lexical and syntactic means, as well as certain stylistic conventions (Gläser 1998, p. 557).

The macrostructure of patents is rigid and interdisciplinary, with only minor national or culture-specific deviations. Generally, the patent text consists of a section describing its administrative and technical details, a description of the invention and its clearly-defined claims, with the latter serving to define the scope of protection. The following table depicts the text type profile of patent applications (see Table 2). In comprehensive studies, Göpferich (1995) and Schamlu (1985) analyze the details of patent applications, their features and conventions.

<b>Patent Application</b>	
<b>Macrostructure:</b>	rigid
<b>Standard formulations:</b>	numerous and rigid
<b>Directive speech acts:</b>	low proportion (in German 6.65 % in English 8.83 %)
<b>Inclusion of recipient:</b>	is avoided
<b>Inclusion of sender:</b>	in German 0 %, in English 1.51 % due to the use of first person plural in standard introductory formulations in British patent applications
<b>Inclusion of persons:</b>	low proportion (in both languages significantly below 4 %)
<b>Metalinguistic elements:</b>	low proportion (in German 0.3 %, in English 0.4 %)
<b>Metacommunicative elements:</b>	significantly higher proportion in English (4.5 %) than in German (2.77 %)
<b>Passive voice:</b>	relatively high (in German 42.89 %, in English 54.02 %)
<b>Nominalization:</b>	extremely high
<b>Syntactic complexity:</b>	high
<b>Most frequent category of dependent clauses:</b>	in both languages predominantly relative clauses
<b>Most frequent category of adverbial clauses:</b>	in German consecutive clause (27.47 %) and temporal/conditional clause (26.37 %), in English temporal/conditional clause (56.31 %) and consecutive clause (14.56 %)
<b>Other:</b>	in English extremely long adnominal participial constructions

Table 2: Text type profile based on Göpferich 1995, p. 467

The dominant characteristics of patent texts are their standard formulations and lexical expressions. These linguistic means help to structure the text and are, therefore, closely linked to the macrostructure (Gläser 1998, p. 559). For instance, these expressions introduce a new aspect, represent a transition, or refer to another aspect. The following example shows a typical introductory formulation of a British patent application.

*We [...], do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described by the following statement: [...] (Gläser 1998, p. 558)*

Considering lexis, a high degree of terminology is notable, which combines specialized terms from the legal and technical-scientific disciplines. To describe an invention it is essential to use precise and consistent terminology. Clarity and consistency requires an avoidance of synonyms, metaphors, and abbreviations, and international physical quantities must be used. This is the only way to clearly define the scope of protection to the invention.

Translators of patent text are confronted with a high degree of nominalization, complex syntactic structures, and legal and technical terminology, along with standardized lexical expressions. Multi-clause sentences are characteristic of German patents. Translation students must develop the awareness that in order to produce an accurate translation they have to constantly keep in mind that every single word counts. After all, the patent holder's exclusive rights depend upon this precision and could offer him a competitive advantage.

Translators who commit norm violations face rejection of their texts. Even though the initial phase of the seminar will likely be consumed by intense research, once acquainted with the subject matter, translators will find that they benefit from its predetermined micro- and macrostructure. In a further study, Bilić and Kornelius (2013) describe a cooperative patent research in the context of translation studies.

## **5.2 Patent Translation**

The virtual translation seminar aims to acquaint students with patent applications and the text type associated with patent applications, including its micro- and macrostructure. As an introduction to the text genre, students complete various tasks and learn more about patents in general. For example, a linguistic text analysis requires participants to analyze patent texts according to the theories of Brinker (1997), Gläser (1995), and Göpferich (1995), and to deal with text functions, contextual criteria, and stylistic and cohesive devices. A special emphasis is placed on the macrostructure. Stylistic and grammatical conventions are essential to solving text-specific translation problems and to produce an acceptable target text. Besides learning how to use text conventions, participants are asked to create

equivalence and collocation lists containing technical terms related specifically to the patent and its invention. Since the selected patent applications deal with everyday objects that students are familiar with, they provide more impetus for discussion and exchange than unknown objects would arouse. This also allows participants to familiarize themselves with the specific terminology of the subject area, whether it be telecommunications, domestic appliances, or food technology.

The following examples illustrate translation-related phenomena and problem-solving strategies carried out in the cooperative virtual seminar. Patent texts were predominantly translated by German native speakers from their native German into English. In the following, examples of the group discussions are presented in German.

### 5.2.1 Example 1: Technical Terminology

Translation in the field of patent matters requires a familiarization with technical terminology that is rarely found in dictionaries, but instead is located in relevant literature and reference texts. In the patent text of an electric water kettle, the English technical term for the German term “Dickfilm-Technologie” is initially unclear. The peer group makes use of other patent texts of the same subject matter and verifies its choice using an online search engine. The following excerpt shows the source text (ST), the target text (TT), and outlines the common decision-making process.

- ST Aus der GB2 253 551 A ist ein Kochtopf bekannt, dessen Gefäß insgesamt beispielsweise aus Keramik oder Glaskeramik besteht, wobei die Beheizung des Gefäßes mittels **Dickfilm-Technologie** erfolgt, indem eine Folie auf die Unterseite des Topfbodens angebracht wird.
- 1 S 1: Also wir wissen jetzt noch nichts über Dickfilm-Technologie, oder?
- 2 S 2: Ne, dazu habe ich überhaupt nichts gefunden.
- 3 S 3: Also ich habe *in form of a thick film* oder ... wo war es denn?
- 4 S 4: Was ist denn Dickfilm, bitte?
- 5 S 3: ... oder *the heating element is screened onto the surface in form of a thick film*. Bei dem *heating element*.
- 6 S 1: Ich finde, es klingt eigentlich ganz gut.
- 7 S 2: Das kommt auch in diesem Paralleltext vor ... in diesem Patent ... in diesem GB. Da steht immer *thick film*. *Thick film heating element* kommt zum Beispiel

vor ... kommt ganz oft vor *thick film heating element*. Dann kann man bestimmt auch sagen *thick film technology* oder so.

- 8 S 3: Habt ihr es mal bei *Google* versucht? Also *thick film technology*?
- 9 S 1: Aber das kann man so schreiben: *uses thick film technology for*.
- 10 S 2: ... *for heating the vessel*?
- 11 S 1: ... *for heating the vessel*. Ja, genau.
- 12 S 4: Ich habe *thick film* gefunden.
- 13 S 3: Hä, hast du T. (S 4) gerade gemeint, du hast es nicht gefunden?
- 14 S 4: Doch, ich hab's doch. 454 000 Einträge.
- 15 S 3: Ich habe verstanden, du hättest es gar nicht gefunden.
- 16 S 4: Doch.
- 17 S 1: Also ich finde, es klingt gut, oder?
- 18 [The group agrees.]
- 19 S 1: Neuer Satz oder sollen wir einen langen Satz machen? Es bietet sich vielleicht gerade an es noch dranzuhängen.
- 20 S 2: Ich meine eine *participle construction*.
- 21 S 3: Ja, wäre ich auch für.
- 22 S 1: Sehr gut, ja. [...]
- TT GB2 253 551 A describes a cooking apparatus, the vessel of which is, for example, made of ceramic or ceramic glass and that uses **thick film technology** for heating the vessel by attaching a film to the bottom of the vessel.

[Group Translation – Translation VI – Source Text 3 – Group 2]

### 5.2.2 Example 2: Researching the Subject Matter

In comparison to the translation of general-language texts, which provide more latitude for creative and free translation solutions, patent applications require a clear and detailed description of the subject matter. As mentioned above (see chapter 5.1), it is not common to use synonyms or metaphors, and consequently, technical terms are frequently repeated. In the following example, the translation group is uncertain about the condition of the object in question. During a lively discussion, participants share their opinions and find several solutions. For their research they make use of various tools, for instance, they search for pictures from an online store and compare search results in the monolingual text corpus *The*

*Corpus of Contemporary American English*. In the group call session, they often name the website or tool they are currently using. This way, their research steps can be followed.

ST **Elektronischer Wasserkocher**

- 1 S 1: So jetzt haben wir schon mal das Problem, welches Wort wir für Wasserkocher nehmen. Da gibt es ... weiß nicht ... ich habe jetzt schon mal vier gefunden.
- 2 S 2: Also *Langenscheidt* bietet nur *electric kettle* an. In *Wikipedia* hingegen hat der Artikel über Wasserkocher den Titel *water boiler*.
- 3 S 1: Bei *dict.cc* habe jetzt *electric kettle*, *water boiler*, *water kettle* und *electric water jug* gefunden.
- 4 S 3: Dafür, dass es im Deutschen der elektronische Wasserkocher ist, dann *electric kettle*?
- 5 S 2: Wobei *kettle* betrifft nur halt diese normalen Wasserkocher – also mit dem Henkel und so – elektrisch oder nicht elektrisch. Während *water boiler* auch z.B. sein kann, was in der Küche oder im Keller das Wasser erwärmt ... Also *kettle* ist eigentlich spezieller und würde in diesem Fall besser passen, weil es eben spezieller ist und sich genau auf das bezieht.
- 6 S 1: Ich gebe es mal bei *amazon.com* ein. Mal gucken was man da findet, unter was es sozusagen erwerbbar ist. Also bei *electric kettle* findet sich das Gesuchte und bei *water boiler* eigentlich auch – nur da kommen halt Größere. Also da kommen mehr Ergebnisse mit größeren Geräten, die irgendwie drei oder vier Liter fassen, die eben vorher nicht angezeigt wurden.
- 7 S 2: Natürlich interessant.
- 8 S 3: Dann denke ich aber, dass es der *electric kettle* schon am besten trifft.  
[Short comment on how to improve the audio quality.]
- 9 S 1: Ich glaube, das ist jetzt nicht die entscheidende Frage, welches Wort wir da verwenden. Als wir auch bei anderen Patenttexten, zum Beispiel bei dem Bierthema, geschaut haben, wurden auch andere Begriffe in anderen Patenttexten verwendet. Nicht? Oder?
- 10 S 2: Von mir aus können wir auch *electric kettle* nehmen.
- 11 S 1: Also ich kann es jetzt kurz mal in das Korpus eingeben und dann gucken was mehr Treffer hat. Dann haben wir es ... Also *electric kettle* gibt es im Korpus, also in dem COCA, 15 Treffer und was haben wir noch gesagt. *Water boiler*? Oder? [The group confirms.] Da findet es nichts. Ja, vier Treffer bei *water boiler*.
- 12 S 2: Na also.
- 13 S 1: Aber wie ich hier gerade bei *Wikipedia* sehe, kann *water boiler* auch so ein Durchlauferhitzer sein für Wasser.

14 S 2: Wir müssen uns ja jetzt auch nicht stundenlang mit dem Namen aufhalten.  
Ich würde sagen *kettle* ist besser.

15 [The group decides who is going to write in *Google Docs*.]

16 S 3: Wir haben uns jetzt auf *electric kettle* geeignet.

TT **Electric kettle**

[Group Translation – Translation VI – Source Text 3 – Group 1]

### 5.2.3 Example 3: Stereotypical Formulations

The area of patent applications is characterized by highly standardized texts containing stereotypical formulations. To familiarize themselves with this topic, students check reference texts and search other materials to find these syntactical expressions. The linguistic analysis according to the theories of Göpferich and Gläser (see chapter 5.1) helps students to identify and translate these patent-specific conventions. In the course of the semester, participants learn how to use and translate them almost automatically. In general, translating patent texts only allows a few variants, especially since these formulations appear in every patent and are used repetitively. At this point, examples of the group translations are presented. It should be noted that standardization limits the number of acceptable solutions.

The initial part of the patent text deals with the “state of the art” of the invention, describing the prior knowledge made available to the public in other documents and patents. In German patents, this text part usually starts with the syntactic formulation “Die Erfindung betrifft [...]”. During their first patent translation, the translation groups are aware of the standardization and locate the formulations in reference texts in the target language. The translation results show only a few deviations from the standardized formulation. At the same time, the term and reference “Oberbegriff des Anspruchs 1” presents a far greater translation problem. In this case, “Oberbegriff” is a legal term under which the subject matter is characterized (see Schamlu 1985, p. 63). In the example, the English equivalent is “preamble” and further refers to the definition in the first claim. This expression is correctly translated by only half of the groups.

- ST **Die Erfindung betrifft** ein Mobiltelefon nach dem **Oberbegriff des Anspruchs 1.**
- 1 The present invention is concerned with a mobile phone. (*Group 1*)
- 2 This invention relates to a cellular phone according to the preamble of claim 1. (*Group 2*)
- 3 The mobile phone is the invention referred to in claim 1. (*Group 3*)
- 4 The invention concerns a portable cellular phone according to the preamble of claim 1. (*Group 4*)
- 5 The invention relates to a cellular phone according to Claim 1. (*Group 5*)
- 6 The invention relates to a mobile telephone according to the preamble of claim 1. (*Group 6*)
- 7 The invention relates to a mobile telephone according to claim 1. (*Group 7*)
- 8 The invention relates to a cell phone in the preamble of claim 1. (*Group 8*)
- 9 The invention concerns a mobile phone according to the generic term of claim 1. (*Group 9*)
- 10 The invention relates to a mobile phone defined by the preamble of claim 1. (*Group 10*)
- TT **The invention relates to/concerns** a mobile phone as defined in/according to the **preamble of claim 1.**

[Group Translation – Translation VI – Source Text 1 – Group 1-10]

In the “state of the art” text portion it is common to use the stereotypical formulation “Es ist bekannt [...]”, which describes the current technical state of the art of the invention. This can also be expressed by “bei dem bekannten [Gegenstand]” and “des bekannten [Gegenstands]”, both referring to current characteristics of the invention. At the same time, a reference to an already-granted patent can be made with expressions such as “aus der [Patentschrift] ist ein [Gegenstand] bekannt [...]”. Therefore, in patent texts, the term “bekannt” (Engl. “known”) is the typical linguistic indicator for the state of the art (Schamlu 1985, p. 103). The following comparison of the target texts shows that the syntactical expression is translated correctly in most cases.

- ST **Es ist bekannt**, Wasser in sogenannten Wasserkochern zu erhitzen.
- 1 It is known to heat water in so called kettles. (*Group 1*)
- 2 Water is heated in a device, commonly known as a water kettle. (*Group 2*)
- 3 It is well known to heat water in a so called water boiler. (*Group 3*)

- 4 Usually, water is heated in so-called water kettles. (*Group 4*)
- 5 It is well known that water can be heated in such kettles. (*Group 5*)
- 6 It is a common method to heat water in so-called electric kettles. (*Group 6*)
- 7 It is known to heat water in so-called water kettles. (*Group 7*)
- 8 It is known that water is heated in so-called water kettles. (*Group 8*)
- 9 Using an electric water kettle is a common way to boil water. (*Group 9*)
- 10 In a known method water is heated by a so-called kettle. (*Group 10*)
- TT **It is known** to heat water in so-called water kettles.

[Group Translation – Translation VI – Source Text 3 – Group 1-10]

The patent claims include further stereotypical formulations. For instance, the German expression *dadurch gekennzeichnet* should be translated in English as *wherein*. These types of demonstrative or relative adverbs are archaisms that are common in English legal and administrative language. As Gläser (1998, p. 560) states, the use of archaisms has advantages due to their economy of language, easier usage, and unambiguous reference. In the virtual seminar, the best way to find a solution for this formulation problem is to consult reference texts. As shown below, about half of the translation groups use the proper English expression. Even though other solutions are not incorrect per se, they do violate the norm in the claim portion.

- ST **Verfahren nach Anspruch 1 oder 2 oder einem der vorhergehenden, *dadurch gekennzeichnet*, dass [...].**
- 1 A process as claimed in claim 1 or 2 or any preceding claim, in which [...]. (*Group 1*)
- 2 Process according to claim 1 or 2 or to one of the previous claims wherein [...]. (*Group 2*)
- 3 The process according to claim 1 or 2 or to at least one of the preceding claims, wherein [...]. (*Group 3*)
- 4 Method according to claim 1 or 2 or any of the preceding, wherein [...]. (*Group 4*)
- 5 A method as claimed in Claim 1, 2 or one of the foregoing, wherein [...]. (*Group 5*)
- 6 The method of claim 1 or 2 or any of the previous claims, wherein [...]. (*Group 6*)
- 7 Method according to the preamble of claim 1 or claim 2 or any of the above-mentioned, characterised by [...]. (*Group 7*)

- 8 Method according to claim 1 or 2 or one the previous characterized in that [...].  
(Group 8)
- 9 Process according to claim 1 or 2 or to one of the previous claims wherein [...].  
(Group 9)
- 10 The process according to Claim 1 or 2 or one of the former, in which [...].  
(Group 10)
- TT **Process/Method according to claim 1 or 2 or any of the preceding, wherein [...].**  
[Group Translation – Translation VI – Source Text 2 – Group 1-10]

#### 5.2.4 Further Observations

In contrast to translating general texts, patent translation is characterized by extensive research, a lower degree of spontaneity, and a more time-consuming translation process. Standardization leaves less room for creative solutions or variations in style. Since most participants lacked expertise in the area of the invention being described or knowledge of its technical aspects, this text genre presented difficulties in text comprehension. In order to solve translation issues, students had to acquire an in-depth knowledge of legal and scientific terminology, including patent-specific formulations. Generally, students were assisted in their attempts to clarify this complex content by locating more reference sources and engaging in group discussion.

Over the course of the semester, a positive effect on the overall translation process was noticed. Students gained a better understanding of the genre of patent texts, especially of its macro- and microstructure and its high standardization. Linguistic and knowledge research evolved into a habit, and it seemed that repetitive standard formulations were being translated almost automatically. A side effect of this high level of standardization is a resulting small proportion of free translation solutions. This is in synch with expectations for technical translation in this field.

#### 5.3 Special Tools for Patent Translation

In the virtual patent translation seminar, the participants work in a constructivist and realistic learning environment with the entire range of learning resources and reference tools available that are found in professional translation practice, including monolingual and multilingual dictionaries, text corpora, glossaries, knowledge databases, and reference texts.

Even though students can choose to refer to print material, patent-related research is conducted almost exclusively online. All the course materials are accessible on the *Moodle* learning platform. Parallel reference texts of patents on the same subject matter present a particularly valuable resource. Those provided within this course originate from the databases of the *European Patent Office* (w<sup>8</sup>) and the *United States Patent and Trademark Office* (w<sup>9</sup>). For patent research, students also consulted *Free Patents Online* (w<sup>10</sup>), *World Intellectual Property Organization* (w<sup>11</sup>), *WikiPatents* (w<sup>12</sup>), *Google Patents* (w<sup>13</sup>), and *SumoBrain* (w<sup>14</sup>).

During the translation process, student groups took full advantage of the assistance available online. Various resources were cited in the translation minutes and the evaluation. The following table shows the wide range of resources used in patent translation.
























General Tools	Monolingual Dict.	Multilingual Dict.
		
 Google Search	 Merriam-Webster	 Linguee
 Google Image Search	 COCA	 dict.cc
 Wikipedia (en/de)	 Oxford Coll. Dict.	 LEO
 ProZ.com	 Collins Dictionary	 Pons
 Answers.com	 OALD (Print)	 Langenscheidt (UB HD)
 HowStuffWorks	 Longman English Dictionary Online	 IATE
 Planet Wissen	 Oxford Dict. of Syn./Ant.	 Google Translator
 Statista	 Office-Bibliothek	 Wörterbuch Projekt Dt. Wortschatz
 Google Books	 Longman Language Activator	 BEOLINGUS
	 Duden	
	 Wortschatz Univ. Leipzig	
	 OED Online (UB HD)	
	 Thesaurus.com	
	 Webster's Online Dictionary	

Table 3: Tools and reference sources used in patent translation

The *Google* search engine is used to find more resources and reference material and to support the verification of terms, collocations, or syntax in the target language. Student searches for specific resources, such as glossaries and terminology lists, were assisted by the translation portal *ProZ* (w<sup>15</sup>).

The *Corpus of Contemporary American English* (w<sup>16</sup>) proved to be a reliable monolingual resource for choosing and verifying words and word combinations in context. Students became remarkably confident using this tool, and it assisted many translation groups in their text production.

For both general-language texts and patent texts, a majority of translators look up unknown vocabulary in bilingual dictionaries such as *LEO* (w<sup>17</sup>), *dict.cc* (w<sup>18</sup>), *Linguee* (w<sup>19</sup>), and *PONS* (w<sup>20</sup>). While translating patents, they consulted a greater variety of monolingual dictionaries in both languages, including *Duden* (w<sup>21</sup>), *Wortschatz Universität Leipzig* (w<sup>22</sup>), *Merriam-Webster* (w<sup>23</sup>), and *Collins Dictionary* (w<sup>24</sup>), as shown in Table 3.

Within a virtual patent translation seminar, print media is often outdated and research too time-consuming. Online research enables students to quickly search for additional media, such as graphics, pictures, and videos that allow them to better understand the technical aspects of the subject matter. Other official and unofficial patent websites such as *Google Patents* and *Free Patents Online* were used for knowledge search. Nevertheless, it is preferable to consult the reliable official databases of national and international patent offices, especially since in professional life, producing patent texts has legal consequences (see Bilić et al. 2009, p. 229).

## 6 Conclusion

Our investigations show that the cooperative translation method can be successfully realized virtually for a professional, practice-oriented approach. Special focus is given here to the overall translation process, cooperative research, and the technical translation of patent applications. At the same time, this method implies that students create their own learning and working environment using the required tools for online communication and accompanied by a variety of online resources. The cooperative translation takes place by

means of synchronous communication supported by the VoIP software named *Skype* (see chapter 4.1.2) and collaborative online text editors (see chapter 4.1.3). The online learning platform *Moodle* is an integral part of the process, providing a valuable portal for distributing learning resources and tools that support translation. These include search engines, monolingual and multilingual dictionaries, encyclopedias, knowledge databases and newspaper archives. During the entire translation exercise, an accompanying online research effectively supports the translation process. Within this shared online space students can freely share and discuss their findings and solutions in a group setting as they collaborate to create one target text as their team product.

When the project involves general-language texts, their main topics and language provide a good basis for discussion. The resources on hand assist students in finding solutions and often lead them to creative proposals. The scientific nature of patent texts requires students to closely engage with both standardized rules and established technical terminology, and requires a concentrated and extensive research in the technical field. Over the course of the semester, students are able to develop routine processes in the areas of cooperation, online research, and technical problem-solving. Since they work exclusively in a self-directed peer group, responsibility to the group, its learning process and successful translation outcomes are actively promoted.

Evaluations of this cooperative method have been generally positive. The didactic value of virtual cooperative translation method lies in a design that fosters student acquisition of a range of key professional competences. Next to competences in the areas of linguistics, cultural studies, and technical translation, it develops social competences such as team competence, cooperation, and the ability to disagree constructively and then make compromises. Moreover, media competence is enhanced, and problem-solving skills are directly applied within a realistic and dynamic working environment. Since they are working completely online, students are independent of time and location constraints and can arrange meetings that are convenient to all team members. Working cooperatively challenges students to acquire professional skills within a safe and reliable online

environment. Supported by teammates, students demonstrated that they could gain competence in using new programs and tools.

The main disadvantage of this online cooperative method remains its reliance on a strong and stable technical environment. Individual students work on differing technical infrastructures, and these may be inadequate or unreliable. Our response to student technical problems had to consider this variability. In one instance, we found that the video group call could well be omitted. Since it did not contribute to enhanced communication during the translation process, many students expressed that they found the video transmission rather disturbing.

Both past and present experiences in e-learning conclude that it enriches the curricula of translation studies and addresses aspects that cannot be approached in other contexts. Since its initial stages, e-learning has been regarded as a valuable supplement to traditional teaching methods, not a substitute for face-to-face learning.

E-learning allows students to gain practical experience in a new learning environment using modern technology in a group setting. Students learn how to adapt to new learning environments, to network and complete translation work as a team. When they enter the working world, they will undoubtedly encounter a variety of new working environments and concepts that reflect the changes transforming our information- and knowledge-based society. Having successfully completed a virtual group translation course enables future professional translators to confidently approach their twenty-first century workplace.

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w<sup>3</sup>: <http://docs.moodle.org/25/en/Philosophy>

w<sup>4</sup>: <http://www.elearning-center.uni-hd.de>

w<sup>5</sup>: <https://www.skype.com/en>

w<sup>6</sup>: <http://etherpad.org>

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w<sup>8</sup>: <https://www.epo.org>

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w<sup>17</sup>: <https://www.leo.org>

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### 7.3 Tables

Table 1: Stewart et al. 2010, pp. 24-25

Table 2: based on Göpferich 1995, p. 467

Table 3: Author

### 7.4 Figures

Figure 1: Author

Figure 2: Author

Figure 3: <https://elearning2.uni-heidelberg.de>

Figure 4: <https://www.skype.com/en>

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