

Group Work in a Technology-Rich Environment

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Abstract

This paper addresses several components of successful language-learning methodologies—group work, task-based instruction, and wireless computer technologies—and examines how the interplay of these three was perceived by students in a second-year university foreign-language course. The technology component of our learning design plays a central role in this article. The main part is dedicated to the analysis and interpretation of student data collected in two different groups during two subsequent semesters. After a general discussion of the learning design of the course and task-based language learning, we analyze the interaction between two sets of factors: 1) the students' use of information and communication technologies and their perception thereof, and 2) students' perception of and participation in task-based instruction and group work.

1. Introduction

Group work, task-based instruction, and the use of learning technologies are often described as important components of successful learning methodologies because of their focus on social learning, peer interaction, cognitive and communicative processes and modern communication media. We were interested in finding out how the interplay of these three components in one course was perceived by students. Although all three components are now widely used in classrooms, our approach which could be described as *singular text – plural authors* in writing classes is a fairly novel strategy in group work in the (foreign-language) classroom (see also Storch, 2005).

This article discusses the learning design and the learning objects which were developed and implemented for an intermediate, university-level German language course in a technology-rich classroom.¹ Development, implementation, and data collection were conducted between the Fall term of 2003 and the Spring term of 2006—the funded period of the WatPAL project² at the University of Waterloo. The German language course entitled ‘GER 203 Written Communication’ is typically offered once a year in the Fall term, the course was run several times during and after the project and took its full implementation in the Winter and Fall of 2005, during which the data for the study was collected.

The WatPAL project studied the development and implementation of group-oriented and task-based learning designs in a technology-rich language learning environment (see section 2). The goals of the project were: to implement task-based learning designs (see section 2.1) for small groups and to record and analyse students’ learning processes and results over the duration of one semester of a university course on German written communication and grammar. At the conceptualisation phase, the WatPAL project team³ anticipated the following results:

- a) a set of learning designs which increase the quality of teaching and enhance the learning experience of the language students and which can be further developed with new content for other university courses (see section 2);
- b) a set of learning objects and other learning resources to facilitate individualized learning in this German language course and other courses (see section 2.5);

¹ For approaches with limited technologies see Egbert and Yang (2004).

² We gratefully acknowledge the financial support of the Learning Initiative Fund of the University of Waterloo. The University also loaned our two groups of students the tablet PCs and provided tablet PCs for the researchers.

³ A large group of graduate students and faculty members of the Department of Germanic and Slavic Studies at the University of Waterloo participated in the design and implementation of learning objects, data collection, analysis, and in fruitful discussions throughout the three years. Thank you.

- c) outcomes from and the evaluation of a pilot study of the use of the tablet PCs, the work with a virtual learning environment (VLE), and the learning in a technology-rich classroom in university-level language teaching (see sections 3 to 6);
- d) results from a learning impact study which will provide new insights into instructed language acquisition with new media (see Liebscher & Schulze, 2008).

In this paper, we first provide a general discussion of the learning design and then our analysis of the interplay of, on the one hand, the use of technologies in this course and the perception of these by our students and, on the other, the students' perception of and participation in task-based instruction and group work. This means that the technology component of the learning design of this course takes centre stage in this article; we have discussed the conceptualisation and the pedagogic design (Schulze, 2004a, 2004b), the role of task-based language teaching (Schulze, 2005), the use and perception of language learning strategies (Schmenk, Schulze, & Hamann, 2005), the computer-aided analysis of learner texts (Schulze & Wood, 2008a, 2008b), and a qualitative analysis of the task-based group work (Liebscher & Schulze, 2008) elsewhere. A short discussion of our task-based learning design (section 2) will have to suffice as the context of the study presented here. In section 3, we will introduce the language learning technology utilised in this course. The main part of this article is dedicated to the analysis and interpretation of data which concerns the perception and use of language learning technologies, with a particular concentration on the role of information technologies in group work and task-based instruction. (sections 4 and 5).

2. Learning Designs

In our opinion, the main innovative features of the learning designs in our Written Communication course (see section 2.2) are:

- a) task-based language teaching in small groups (between three to six students in four or five groups) in a foreign-language writing class (about twenty students) (see section 2.1);

- b) foreign-language learning and collaborative second-language writing in a technology-rich environment (e.g., tablet PCs, a virtual learning environment, wireless technology and communication software) (see section 3);
- c) enriched student-student interaction through computer-mediated communication (see sections 2.3 and 2.4);
- d) computer-aided, diagnostic tests with individualised feedback at the beginning of each of the three projects which provide guidance for individual learners throughout the four-week project (see section 2.3);
- e) online learning resources (e.g., language exercises, explanatory animations of selected grammatical phenomena, listening texts) in addition to the textbook and workbook material were all integrated in the online learning environment (see section 2.5).

2.1. Task-Based Language Teaching

In the context of our task-based approach to the conceptualisation of the language course and the study, we follow Willis' (1996) definition of task as a "goal-oriented communicative activity with a specific outcome, where the emphasis is on exchanging meanings, not producing specific language forms" (p. 36), which appears to be widely accepted (Bygate, Skehan, & Swain, 2001, p. 11; Ellis, 2003, p. 3; Skehan, 1996, p. 38). We note, however, that in contexts with a more practical focus a task is understood more broadly as a "classroom event that has coherence and unity, with a clear beginning and an end, in which learners take an active role" (Cameron, 1997, p. 346) Our understanding of task is further informed by Sociocultural Theory (Lantolf & Thorne, 2006) and is understood within this framework as collaborative construction of knowledge (Edwards & Willis, 2005, p. 24). Task accomplishment and L2 learning are thus not only a matter of individual cognitive efforts, but are first and foremost dependent on their embeddedness in a social interaction. Often, this is (wrongly) understood to mean that there has to be a more knowledgeable expert to interact with a novice to help the latter acquire a certain kind of knowledge. We see peer interaction in general as conducive to learning, since learners may be expert and novice on different planes and in different ways during the learning process

and since they have been shown to solve problems through the interaction which are beyond their individual abilities (Donato, 1994).

“Task-Based Language Teaching ... constitutes a coherent, theoretically motivated approach to all six components of the design, implementation, and evaluation of a genuinely task-based teaching program: (a) needs and means analysis, (b) syllabus design, (c) material design, (d) methodology and pedagogy, (e) testing, and (f) evaluation” (Doughty & Long, 2003, p. 50). We agree with (Eckerth, 2003a, 2003b) who prefers tasks (*Lernaufgaben*) which have some relevance for our learners over fictitious tasks (see e.g., Skehan, 1998, p. 143), but we would not go as far as Börner (1999) and describe fill-in-the-blank exercises as tasks. However, we do see a link between language learning tasks and the teaching and learning of structural elements—grammar and vocabulary. We see tasks as “a vital part of language teaching” (Skehan, 1996, p. 39), but not as the sole unit of instruction. As Willis (1996, p. 42) suggests, our tasks are preceded by pre-task activities and followed by reflection as a post-task activity (Levy & Kennedy, 2004; Skehan, 1998, p. 149). Our pre-task activities are conducted in the classroom and as part of the students’ individual and group-based self-study. In class, the instructor presents the tasks and discusses different aspects with the students. Other pre-task activities fall into two broad categories: (1) linguistic priming and review and (2) pre-task planning activities. Task-relevant and project-relevant grammatical constructions and semantic fields are introduced to students or are reviewed if they are (partially) familiar to the students. Students practise these in online exercises, short online writing activities, textbook-based exercises, pair work, small group discussions and class discussions. Other activities under (1) include the discussion of essay writing strategies, relevant textual structures, meta-communicative elements, and proof-reading algorithms. We would not deny that the sequence pre-task activities—task is reminiscent of the so-called 3Ps approach to language teaching methodology – present, practice, produce (PPP) (see Skehan, 1998, pp. 94-95). This way, we are providing a familiar structure for each set of tasks for our students—a structure which they could simply follow, but could also move away from if they think it does not facilitate their learning. This balancing act of prescriptive guiding structure vs. informed, individual flexibility of students was necessary because of the heterogeneous groups (wide range of motivations, language proficiency and awareness) (see section 2.4). We would

like to emphasise, however, that for us the PPP sequence is just that: a procedural sequence. The task is still central and emphasis is on cognitive processes not skill-oriented training (see Bruton, 2002; Skehan, 2002).

Students are given time during class-contact hours for their planning of tasks in small groups or they conduct these outside of these hours face-to-face, via e-mail, online chat and group discussion boards. All online communication media were made available to students through UW-ACE (see section 3.2) to create a protected work space for students and to facilitate easy access. In these discussions students negotiated and agreed upon the division of labour, the different roles of group members, schedules and deadlines. The students' planning can be classified as either pre-task or unpressured within-task planning (Ellis, 2005).

Before we will discuss the design of individual task types (see section 2.3), we would like to sketch the task context: the German language course the students took.

2.2. Course Description

German for Written Communication (GER 203) is a second-level university course. The minimum prerequisites are either credit for two semester-courses in German language at university level or the successful completion of German courses in grade 12 at high school. However, the course is also suitable for more advanced learners of German who take it, for example after having spent a considerable period of time in secondary education in a German-speaking country or who are of German heritage. It has been offered regularly since 2002 usually in the Fall term. The class size ranges from fifteen to twenty-five students.

This intermediate German-language course concentrates on essential phenomena of German grammar. Students develop further the skills necessary for the production of different genres of written texts. The course focuses particularly on the students' development of increasing linguistic accuracy and complexity

(Foster & Skehan, 1996, 1999; Schulze & Wood, 2008a, 2008b; Skehan, 2003; Skehan & Foster, 1997, 2005; Tavakoli, Skehan, & Ellis, 2005). Both class size and general nature of the course (the handling of mainly written material, a great deal of interaction among the students themselves and between the instructor and the students) made it an ideal course for our study. Each semester, the course consisted of three four-week projects entitled *The Verb Group*, *The Noun Group*, and *The Sentence and Its Parts*. For each of the projects groups of four or five students were formed (see sections 2.2 to 2.4).

The course textbook—*Handbuch zur deutschen Grammatik: wiederholen und anwenden* by Rankin and Wells (2004)— is used as a reference book and a practical communication guide. It consists of thirty chapters and provides both an overview of grammatical topics and “provides meaningful, communicative practice for those topics” (p. XVIII).

2.3. Testing and Tasks

At the beginning of the course all participants were asked to complete the Strategy Inventory for Language Learning questionnaire (SILL) (Oxford, 1990), a self-assessment instrument designed to measure how students perceive their use of language learning strategies. Our main purpose for the test was to raise students’ awareness of their ways of going about learning. This test determined their strategy profiles and collected some personal information. The complete SILL was presented to students as an online survey within the virtual learning environment (VLE). Students were encouraged to consult their filled-out questionnaire several times during the course in order to work with their strategy profile, and the online availability meant that they had easy access. Students were made aware of certain strategies being potentially inherent in or suitable to individual tasks, encouraged to reflect on their actual strategy use in certain tasks, and to try out previously unknown or underutilized strategies to facilitate successful task completion.

Before starting each of the three four-week projects students were required to complete a diagnostic test measuring their knowledge of project-relevant morpho-syntactic constructions.⁴ Each item in this multiple-choice test contained one correct answer and a minimum of three distracters for which partial credit was given as well as a “I don’t know” option. At the end of the diagnostic test, each student received robust⁵ error-contingent feedback coupled with each answer choice, general feedback on this question, and the correct answer (see Table 1). Scores, however, are not disclosed and are used exclusively to determine group membership (see section 2.4). Students were explained the nature and function of the diagnostic test. They were encouraged to answer about twenty short questions to the best of their abilities—it was perfectly fine to admit not to not know an answer—so that they would have an accurate record of their project-relevant knowledge and awareness of grammatical items and rules at the very start of the project. They were reminded frequently throughout the duration of the project to consult this record in order to help them structure their individual learning.

⁴ Construction is understood here as the main unit of construction grammar (Fischer & Stefanowitsch, 2007; Schulze & Penner, 2008), a unit which has morpho-syntactic form, meaning, and pragmatic function.

⁵ Robustness of the feedback, simplicity of item analysis, and the speed of automatic feedback were the criteria that influenced our decision to employ a multiple-choice test.

Question		
Eine Mutter spricht mit ihrem Sohn Peter und sagt:		
Answer Choice	Credits	Contingent Feedback
Peter, komm zu mir.	5	Gut, das ist die richtige Imperativform.
Peter, kommt zu mir.	3	Nein, das ist der Imperativ, aber die falsche Form.
Peter, kommen zu mir.	2	Nein, das ist der Infinitiv des Verbs.
Peter, kam zu mir.	2	Nein, das ist das Präteritum (past tense).
Peter, komms zu mir.	1	Nein, diese Verbform gibt es nicht.
I don't know.	0	This question was on the imperative. Review chapter 6.
Question Feedback		
This was a question on the imperative . If you did not get it right and/or felt uncertain about your answer, you should revise the relevant parts of <u>chapter 6</u> .		

Table 1: Item from the diagnostic multiple-choice test

For every project, each group was required to produce collectively one grammar card (*Grammatikkarte*) and one text (*Text*) on one of three topics given, and to report and reflect on their teamwork in a portfolio text (*Portfolio*) (see Table 2).

Task type	Description	Length	Weighting
<i>Grammatikkarte</i>	notes on grammatical phenomenon which are relevant to the group, list rules, show tables, use keywords and graphics	max. 1 page	5 points
<i>Text</i>	written collaboratively; on a set topic	1200 words	15 points
<i>Portfolio</i>	record your learning activities, submit an evaluative summary of the group activity as well as the activities of individual members	800 words	5 points

Table 2: Task types in each of the three projects with weighting for group grades

The output for all three tasks had to be in German. For the grammar card, students were limited to one page (letter size), had to provide some information on two or three grammatical phenomena relevant to the project, which were stipulated by the instructor, and otherwise choose linguistic phenomena for their description, which they found important. They were asked to determine the subjective importance of different phenomena based on the feedback they received on their diagnostic test. The task sheet for the text production explained the output assessment would concentrate on linguistic accuracy and complexity of the written text and asked them to focus particularly on constructions relevant to the project at hand. Text topics included the discussion of attitudes towards the German language and culture, German grammar, language learning, the use of language learning technologies, study abroad, and the study at the University of Waterloo. The text production tasks were embedded in a communicative scenario and an—albeit often fictitious—target audience was given. Students were also required to maintain an individual portfolio with weekly entries on a group-accessible discussion board, which should serve as the basis for their contribution to the graded group portfolio. All three task types can be described as real-world tasks, but also have elements of pedagogic tasks (Leaver & Willis, 2004; Willis, 2004). Grammar card and portfolio are derived from the real-world situation the students are in as members of this course group, although they fulfil a pedagogic purpose in that they encourage the students to share and consolidate their knowledge of grammatical rules and / or report and reflect on their language learning practice. The text production tasks were constructed based on examples from real communicative situations, in which the students could potentially find themselves.

All task outcomes were submitted online and students used discussion boards for collaborative writing activities and task preparation, communicated through online chat rooms because we saw the adaptation of individual language learning tasks to the online medium as important. Knight (2005) comes to the same conclusion after his study of task design in computer-mediated communication.

In addition to the points given in Table 2 based on the evaluation of the task results by the instructor, students received a maximum of five points awarded by their group peers for their contribution to the group work.

2.4. Group Work

Group membership was assigned by the instructor based on the results of the diagnostic test (ranking according to percentage scores), with which each project was started. In terms of the students' ranking, these groups were as heterogeneous (in-group) and as homogeneous (between groups) as possible. This was achieved by having groups with members who had an identical or at least very similar overall ranking average and standard deviation (see the example for 19 students in Table 3).

group	rank number of individual group members	sum	stdev	avg
I	1 7 11 15 16	50	6.16	10
II	4 5 9 14 18	50	5.96	10
III	3 6 10 12 19	50	6.12	10
IV	2 8 13 17	40	6.48	10

Table 3: Group membership by rank (n=19)

This meant that each group had some members who already had a high level of knowledge of German grammar⁶ and some who had shown less knowledge and awareness of the task-relevant grammatical constructions. Thus, our group setup ensures that learning is conceptualized as an “inherently socially situated activity” (Storch, 2005, p. 153) in the Vygotskian sense. It is in particular the in-group heterogeneity which means that students can work and learn within their zone of proximal development. In other words, less expert peers are pushed in their development through interaction with their more-expert peers. With Alley (2005), we see group work as a viable alternative to general instructor-student

⁶ Assessment based on the results of the multiple-choice diagnostic test which focused on grammar knowledge and awareness.

group interaction because it provides each student with more frequent individual learning opportunities, in spite of the fact that part of the intra-group communication is not conducted in the learnt language (L1). The L1 is predominantly used for task-planning, to discuss foreign-language constructions, and—if they are indeed off-task—to promote “an effective group environment that was conducive to peer tutoring” (Alley, 2005, p. 256).

At the beginning of the course, students received an introduction to group work specific to this course. The class discussed different potential roles for group members and they were aware that they had to produce one coherent text as a group for each task and not a rough compilation of individual texts.

2.5. Learning Objects

To facilitate effective task processing, we created a large number of computational learning objects which are all ‘housed’ in the VLE:

- interactive online exercises with automated feedback, which focused on a variety of grammatical constructions, relevant semantic fields;
- discussion boards for writing tasks as well as for group discussion,
- chat rooms for informal student-student interaction and for discussions,
- audio files for listening comprehension;
- *PowerPoint* animations to illustrate grammatical processes such as conjugation, word order and relative pronouns;
- textual and pictorial resources to illustrate the range of language learning strategies,
- diagnostic and graded, online language tests;⁷
- assignment submission boxes and other miscellaneous course management tools.

⁷ The graded, online tests were only introduced after the two run-throughs discussed for this study.

3. Language Learning Technology

The class met face to face twice a week in a technology-rich classroom, the course was also hosted online, many in-class activities were conducted through the virtual learning environment, and all tasks in the group projects were prepared and submitted electronically. They were also annotated, graded, and distributed online. Using the VLE and portable computers for the course-related work enabled us to track students' actions and to record various data throughout the course including a questionnaire on students' usage of and attitude to various aspects of technology in the course.

3.1. Tablet PCs

Before the first week of instruction each participant in the course was loaned a tablet PC for the duration of the term. These small notebook computers are equipped with a digital pen which functions as a point-and-click device and, in some applications (e.g., Microsoft OneNote), allows the user to hand-write and draw directly on the screen, and in others (e.g., Microsoft Word, Microsoft PowerPoint, Adobe Acrobat), to annotate documents with hand-written or hand-drawn notes. This feature is especially useful for reviewing and correcting existing electronic documents. Overall, the small size and light weight of tablet PCs, their built-in ability to recognize hand-writing and leave notes on electronic documents combined with features allowing wireless document sharing, made them an ideal tool for experimentation in a language classroom. It must be mentioned, however, that at the time of the project the hand recognition feature on tablet PCs was not available for German.

After signing the rental agreement for the tablet PC and consenting to the participation in our study, students were required to bring their computer to each class and were free to use them for their other courses and work or leisure activities. Every few weeks, students would hand in their PC to the research assistant for a very short period of time, so that system maintenance could be performed and locally saved learner data could be retrieved and backed up.

3.2. The Virtual Learning Environment

The online environment for the course was UW-ACE (University of Waterloo Angel Course Environment),⁸ designed by Angel Learning.⁹ Besides containing complete information on the course—the syllabus, a course calendar, announcements, task descriptions etc.—the UW-ACE site provided the students with a wealth of exercises and online resources. This online environment made it possible to record a wide range of data, such as results of online quizzes and exercises, participation in chats and discussion boards, student's background information and data in several diagnostic tests, questionnaires and surveys. The content of the course was available only to registered students and to the researchers associated with the project.

3.3. The Classroom Environment

Class meetings took place in the computer laboratory of the Centre for Teaching Excellence.¹⁰ This classroom is known as the FLEX lab (Flexible Learning Experience).

The FLEX Lab ... has been designed to support collaborative interaction and pedagogical innovation. Instructors are encouraged to make use of the room's movable and configurable tables, its two projectors and screens, its cohort of Tablet PCs (all of which are wirelessly connected to the internet), and the various software packages that are installed on the podium computer, in order to experiment with new forms of learning and student interaction. ("Flex Lab," 2009).

⁸ See <http://uwace.uwaterloo.ca>

⁹ See <http://www.angellearning.com>

¹⁰ At the time of the project, the centre was known as the Learning and Teaching through Technology (LT3) Centre.

In addition to internet browsers and word processing software, which were used in this course, all computers had Silicone Chalk,¹¹ which facilitates instructor-student-student communication through a (wireless) local network by broadcasting individual screen content and recorded audio to the group. Presentations can be broadcast to all students in real time, quizzes and polls, ranking questions can be sent to all students and the instructor can review the incoming responses in real time. These data are recorded as a sequence of screenshots with accompanying audio on each machine. Although we collected all recordings, which also incorporated the student's note-taking activity, the screen-capture movies could not be read and analysed because Silicon Chalk had been licensed to the University for a fixed period of time and the company was sold in late 2005, at which time support for the software ceased.

4. The Study

Using a subset of the data collected, in this paper we are addressing two related research questions:

1. How do students perceive the use of modern technologies such as tablet PCs and a VLE in the context of their language study at university?
2. Is there an interrelation of the students' perception of the technologies and the general learning design and group work in particular?

4.1. Data Collection

The data for the project was gathered in two different groups in two subsequent teaching terms: (Winter 2005 (n=19) and Fall 2005 (n=17)). Of these, thirty students (fifteen from each term), who answered all questions on the questionnaire, are considered in this study. The VLE together with the obligatory use of portable tablet computers during class meetings allowed us to track a wide range of students' actions and to record various data throughout the course, such as results of quizzes, exercises, questionnaires, contributions to the discussion boards and chat rooms, and diagnostic tests. In addition to the recording

¹¹ The Silicon Chalk technology was acquired by Horizon Wimba in 2005.

of selected screen activities using Silicon Chalk mentioned above, we video-recorded two eighty-minute classes (one in the beginning and one in the end of one term) and conducted individual audio-recorded interviews with students at the end of the semester, in which qualitative perception data about students' attitudes to task-based teaching, group work, and the use of language learning technology were elicited.

4.1.1. Questionnaire Data

The main source of data for the aspect of the study discussed in this paper was what we affectionately termed the 'technical questionnaire': Students were asked to complete this questionnaire online during the last two weeks of instruction (weeks 11 and 12) in both semesters, i.e., after they had gained sufficient experience in using the tablets. This questionnaire¹² focused on the ways participants used and perceived technology in the course in the context of talks-based language learning and in group work, and presented seventy-eight items reflecting students' usage of various features of tablet computers, their activities in the online course environment, and perceived effectiveness of technology on different aspects of studying for GER 203 (e.g. participation in electronic discussion boards, participation and completion of online exercises, perceived effects of technology on submitting assignments or on the actual process of writing, etc.) as well as students' attitudes to different aspects of the learning design.

The questionnaire featured several types of items including questions requiring ranking on 4- or 5-point Likert scales (e.g. A=Strongly Agree, B=Agree, C= Disagree, D=Strongly Disagree, or A=Much more likely, B=Somewhat More Likely, C=About the Same, D=Somewhat Less Likely, E=Much Less Likely), open-ended questions (e.g. *Briefly list three features that you see beneficial in the tablet PC provided in GER 203. Also, list any drawbacks you see in using this computer.*) and multiple choice questions which were assigned categorical values (e.g. *How often did you carry your tablet PC to campus?* A=the days of the GER 203 class; B=the days of the GER 203 class and some other days; C=every day, or *Which*

¹² We relied on Dörnyei (2003) and adapted a number of items from questionnaire databases available at the University of Waterloo. We are grateful to Vivian Schoner for her help.

device did you use most often to input text into MS Word? A=Pen, B=Keyboard). All items appeared on the questionnaire without headings and were normally neither grouped thematically nor according to the question type. The decision not to arrange questions in any type of logical pattern or thematic order was consciously made by the research team when designing the questionnaire in order to ensure that the participants read each question carefully and to prevent them from selecting the same answer for each item automatically.

4.1.2. Study Sample

While the questionnaire contained several items about the students' academic situation at the time of the course (e.g. *How many course are you taking this semester?*), most of the background information data was collected in another questionnaire—the preliminary part of the Strategy Inventory for Language Learning (Oxford, 1990), which the students completed in the beginning of each semester. Relying on these data, we introduce two groups of students—one in each semester—in Table 4.

Description	Number of students	Percentage
<i>Groups:</i>		
Winter	15	50%
Fall	15	50%
<i>Gender:</i>		
male	6	20%
female	24	80%
<i>Age:</i>		
18-19	8	26.7%
20-21	16	53.3%
22-24	6	20%
<i>Took German as:</i>		
major	11	36.7%
minor	9	30%
neither	10	33.3%
<i>First Language:</i>		
English	21	70%
German	1	3.3%
Russian	2	6.6%
Cantonese	2	6.6%
Bosnian	1	3.3%
Thai	1	3.3%
Unspecified	2	6.6%
<i>Have studied languages other than German?</i>		

Yes	25	83.3%
No	3	10%
Unspecified	2	6.6%
<i>Do you enjoy studying languages?</i>		
Yes	27	90%
No	1	3.3%
Unspecified	2	6.7%
<i>How important is it for you to become proficient in German?</i>		
Not so important	2	6.7%
Important	7	23.3%
Very important	19	63.3%
Unspecified	2	6.7%
<i>How many courses are you taking this semester?</i>		
2	1	3.3%
3	2	6.7%
4	6	20%
5	21	70%

Table 4: Students in the two groups: background information

4.2. Methodology

First, the responses of the questionnaire were checked for errors and scanned for completeness. The answers were then assigned numeric values and entered into the Statistical Package for Social Sciences software (SPSS v.16). Next, the questions were grouped thematically and sorted according to the question type (e.g. 4-point Likert scale, 5-point Likert scale, frequency counts, 3 point multiple-choice, open-ended questions). From these groups of statements the following measures were modelled:

1. *Helpfulness of Tablets (HOT)* comprised the following statements: *I liked studying for this course because I could use the tablet PC; Overall, I found the tablet PC helpful; and The course was more interesting because I could use the tablet PC.* Each statement in this measure was ranked on a four-point Likert scale representing: (1) Strongly disagree, (2) Disagree, (3) Agree, and (4) Strongly Agree. The mean values for each participant were calculated in this measure.
2. *Disadvantage (DIS)* consisted of four statements: *Because of the way this course uses technology: I was at a disadvantage because I do not possess adequate typing skills; ... I was at a disadvantage, because I do not possess adequate computer skills; Because of the way this course uses Electronic Communication: I was at a disadvantage because my typing skills are not good enough; ... I was at a*

disadvantage because my computer skills are not good enough. These statements were ranked on a four-point Likert scale and the mean value for each participant was calculated in this measure. Since the statements in this measure are negatively phrased, the associated scores for them had to be reversed: (1) Strongly agree, (2) Agree, (3) Disagree, (4) Strongly disagree.

Further, a hierarchical cluster analysis was run in order to identify relatively homogenous clusters of participants who share similar views with respect to 1) preferring to learn a foreign language alone or with other students (statement: *I prefer self-study to group work*) and 2) the perceived helpfulness of the tablet PCs in the course (HOT). We selected these two complex, cluster-determining features because they are central to our research questions. Then, a one-way ANOVA with Scheffé post hoc test algorithm was performed in order to determine if there were significant differences among clusters with respect to different variables from the questionnaire. Since we were analyzing the variance of means for a number of dependent variables (questions and statements from the questionnaire) by a single factor (cluster affiliation), one-way ANOVA was deemed most appropriate for our purposes. Finally, a linear regression equation was constructed in order to determine the correlation between the self-study/group-work preference of students and the HOT measure. This procedure attempts to identify relatively homogeneous groups of cases (or variables) based on selected characteristics.

4.3. Results

4.3.1. Tablet Perception and Their Features

The analysis has shown that 60.7% of the students reported to have enjoyed studying for the course because of using the tablets and 55.1% felt that the course was more interesting because of them. In addition, more than half of the students (60%) claimed to have studied more because of using the tablets. Our data has shown that using technology did not cause a loss of time. 73.4% of participants felt

that they did not spend more time to learn the same amount),¹³ and that almost one third of the students (28%) claimed have learnt more in a shorter amount of time (see Figure 1).

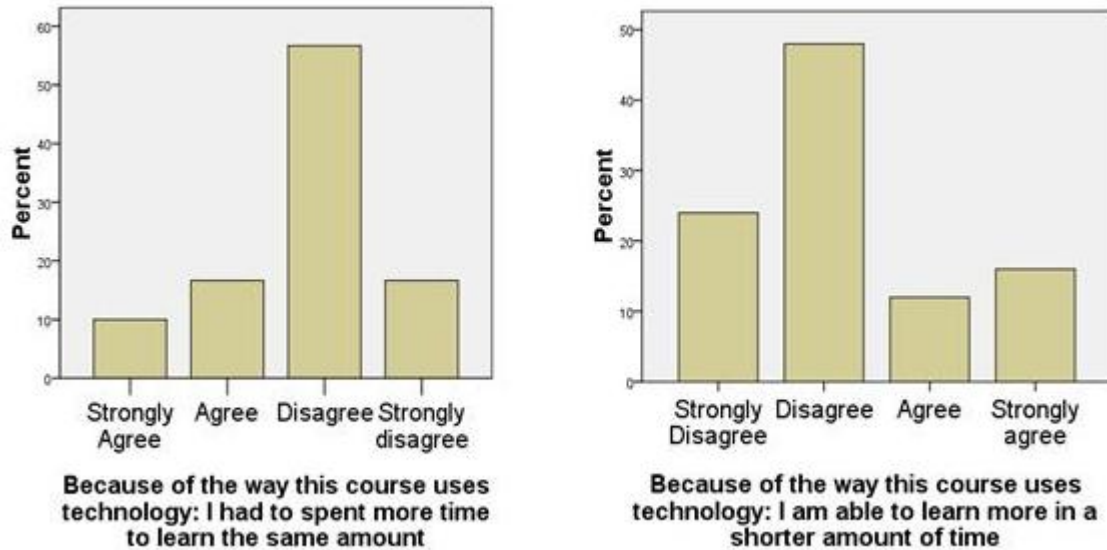


Figure 1: Perception of efficiency of tablet PCs

Further, although 71.5% of all respondents found tablet PCs helpful or very helpful, only about a quarter of all of students (26.7%) carried them to campus every day. At the same time, more than half of the respondents (53.3%) claimed to have used tablets for work in other courses *all the time*, but only 10% stated they had never used it for work not related to the course (see Figure 2).

¹³ The students' perception was confirmed through an observation study, in which we measured the time students took for different activities with the tablet PC or with their textbook. Time spent was very similar for each of these comparable activities.

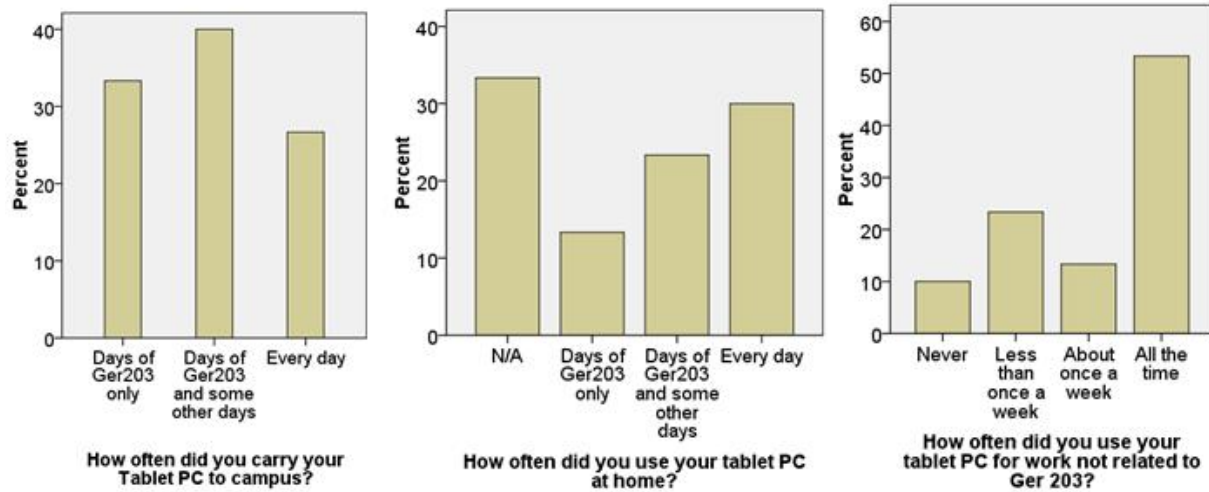


Figure 2: Statements about the use of tablet PCs

The specific functionalities tablet PCs provide appeared to be not very popular with students. Digital pens were used for pointing and clicking only by 7% of the participants, whereas 93% of students preferred using the touchpad. Pens were also not used regularly for entering texts in MS Word documents (96.6% used the keyboard) or emails (100% used the keyboard). In line with this, 58.3% of the participants disagreed or strongly disagreed that handwriting recognition feature worked well for them and 93.3% claimed to have either not used it at all or less than once a week. 86.2% also reported to have never used the speech recognition feature of the tablets.

4.3.2. Cluster analysis

The hierarchical cluster analysis revealed that according to the perceived helpfulness of tablets (HOT) and students' preference to study German alone or in groups, the following three well-defined clusters could be formed: Cluster SELF/-HOT was comprised of thirteen participants (43.3% of all students) who preferred self-study to group work (their mean score of 3.46 out of 4 represents a value close to the middle point between "Agree" and "Strongly agree") and did not perceive the tablet PCs to be helpful during the course (the mean score of 1.98 represents a response slightly lower than "Disagree"). Cluster GROUP/+HOT consisted of eight students (26.7% of all participants) who both preferred group-work (the

value of 1.62 represents a response below that of “Disagree”) and found the tablets to be helpful (the mean of 3.2 here represents a response higher than “Agree”). The final cluster SELF/+HOT included nine participants (30% of all students) who thought the tablets were very helpful and preferred self-study to group-work (they assigned a high value of 3.3 to both statements). The summary of the clusters is presented in the following table:

Cluster (Ward Method)	I preferred self-study to group work (out of 4)	Helpfulness of tablets (out of 4)	N of participants	% of all participants
SELF/-HOT	3.46	1.98	13	43.3%
GROUP/+HOT	1.62	3.20	8	26.7%
SELF/+HOT	3.33	3.33	9	30.0%

Table 5: Clusters of +/- HOT and GROUP/IND

The results of the one-way ANOVA indicate that in questions regarding saving time because of technology, there were great differences between the three clusters. The participants in cluster SELF/-HOT did not feel that the technology has helped them save or reduce learning time and generally disagreed or strongly disagreed with the statements *“I am able to learn more in a shorter amount of time”*; and *“I put less time into travelling to campus because of the computers”* (means of 1.5 and 2.18 out of 4) whereas cluster GROUP/+HOT agreed with both statements (3.29 and 3). Cluster SELF/+HOT, however, slightly disagreed with the first statement (2.33 out of 4) and agreed with the last (3.29 out of 4).

Further, while the clusters SELF disagreed that they were able to learn more in a shorter period of time (and had scores of 1.5 and 2.3 respectively), participants who preferred group-work (GROUP) agreed or strongly agreed with this statement (3.29 out of 4). It is quite ironic that despite of this, students from the cluster GROUP/+HOT reported to have spent the most time on the course (8.38 hours/week) while participants from cluster SELF/-HOT, who disagreed that using tablets reduced their study time, reported to have spent the least time studying for the course (6.54 hours/week). Cluster SELF/-HOT was also found to be significantly different from the other two clusters in agreeing that they had to spend more time to learn the same amount or that they missed important information because of using technology in

the course (scores of 2.23* and 2.42* respectively)¹⁴ as compared to the other two clusters, who perceived tablet computers as helpful. It is also interesting to mention that those students who preferred group-work disagreed with both statements having the scores of 3.11* and 3.25* respectively). Again, it is quite peculiar that students from cluster SELF/-HOT, despite of agreeing that they had to spend additional time to learn the same amount and that they missed important information because of using technology, reported to have spent less time a week on the course than the other two groups.

Further, a one way ANOVA was computed to establish if there were any differences between the clusters regarding their overall enjoyment of the course. A Scheffe test indicated that clusters SELF/-HOT and GROUP/+HOT were significantly different. In other words, those participants, who preferred group-work and perceived tablet computers as very effective, reported to enjoy the course much more (3.75 out of 4) than those who preferred self-study and disliked the computers (2.31 out of 4), and slightly more than cluster SELF/+HOT (3.25).

ANOVA and Scheffe tests were also run to establish if the clusters were different in their feeling at a disadvantage because of not possessing adequate computer or typing skills (DIS). The results did not demonstrate significant differences between the clusters in respect of the aforementioned DIS measure and showed that participants from all three groups had very similar highly positive scores of 3.48*, 3.55*, and 3.61* (out of 4), all of which represent values between “Disagree” and “Strongly Disagree” on the inverted Likert scale and indicate that both groups of language students perceived their computer literacy as adequate if not high.

Similarly, all three clusters gave positive responses to the items regarding the effects of technology on the writing process (*because of the way this course uses technology, how likely were you to: ... make*

¹⁴ These statements are negatively phrased and therefore, Likert scores associated with them have been reversed. I.e. the value of 1 represented the answer “Strongly Agree”, and value of 4 stood for “Strongly Disagree”. Here and later such reversed scores are marked with asterisks.

major changes in a draft of an assignment; ...produce one or more versions of an assignment before producing the final product; and It was easier to combine written work by more than one person into a single document). The scores for the first two questions ranged between 3.38 and 4.38 (out of 5) and 3.46 to 4.5 (out of 5) respectively, which represents answers between “Somewhat more likely” and “Much more likely”. The last item was ranked on a four-point Likert scale and also received highly positive scores between 3.08 and 3.88, which represents responses between “Agree” and “Strongly Agree”.

Further results from the ANOVA indicated that the three clusters were significantly different with respect to their perception of the wireless technologies and electronic communication in the course. While Cluster SELF/-HOT disagreed that *Because of the way this course uses Electronic Communication: I put more thought into my comments* and *...I felt more comfortable asking an awkward question* giving both the scores of 2.45 and 2.00 out of 4 respectively, cluster GROUP/+HOT perceived using electronic communication positively, giving both statements higher scores of 3.25 and 3.14 out of 4. Responses of Cluster SELF/+HOT were generally positive but not as pronounced as those of GROUP/+HOT (2.86 and 3.11 respectively).

Despite such differences between the clusters, electronic responses to posted questions were rated positively by all three clusters with cluster SELF/-HOT giving the lowest score of 2.75 out of 4, cluster GROUP/+HOT the highest score of 3.50 and cluster SELF/+HOT occupied the middle position with 3.11. Using wireless network and electronic communication also was not found to have negative effects on the way participants related to each other. The lowest score in this category of statements again belongs to cluster SELF/-HOT, who gave the statement *Because of the way this course uses Electronic Communication: It was difficult to relate to the other students in this class* the score of 2.62 out of 4 (which represents a value slightly towards “Agree”) and the statement *Compared to another course relied primarily on face-to-face interaction, because of the way this course was set up, how likely were you to: ...feel isolated from other students* the score of 3.00 out of 5 (which represents the response “About the same”).

Analysis of the perceived effects of using online discussion boards (*I learned from contributions other students made in discussion boards*) showed significant differences between the clusters ($p=0.000$). Scheffe test, once again, confirmed that Clusters SELF/-HOT and GROUP/+HOT were significantly different, as the former disagreed with this statement giving it a low score of 2.08 and the latter agreed giving it 3.50 out of 4. Cluster SELF/+HOT wasn't found to be significantly different from either group having a score of 2.75. However, despite such range in the perceived effectiveness of the online discussion boards, participants from all three clusters reported to like the online discussion boards - the score for the statement *I liked using the online discussion boards* ranged between 3.00 (SELF/-HOT) and 3.62 (GROUP/+HOT) out of 4 and generally disagreed with the statement *Because of the way this course uses Electronic Communication: I hardly ever participated in discussion boards* (score range 2.78* - 3.50*). Also, a Scheffe test did not find significant differences between the clusters in responses to the question *How often did you post your question in German rather than English?* Which received the lowest scores of 1.62 (GROUP/+HOT), 1.92 (SELF/-HOT) and 2.11 (SELF/+HOT), all of which represent values between "Never" (1) and "About once a week" (3).

Finally, a linear regression equation was computed to establish if there was a correlation between the students' preference for self-study or group-work and their overall perception of the helpfulness of the tablet computers. In the equation, the statement *I preferred self-study to group work* was used as an independent variable and HOT functioned as the dependent variable. The results revealed that there was a statistically significant correlation between the two items ($p<0.013$, $F=7.04$) and that a change in 1 point on the Likert-scale in the self-study/group-work statement would result in a reduction of 0.448 in HOT ($\beta=-0.448$). In fact, as much as 20.1% of variance in the overall perception of helpfulness of tablets could be attributed to the students' response to the self-study or group-work statement.

5. Discussion

The results of the analysis indicate that implementation of the tablet computers together with the learning designs and computational learning objects in the course was generally successful and had numerous

positive effects. Thus, tablet computers contributed to the students' enjoyment of the course, made the course more interesting to more than half of the group, and encouraged sixty percent of the participants to study more. Further, heavy use of technology throughout the course did not make the overwhelming majority of students feel at disadvantage because of their typing or computer skills, which is evident from the very high mean of the *disadvantage* measure (3.54* out of 4), which represents a response slightly higher than the middle point between "Disagree" and "Strongly disagree" (with feeling at disadvantage). This outcome might not sound remarkable today, but indicates a great shift in the comfort level of populations of language students over the last ten to fifteen years. Students fifteen years ago—or even more recently—might have also enjoyed computer-based activities in the language classroom as has been reported frequently, but would not have been as comfortable with tasks which require some level of computer literacy and keyboard skills. Finally, while use of technology in the course was not perceived to have saved students' learning time (only twenty-eight percent of all students felt that they were able to learn more in a shorter period of time), it did not cause significant loss of time either. This is confirmed both by the observations of research assistants and the participants themselves who generally disagreed or strongly disagreed that they had to spend much time to learn how to use the tablet PC (76.6%), to connect to a wireless network (83.3%), or that they had to spend more time to learn the same amount (74.4%).

Furthermore, the tablet computers turned out to be quite popular among the participants as more than half of the students reported to have used them for course work not related to German 203 all the time and the same number (53.3%) used them at home three or more days a week. A slightly higher number of students (66.7%) carried them to campus three or more days a week. Nevertheless, none of the students frequently used special features of the tablet computers, such as digitized pens as a pointing and clicking device, handwriting recognition, or ability to take notes or to make comments in existing documents. The fact that all students preferred a touchpad to a pen-like pointing device may be attributed to the newness of the last at the time of the project, and may possibly indicate that most participants' typing abilities were at least on par with if not exceeded their handwriting skills. The last assumption in conjunction with the fact that handwriting recognition feature for German was not available

at the time of the project, seem to provide a sound explanation for the lack of popularity of the other special features tablet PCs offer.

The individual student's preference to learn languages alone or in groups together with their overall perception of tablet computers—a factor central to our project—were inversely related to each other and had a significant influence on a number of important aspects of the course: A general tendency was discovered that those participants who had a negative attitude towards the two key aspects of the course, i.e. most strongly preferred self-study to group-work and found the tablets to be the least helpful, had a much more negative impression of the course in general and various effects of technology in it. For example, such participants did not feel that technology allowed them to save time travelling to and from campus or to reduce learning time (despite of spending less time on the course per week than the other participants) and they did not find electronic communication, wireless technology, or discussion boards beneficial for language learning. On the other hand, those participants, who were comfortable with both key aspects of the course, i.e. preferred group-work and found tablet computers helpful, enjoyed the course much more, and generally had a significantly more positive impression of the course and the technology used. For instance, these students felt that technology allowed them to save time travelling to and from campus as well as to reduce learning time (despite spending more time on the course per week compared to the other students), and saw electronic communication, wireless technology, and electronic discussion boards as useful. The remaining students, who preferred self-study to group-work and found tablet computers useful, occupy the middle position having generally a somewhat more positive attitude toward most aspects of the course and technology in it than the SELF/-HOT group but not as pronounced as the GROUP/+HOT cluster.

It is particularly striking that despite such significant differences in opinions, especially between cluster SELF/-HOT and GROUP/+HOT, a number of aspects received very similar evaluation by members of all three groups. For example, all participants regardless of their stance toward the two key variables, perceived technology to have a very positive effect on the writing process and found electronic responses to questions posted online helpful. At the same time, technology was reported by all

participants not to have any positive effects on helping them post, ask or formulate questions to their peers in the target language. Also, it is quite peculiar that although most activities required electronic rather than face-to-face communication, 56.7% of students felt less isolated from other students compared to a course without electronic communication, and 70% of participants disagreed or strongly disagreed that technology made it difficult for them to relate to other students in this class. This outcome is especially important for language learning as it shows that integrating technology and means of electronic communication in a language course do not negatively affect student-student relations and do not endanger interaction between them.

6. Conclusion

Our study has shown that the introduction of modern technologies into a language course at the university level is perceived rather positive by students and has numerous positive effects both on students' perception of the course and on the learning process. Moreover, wireless technology turned out to be especially effective for producing and editing written texts, and was found not to isolate students from each other or to affect students' ability to relate to each other. Further, while students' perception of technology was generally rather positive, their attitude towards group-learning was found to be a major factor influencing their perception of the technologies and the general learning design. An inverse relationship between students' preference of self-study and their attitude toward various aspects of the course including technology was discovered. Our finding is in line with results of earlier studies of group work in writing classes. Storch (2005), for example, states in her discussion of collaborative writing reports "when I ask students to work in pairs (or in small groups) on tasks which require written output, some students seem reluctant to do so. They seem to prefer to complete such tasks individually" (p. 166). An impression that was also borne out by her post-task interviews with students.

The course has been offered once a year since and we are currently exploring the use of these resources as well as of some of the learning designs in a distance education version of this course.

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