THE EFFECTIVENESS OF WEB-BASED INSTRUCTION IN EDUCATING TEACHERS - A QUASI-EXPERIMENTAL FIELD STUDY

Taher Farahat & Hermann Astleitner[*)]

The purpose of this study was to investigate the effectiveness of web-based instruction (WBI) in preparing teachers for integrating students with special educational needs in regular schools. Forty teachers (teacher students) were incorporated in a quasi-experimental field study which was embedded within a course on special education at the Salzburg Academy of Education. Two versions of the course were produced: The first version was provided to the control group by a face-to-face setting, and the second was provided to the experimental group by the Blackboard-e-learning-system. The effectiveness of WBI was tested based on students´ achievements, students´ motivation, and students´ attitudes towards WBI. Three instruments were created and used to collect data: An achievement test, a motivational scale and an attitude test. The results suggested that using WBI maintained students´ motivation during the studying period. Students´ attitudes towards WBI changed positively but insignificantly. The students of the experimental group outperformed the face-to-face group in a test of theoretical knowledge, whereas the face-to-face group surpassed the WBI-group in regard to the acquisition of practical skills. Furthermore, the more positive attitudes and the higher motivation the students showed, the more achievement they got of the theoretical knowledge in comparison to practical skills. Finally, practical implications, methodological and theoretical problems are discussed.

1. Special educational needs, teacher education, and web-based instruction

A child has special educational needs (SEN) if it has a learning difficulty which may be a result of a physical or sensory disability, of emotional or behavioral problems, or of development delay. Students with SEN are within the focus of a continuum of educational settings and strategies. The segregation strategy is placed at one end of the continuum and at the other end the more often propagated integration strategy is placed. The effective integration of children with SEN in classrooms requires teachers who are highly skilled and sensitive to the needs of their learners. Those teachers must have skills such as identifying a student´s special needs, gathering a range of information about the student´s behavior and judging the students´ capacities to learn which contains some minor skills such as: identifying the students´ specific weaknesses and strengths, adapting the materials and rewriting the objectives for the student´s needs, etc. In spite of the importance of the skills that enable teachers to integrate pupils with SEN into regular classes successfully and in spite of the growing movement within the national systems towards the integration provision, the literature ensured that there is still a lack of well-prepared teachers for the integration system (e.g., Wetzel, 2003). Also, many mainstream class teachers express feelings of inadequacy and incompetence coupled with the feeling of done nothing. Hence, leaders in special education emphasized on the importance of training to rehabilitate regular teachers and to help them acquire specific competences that are necessary for integrating students with SEN into regular school settings.

The initial training for teachers to integrate students with SEN in classes is established in most countries through traditionally offered courses or programs at universities. However, traditional training encounters some considerable barriers such as: (a) the special needs of the

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trainees to work and study at the same time; they need to determine the suitable time for their studying, study at their own pace, and control the learning process; (b) the distribution of training centers that are usually located in urban areas and therefore those who live away from these centers are deprived of the training service; (c) the high costs of providing traditional training classrooms that could incorporate large numbers of trainees; and (d) the limited number of competent trainers (see Astleitner, 2002).

Accordingly, these barriers reduce the quality and availability of traditional training. To overcome these barriers, educators turned their concerns towards investigating the capabilities of distance education in training teachers. According to recommendations of the European Community, using the web resp. the Internet should be a strategy to improve the quality of the conventional training by realizing distance education. Concurrently, as information technology comes into greater use, distance education courses and training programs are offered through the web and are called "web-based instruction" (WBI). Some institutions consider WBI as a way to meet the needs of students, to reduce the costs and to improve the quality of training programs, to increase the availability of the training programs, to break down the time and geographical barriers, and to overcome the problem of incompetent trainers.

In a study with full time teachers, Schlough and Bhuripanyo (1998) used Asymetrix Tool Book II instructional software to deliver a course on task analysis. The findings revealed that nearly 80 percent of the sample preferred traditional classroom instruction and not WBI. However, the web was considered as a viable way to deliver teacher education instruction to the students at remote locations. Lan (1999) incorporated WBI into two educational technology courses for pre-service teachers. The results indicated that learning shifted from teacher-centered-lecture-driven to learner-centered-self-regulated-driven. Using WBI in the field of preparing teachers for special education was also examined within a project that offered two online courses to develop the skills of in-service teachers who worked with children with special needs. The first course addressed topics such as: writing goals for home visits on individualized education plans, developing individualized family service plans, and planning, scheduling and preparing for home visits. The second course addressed topics from the first course, but additional topics, such as: incorporating technology, and assessing the child using technology for learning. The data from the first course showed essentially no differences from pre-test to post-test in either attitudes or knowledge, but data from the second course showed substantial positive changes in both attitudes and knowledge (Ludlow, 2002). Andrews (2002) investigated the use of WBI in preparing general education for the integration of students with SEN into the traditional classroom. The participants were 40 pre-service teachers who all had prior instruction and experience in developing teaching units and lesson plans. The participants received a four-week traditional instruction which included basic knowledge and guided practice about learner characteristics and needs of students with disabilities. After that the participants shared activities between web and classroom settings to reach the course objectives. The results showed that WBI was found to be a powerful tool for linking theory and knowledge to practice in teacher education.

Based on these results, the following questions should be answered within this study: A) Is WBI as effective as traditional instruction in teaching a course in special education for teachers in pre-service settings? B) Does the WBI influence learners´ motivation? C) Does the status of students´ motivation before starting studying a web-based course affects their achievements? And D) Does studying a web-based course change students´ attitudes towards WBI? Based on previous studies, it is assumed that WBI is as effective as traditional instruction, also that WBI enhances students´ motivation, that studying a WBI course improves students´ attitudes towards WBI and that the more positive motivation and attitudes students have towards WBI, the higher their achievements are (Astleitner, 2003a).

2. Method

2.1 Creating the online course

The process of creating the online course for the current study consisted of the following steps (see Horton, 2000):

1. Determining the course content: The content of the course was general special education. This course was offered as an obligatory course for the students who study in the first semester in Salzburg Academy of Education.

2. Specifying the course elements: The course elements consisted of: handouts, PowerPoint presentations, lecture notes, assessments, and discussion topics. Also, the knowledge needed for the students to meet the objectives was determined.

3. Making the course outline: A comprehensive outline was made for each course element, material, and lesson.

4. Creating the course structure: The course structure consisted of four units: mental retardation (MR), learning disability (LD), assessment and evaluation, and teaching the academic skills for MR and LD pupils. Each unit included some practical activities and assignments.

5. Determining the suitable ways to deliver the course materials:

A. The online materials were: The course guide and four units which were presented as texts. Each unit included a list of measurable objectives, the specific knowledge that matched with the objectives and a variety of practical activities such as: (1) the students designed and produced the instructional materials that suited MR or LD students, (2) the students used the produced materials to teach MR or LD, and (3) the students designed and used assignments.

B. Face-to-face meetings were determined for two times: The first meeting was established before the course started and it was set to give the students an overview for the course. In this meeting, the students were instructed how they could log in the course, navigate the content, collaborate with each other and with the instructor online, and how to log in the assessment tasks and submit these tasks. The second meeting was established at the middle of the course time to discuss troubleshooting and common problems that were too difficult to be discussed online.

6. Putting the course online: The international Blackboard system (URL http://www.blackboard.com) which represents a web-based integrated classroom management system was used to offer the course online.

7. Planning to motivate students to collaborate and interact: Some of the tactics that matched with the ARCS-model from Keller (1999) were considered to stimulate and sustain students´ motivation. These tactics were distributed on the four motivational constructs which are attention, relevance, confidence, and satisfaction. For example, in order to stimulate the relevance of the course content, the presented knowledge was related to the needed skills for teachers of students with SEN. Students were also asked to relate the presented knowledge to their future roles as teachers of students with SEN. Also, attractive resources and external web-sites related to the course content were provided.

8. Adding the staff information: Some information about the instructor and his assistant such as the names, positions, telephone numbers, office hours, and e-mail addresses were added.

9. The announcement: It directed the students to the course information. A welcome message was posted to each student as an announcement at the beginning of the course.

10. Evaluating the course online: The instructor previewed the course materials by navigating each link and proofreading the contents. Then, the course became available online. A blackboard account was created for each student. The ID and password were sent to every student.

11. Starting the course: The students were invited for the first meeting on September, 15th, 2002. They started studying the course online in the first week of October 2002 and finished the course after eight weeks of studying.

2.2 Participants and design

40 undergraduate students (4 males and 36 females with an average age of 21 years) from the Academy of Education in Salzburg participated in this experiment. The sample was randomly chosen from the students who were registered in the introductory course of special education in the winter semester 2002/03. The study was based on an incomplete quasi-experimental pre-post-test-design with two groups. The students were assigned randomly to two groups. The first group (control group, n=20) studied the course within a traditional classroom situation. The other group (experimental group, n=20) studied the same course via WBI by using the Blackboard environment and related resources. There were two main tests: A pre-test at the beginning of the course and a post-test at the end of the course in which the dependent variables were measured (i.e., attitudes towards WBI, motivation, and achievement). Achievement was only measured at the post-test because the students were for the first time confronted with the content of special education. So, there were no pre-test differences, because all groups of students had no knowledge in the field of special education. Attitudes towards WBI and motivation were measured within the pre- and the post-test, but only for the WBI-group, because only within this group, attitudes and motivation were of research interest. Within the traditional classroom group, attitudes towards WBI were irrelevant, because they did not have the WBI-experience. Motivation was considered to be critical for WBI-students and not for students in the traditional classroom because of past experiences when teaching this course.

2.3 Instruments

Three instruments were created and applied within this study: A scale for measuring attitudes towards WBI, a motivational scale, and an achievement test.

Attitudes towards WBI. The measurement of the attitude towards WBI (AWBI) consisted of 10 items distributed on a four-point-Likert-scale (from strongly agree to strongly disagree). The measurement included the following items: "studying via web sets me free", "studying via web is a new experience that I hope to pass through", "I have the desire to study via web", "studying via web is interesting", "I am worried about studying via web", "learning via web is not enough to succeed", "learning via web needs teacher´s help", "learning via web is not a safe adventure", "I (will) feel frustrated when studying via web", and "traditional learning is safer than studying via web". Items reached high reliability (Cronbach´s Alpha: 0.78 (for pre-test) and 0.77 (for post-test).

Motivational Scale. A motivational scale (MOTS) was created to measure students´ motivation before and after studying the course. The motivational scale consisted of 29 items and reached high reliability (Cronbach´s Alpha: 0.91 (for pre-test) and 0.86 (for the post-test)). The items were distributed under four subscales that matched the ARCS-model from Keller (1999). The attention subscale included seven items like "using visual cues and colors in some parts of the content directs my attention to important points", or "I didn't give my full attention in studying this course all the time". The relevance subscale contained six items like "the course content goes with my academic expectations" or "the course content is close to my future job". The confidence subscale includes eight items like "the possibility to meet the peers helps me to handle course problems" or "clear objectives at the beginning of each section make me confident in reaching these objectives". The satisfaction subscale consisted of

eight items like "I am satisfied to receive immediate feedback for my answers on the quizzes" or "organized meetings with the course staff are useful in solving course problems". All items were presented in a four-point-Likert-scale (from strongly agree to strongly disagree).

The achievement test. An achievement test was created from 30 items to assess students´ achievements (TOTSCA). The items were equally distributed on two parts: The first one included items that assessed students´ acquisition of the theoretical knowledge (THEOA) and the second part included items that assessed the application of the theoretical knowledge in practical situations (PRACA). The THEOA-test showed low consistency (Cronbach´s Alpha: 0.44) because of high heterogeneity of the problems to be solved by the students. The test contained, for example, the following questions: "1. An educational classification of MR depends on (a) the individual performance level on a valid and reliable intelligence test, (b) the individual´s aptitude and their ability to learn, (c) the individual´s performance on an adaptive behavior scale, or (d) the individual´s performance level on a valid and reliable test with taking into consideration the individual´s aptitude and ability to learn." or "2. Individuals with written language difficulties have specific characteristics such as: (a) difficulties in speaking correctly, (b) difficulties in following oral or written directions, (c) problems in spelling, or (d) problems in decoding. The PRACA-test showed acceptable reliability (Cronbach´s Alpha: 0.72).

3. Results

3.1 The effectiveness of WBI vs. traditional instruction

To investigate students´ achievements in both the experimental group and the control group, an independent-sample t-test was conducted for post-test measures of TOTSCA, THEOA, and PRACA. It was assumed that there are no pre-test differences within the measures because the students had no prior knowledge in respect to the content of the course (special education). The results revealed that the performance of the experimental group on the TOTSCA surpassed slightly, but not significantly, the performance of the control group ($t(38) = 0.749$, $p=0.228$). There were significant differences between the performance of the experimental group on THEOA ($M=33.3$, $SD=5.56$) and the performance of the control group ($M=28.7$, $SD=4.34$) ($t(38)=2.901$, $p=0.003$) in the favor of the experimental group. For PRACA, the control group ($M=27.4$, $SD=5.35$) outperformed the experimental group ($M=24.9$, $SD=4.75$) ($t(38)=1.595$, $p=0.058$). Overall, WBI and traditional instruction did not differ in their effects on achievement, but the WBI-group showed higher theoretical knowledge and the traditional-instruction-group showed higher practical knowledge in comparison with the other group.

3.2 The influence of WBI on students´ motivation

To examine the influence of WBI on students´ motivation, a paired-sample t-test was conducted to compare students´ motivation before (MOTB) and after (MOTA) studying the WBI-course. The results illustrated a weak, but not statistically significant increase in students´ motivation after studying the WBI-course ($M=83.6$, $SD=11.3$) in comparison to their motivation before studying ($M= 81.2$, $SD= 9.5$) ($t(19)=8.48$, $p=0.204$). Although these results are not sufficient enough to assume that WBI increases students´ motivation, these results lead to the conclusion that WBI maintain students´ motivation during their studying.

3.3 The relationship between students´ motivation and their achievement

A Spearman rank order was correlated to explore the influence of students´ motivation before they started studying a WBI-course as a predictor for their achievement after studying the WBI-course. Within the results, one can notice a significant and positive correlation between the status of students´ motivation before studying the WBI-course (MOTB) and their performance on the achievement test (TOTSCA) ($r=0.527$, $p<0.01$). Also, the correlation between students´ motivation before studying the WBI-course and their performance on THEOA was positive and significant ($r=0.505$, $p< 0.05$), however, it was not significant with students´ performances on PRACA ($r=0.105$, $p>0.05$). Overall, results suggest that motivation before starting a WBI-course is important for learning outcomes, especially for theoretical knowledge which is not always motivating students as strong as practical knowledge can do.

3.4 The effects of WBI on students´ attitudes

A paired-sample t-test was used to investigate the influence of studying a WBI-course on students´ attitude towards WBI. The results revealed that students´ attitudes before studying the WBI-course ($M=22.8$, $SD=4.24$) did not differ from those after studying ($M=23.6$, $SD=4.11$) ($t(19)=.688$, $p=0.250$). So, using WBI had no positive, but also no negative effect on attitudes towards WBI.

3.5 The relationship between students´ attitudes towards WBI and their achievement

A Spearman correlation was used to investigate the influence of students´ attitudes towards WBI before starting studying the WBI-course on their achievement. The results showed that there is a significant positive correlation between attitudes towards WBI and TOTSCA ($r=0.515$, $p=0.01$) and between attitudes and THEOA ($r=0.491$, $p=0.01$), but a non-significant correlation between attitudes and PRACA ($r=0.045$, $p=0.43$). These results are similar to those found with motivation.

4. Discussion

Results from this study suggest that WBI is - at least - as effective as traditional instruction in the field of teacher education. This result corresponds with similar findings (for a comprehensive review of WBI-effectiveness, see Astleitner, 2003a). WBI produced better achievements in theoretical knowledge, but lower achievements in practical knowledge in comparison with traditional courses. However, this disadvantage of WBI can be compensated when especially practically relevant exercises are integrated within the course. Also, within offline-phases, such practical problems should be handled comprehensively. Although WBI uses a technically driven environment, positive motivation and attitudes towards WBI were not decreased. So, based on the results of this study, it can be concluded that no major negative motivational and attitudinal effects can be expected by integrating WBI in the field of teacher education. Based on the results of this study, using WBI can be recommended for teacher education, at least for introductory courses in which basic knowledge is acquired.

However, this conclusion is only true for carefully designed WBI-environments in respect to educational or psychological matters. For courses with a strong focus on applying knowledge in practically relevant situations and for courses not delivering the major instructional events (motivating, stating objectives, relating to prior knowledge, presenting content as self-instructional texts, providing tasks with feedback, guiding self-regulated learning, and assuring learning transfer) WBI cannot be recommended for teacher education (see Astleitner,

2003b). The implications from this study are also limited due to methodological problems. The sample size was small and only one particular WBI-environment (i.e., Blackboard) was used to deliver instruction what causes problems for transferring these results to other contexts of teacher education. There were no measures for the validity of the findings and no complete research design in which all dependent variables were measured for pre- and post-tests. As dependent variables were correlated, also a multivariate analysis of the data should have been undertaken.

The major problem within WBI and teacher education represents a theoretical one: A model of WBI-learning has to be developed. Within this model, it could be assumed that human characteristics together with technology and course attributes represent important conditions for WBI. Individual learners, groups of learners, instructors, instructional systems, and learning materials realize - based on human characteristics, technology, and course attributes - instructional events which support learning. Instructional events influence motivational, cognitive, and emotional processes of a learner. These processes lead to certain learning outcomes. Learning outcomes themselves influence student characteristics and learning processes in an iterative process. Within the variables of human characteristics, gender, cultural habits, pre-knowledge, pre-skills, and attitudes are distinguished for individual learners, groups of learners, and instructors. Technological aspects concern visual/auditory input, access, usability, reliability, and using tools like computer-mediated communication (CMC), or assessment and management capabilities. Course attributes refer to subject area, level (e.g., basic or advanced), and organizational context (e.g., considering professional duties of learners). Instructional events (from motivating to enhancing retention and transfer) are based on group-, instructor-, system-, and material-related activities. Instructional events influence motivational processes (i.e., goal setting and action control), cognitive processes (i.e., attention, processing with searching, organizing, and integrating information, storage, or monitoring), and emotional processes (consisting of positive feelings like sympathy or pleasure and of negative feelings like fear, envy, or anger). These processes produce learning outcomes which are cognitive (knowledge and skills), motivational (interest and persistence), and/or emotional (satisfaction). Future WBI-research should develop such a model and produce empirical research which is closely related to this model.

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