

TEMPLATES FOR ONLINE TEACHING

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ABSTRACT

To date, most uses of the WWW for teaching and learning use either: proprietary communication packages which support resource distribution by the web and communication via email; or simply publish course content and student instructions as web pages as a means of delivering information to students and then offer to answer queries by email. What is missing in many cases is an instructional design that relates the materials offered to a planned process of teaching and learning. The dynamics, flexibility and communicative richness of the face-to-face classroom are mostly not supported by these packages and hence the teacher/learner and learner/learner interactions are reduced to little more than messaging.

The authors have delineated a number of common and effective teaching strategies used in classroom teaching and have developed software to support online correlates of these strategies. The software, WebTeach, was originally employed in the flexible delivery of a postgraduate program in Higher Education. It represents an attempt to model a range of sound pedagogical approaches and to ease the transition to the online learning environment for both teachers and students. The current version of WebTeach supports templates for discussion, brainstorming, class quizzes and task setting among others.

To date, the authors and colleagues teaching within the Masters of Higher Education programme have successfully used a number of the templates to support group interactions, and the software is now being trialed in other disciplines at UNSW in a number of innovative ways. On the basis of this trialing, WebTeach is being developed to incorporate more strategies such as case studies, debates, role-plays and small group work. This session will demonstrate the current version of WebTeach, provide examples of its use across a range of disciplines, and include discussion of the benefits of structured interactions in the online classroom.

KEYWORDS

Internet, online, instruction, interactive, design, software, university.

1. INTRODUCTION

Teachers beginning to teach in online environments such as the Internet bring with them a well-developed and sometimes highly refined knowledge base for teaching, together with skills in facilitating a range of methods for classroom teaching. Most also derive some satisfaction from their classroom efforts and look forward to similar rewards in the new environment. This is not to say that all classroom practice is good – far from it. But good practice can and does occur in the classroom, and this benchmark should not be lost in the transition to the online environment. However, few online teaching systems allow much of this knowledge and skill to be utilised. If teachers could have access to tools, processes and teaching methods that are equal to or better than those they use in the classroom, and if these

tools could support both the transfer of familiar methods to the new environment as well as the development of new possibilities, then the ongoing commitment of teachers (and students) could perhaps be won. The Internet clearly does offer new possibilities, but linking these to the existing knowledge and skill base of teachers is a problem. This paper looks at some of the key elements of teachers' knowledge and skill base and considers how these elements might be supported in web-based instruction. It also reports on the initial approaches and experiences of teachers, from a range of disciplines, in using a prototype package designed to support their transition to the new environment.

2. CLASSROOM TEACHING

There is a huge literature on classroom teaching and on the knowledge and skill base which underlies its successful performance. Most teachers at all levels, but especially in higher education, access little of this literature directly. However they do develop techniques and methods which are ultimately based on the research evidence and underlying philosophies (e.g. constructivism and experiential learning). Thus getting students actively involved in classroom activities, and involving them in discussion, debate, and reflection on their experiences (and that of others) is generally accepted. Of course the general approach, together with the range of specific methods or techniques selected to form the educational design will depend upon the desired educational outcomes. Experience has shown that successful instructional designs differ across the disciplines. There are methodological 'traditions' and established knowledge bases for the teaching of most content areas. Design frequently uses studio methods; Law and Management tend to favour case studies and the Physical Sciences often use practical laboratory work as commonly accepted methodologies.

John Biggs (Biggs, 1996; Biggs & Collis, 1982), in his work on the SOLO taxonomy and on constructive alignment, suggests that learning outcomes can be placed along a continuum of cognitive complexity from simple recognition (prestructural and unistructural) to reflection and hypothesis making and testing (extended abstract), and can be promoted through the careful selection and assessment of learning activities. It is often appropriate that a teacher seeks outcomes at a range of levels from factual memorising through to abstract hypothesising according to the content and level of study involved. To achieve this the teacher draws on a range of teacher and student controlled activities and interactions. Thus a simple lecture or handout may be used to present new content, with a question or quiz for revision, and these activities may promote unistructural outcomes such as the recognition and retention of factual knowledge. Discussion, debate, project work and problem-based techniques demand deeper engagement with concepts and theory and can be used to promote higher order relational and extended abstract outcomes (Biggs & Collis, 1982). Good teachers choose forms of activity to suit the outcomes they are trying to promote, and the format or conduct of these activities is familiar and accessible to both the teacher and student. If the expectations of particular activities are not understood the teacher usually takes some time to teach the student what they need to know in order to be able to participate. While the connections are not always understood in detail, there is confidence that the processes are grounded in accepted educational theory. Eventually, the designed lesson is delivered to the live group within the complex dynamic of a classroom and, if properly designed, it works to facilitate the desired learning outcomes.

Underlying the successful instructional design are fundamental characteristics of face-to-face teaching that enable the process. Successful instructional design manipulates a range of parameters to facilitate learning:

- 1 control of timing (stop, start, allotted times)
- 2 flexibility of structure (changing methods in response to situation)
- 3 variety of activity and format (large and small groups, student initiated events)
- 4 dynamics (active > passive)
- 5 variety of interaction (teacher/student, student/student, one-way, two-way)
- 6 variety of tenor (formal > informal)

- 7 access to presentation technologies (whiteboard, OHT)
- 8 access to external resources (readings, libraries and facilities)

These qualities are the elements from which the chosen instructional design is built and are mostly transparent to both teachers and learners, as they have been conventions since childhood. However, their importance becomes more apparent when teachers begin to design mediated instruction using technologies such as the Internet.

Many common classroom methods involve forms of one-to-one and one-to-many communication and many writers highlight the importance of communication to effective educational design. Communicative interaction between people (to distinguish this form of interaction from human-machine interaction) is at the heart of most approaches to teaching in educational settings at all levels, and in adult education (Brookfield, 1986; Heron, 1989; Laurillard, 1993). Both the 'constructivist' approach to the design of learning (Jonassen, 1991; Rieber, 1993, 1994) and the research on student approaches to learning (Marton & Saljö, 1984; Ramsden, 1988, 1992) emphasise that active engagement with content and opportunities to interact with teachers and peers are essential elements for deep learning (Gibbs, 1992). It is apparent that despite the efficiency of Internet resources such as email, HTML and FTP to deliver messages, the delivery of messages, in itself, is not sufficient to ensure learning.

One needs to return to sound classroom instructional design to identify those instructional events that may be replicated on the Internet along with the conventions and structures associated with their use. One then needs to go beyond these to consider possibilities offered by the new media, which are not available in the classroom. But first things first. The most important issue facing flexible programs is the establishment of sophisticated and effective communication modes and the support of at least a basic set of familiar techniques.

Classroom designs employ a range of techniques to support outcomes: presentations, questioning, brainstorming, discussions, quizzes, debates, project work and so on. Some of these techniques are implemented in such a way as to enhance known psychological processes which aid learning – a good example of this is the imposition of a 'wait time' in questioning routines (Tobin, 1987). Likewise, brainstorming is conducted so as to place the major emphasis on content and not on the contributor, discussions are conducted so as to facilitate participation and the free exchange of opinions, etc.

3. INTERNET TOOLS FOR TEACHING

The standard Internet communication tools available to support asynchronous educational communicative interaction – email, news groups and bulletin boards – offer greatly improved communication to traditional distance and flexible education. However basic, and despite the limitations of text and asynchronicity, these tools are nevertheless capable of supporting much enhanced interactivity. Never before have such flexible and efficient communication tools been available to teachers. They are widely accessible using standard desktop computers and phone lines, and create ongoing, asynchronous, distributed communication rather than the one-off electronic groups typical of videoconferencing and teleconferencing, and at a fraction of the cost. The rapid deployment of the Internet also means that these tools can support educational programs on a global scale, a possibility only dreamed of a decade ago. In response to the possibilities for enrichment these tools raise, teachers all over the world have worked to harness the potential for their educational purposes (Paulsen, 1995; Romiszowski & de Haas, 1989; Updegrave, 1991). Thus the tools, or close variants of them, are the 'bread and butter' of communication in Internet-based educational programs, and they have been incorporated into most commercial applications designed to support distance and flexible education. Examples include Lotus Learning Space™ and TopClass™.

The typical process for transferring existing courses to the Internet involves the conversion of classroom resources, such as OHTs, handouts, readings, schedules, assessment tasks etc., into HTML (Hypertext Markup Language) and placing them on an Internet server accessible to learners (Figure 1). The class may also offer email as a channel to facilitate two-way interaction.

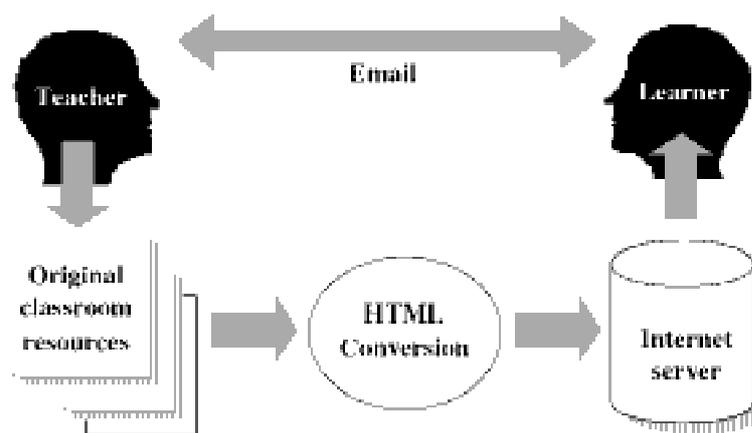


Figure 1: Simple conversion of existing material for WWW delivery

In this conversion process, a subject whose classroom form may have used a range of resources within a sound instructional design involving complex and public two-way teacher and student interactions, group work and dynamics, becomes reduced to the transmission of content, with any student responses or questions, if any, being invited by email, phone or fax. The latter are sometimes conducted in private between the teacher and student involved. Some designs make use of listservs, newsgroups or bulletin boards for group communication. Whatever the facilities provided, teaching online is often like teaching by passing messages under a metaphorical classroom door.

If the online design uses proprietary server/client systems such as Learning Space™ or TopClass™, the students are given individual folders equivalent to an email account and the interactions are again supported with group bulletin boards, and automatic notification of messages. The class can also be configured into small groups. In these cases, the teacher knocks on the metaphorical door before passing the message under it, and there may be more than one student waiting on the other side.

However, despite the relative enthusiasm, the richness of communicative interactivity enabled by the standard Internet tools is actually very poor when compared to that of the average classroom. The restriction to text, while bringing some advantages, removes from the communication many of the linguistic and extra-linguistic features of face to face communication. In plain text there is no intonation, no body language, no facial expressions, no accent, no speech rhythm, no proxemics, no pictures, no images of other(s) and so on. Attempts at incorporating some of these features (for example with the ‘emoticons’ of email :-) :- (;-(etc.) are usually clumsy and inadequate, although the attempt itself speaks of the common view that the medium is significantly impoverished. In fact, none of the immediacy and subtlety upon which most established classroom conventions are built can be approached by the medium.

The impoverishment has effects on the educational potential of the new media. For example, in the common classroom method of brainstorming the teacher signals the start of a brainstorm by posing a question to which all should be able to respond on the basis of their experience or their learning. The purpose is to get the group’s idea of the range of issues involved or the scope of responses to be considered, as a preliminary to further discussion. Once the question is posed, the teacher usually stands and moves to the board, pen or chalk in hand, indicating his or her readiness to hear and record responses. Sometimes the question is written on the board. The students are familiar with the method and the expectations on them, and begin calling out or offering responses, which are recorded quickly, more or less accurately, and anonymously on the board. The teacher is busy writing, so the identity of respondents is not necessarily apparent, the focus is on the ideas not people. Most students participate and the energy levels rise. From time to time the group falls silent and the teacher may encourage further contributions

by suggesting a neglected aspect of the question for consideration. And so a brainstorm proceeds. At the end, the board will be covered with responses, the group will be intrigued and involved, and the scene set for an involving discussion. The whole process is energising and motivating and it clearly relies on a range of linguistic and extra-linguistic devices in addition to the formal process for its successful implementation. Of course something like a brainstorm can be achieved with email (Paulsen, 1995) but it is unlikely to generate the energy levels and degree of involvement that the classroom brainstorm can.

4. TOWARDS A SOLUTION

To address some of these issues in our own teaching, we have developed an interactive teaching system for use on the WWW – a system which, while still constrained to a restricted and narrow range and depth of communicative methods, was nevertheless a significant advance on the capabilities of the standard tools. The prototype WebTeach system implements a number of elements, and supports a range of communicative templates that will be familiar to classroom teachers everywhere. A WebTeach group page consists of three sections, a notice board, a seminar room and a coffee shop. Only teachers can post notices or start activities in the seminar room, but anyone can begin a conversation in the coffee shop. Notices, seminar activities and coffee shop conversations are added to the page simply by filling out a form at its foot. These items appear as links on the group page in the appropriate section, together with identity and source of the original contributor, the number of subsequent contributions and the time and date of the most recent contribution. None of this is particularly original.

Each notice, activity or conversation is available, via the group page link, in its own page, and in the case of activities and conversations, the page concludes with a form soliciting contributions. The system automatically distinguishes submissions from teachers and students and allocates a range of privileges accordingly. At this level the simple distinctions between one-to-many communication via the notice board and one-to-one or many-to-many communication via seminar activities or coffee shop conversations, and distinctions between the roles of teacher and student are implemented. The distinctions are marked by the use of graphics and other extra-textual devices so that teacher notices are clearly identified, as are the formal activities of the program (the seminar activities) and the informal (coffee shop) conversations. In addition almost all changes to the group page or any associated activity or conversation are automatically notified to members of the class group by email, so that staff and students do not have to check to see if there is activity in the group, their email will inform them. This allows for some element of spontaneity in the system: a group can go quiet for days then burst into life for an active discussion over a controversial point. The combination of email and web conferencing is now becoming more common, offering the advantages of both systems as a support to communication.

As noted, a seminar activity or a coffee shop conversation takes the form of a single page representing a transcript of the interaction. At the end of each page there is always a form soliciting a contribution appropriate to the teaching template being employed at the time (Figure 2).



Issues in flexible delivery

The whole idea of flexible delivery of education is controversial and raises many issues for students and staff. Of course we need some definitions, and for the purposes of this activity we should distinguish flexible from alternate modes ie. we are looking at increasing the range of options for students, not substituting electronic modes for traditional modes. (posted by Chris via chris hughes at IP: 129.94.180.101 on 7/5/98 at 9:27 AM)

Note only the group leaders can use the leader options in this discussion



Chris H starts a brainstorm by saying... To kick things off, let's list all the issues the idea of flexible delivery raises for you, then we will group and discuss them. So what are the issues? (submitted on 7/5/98 at 9:28 AM)

Workloads for staff
Copyright and Intellectual Property
Staff skills and the potential for automation of teaching and deskillling
Student access, not all students have computers or connections

Chris H resumes the disussion by saying...

Well, that is a good list to start with. Let's take the student access issue first, what is your experience on this. How many students have access, and what are insitutions doing about this issue? (submitted on 7/5/98 at 9:32 AM)

- **Lindsay** says: At this place we are still thinking through this issue, but the President is forever hoping for the day when every student has a laptop in his/her backpack! (submitted by Lindsay via lindsay hewson at IP: 129.94.180.101 on 7/5/98 at 9:35 AM)

Comments please:

Your Name/Pseudonym:

Preserve my anonymity

Your comment: (see help file for information about entering links, images and html tags)

⬆⬇

⬅➡

Group leaders only!

Use the information above (if needed) to



Figure 2: Screen shot of a typical WebTeach Seminar

Within seminar room activities (and in coffee shop conversations) several communicative templates are available to the teacher and to any students nominated as leaders for the activity.

4.1 DISCUSSION

All WebTeach seminar activities (and conversations, but I will focus on the seminar room from now on) begin with a presentation. The presentation text may be one line or several pages long, although the excessive length can become confusing. If long texts are to be made available to students it is better if this is done via separate web pages (or on paper, audiocassette etc.). Initially the activity will consist only of this ‘activity starter’ together with a final form inviting contributions to a discussion of the presentation. Contributions, plus information about the contributor, are added to the page below the starter and above the final form, and so a transcript of the discussion is built. Each contribution is identified by a name or pseudonym entered by the contributor, and a button is available to request full anonymity, in which case no information about the source of the contribution is included. Teachers can choose to have their contributions highlighted in the transcript. At the bottom of the page there is also a menu for teachers to select a switch to a different template. The ability to nominate students as discussion leaders, such students having teacher access to all the templates available in the activity, permits an online correlate of the more traditional student led seminar.

4.2 BRAINSTORMING

At any time in an activity, a teacher or nominated student leader of the activity can initiate a brainstorm. This is achieved simply by submitting the question or topic for the brainstorm and selecting the appropriate item from the final menu. The brainstorm question or topic is inserted into the transcript at the end and the final form is change to invite ideas in response to the brainstorm. Of course there is also a menu for teachers to use to switch templates. The only student contribution possible during a brainstorm is the submission of ideas. As ideas are submitted they are displayed below the question or topic in a simple table and without any identification of the contributors. As the brainstorm proceeds the table grows. At any time the teacher (or again, a nominated student leader) can switch templates, back to discussion—the most common option after a brainstorm – or posing a question etc. The changing of template is signalled by a bold face insertion in the transcript together with a change to the final form and menu to reflect the new mode of interaction.

4.3 QUESTIONING

Questions can always be raised in the course of a contribution to a discussion within an activity, but sometimes a more formal process and the imposition of a ‘wait time’ is called for. WebTeach supports such formal questions with a ‘pose a question’ template. Once posed the question is highlighted in bold and inserted at the end of the transcript just above the final form, which changes now solicit responses to the question. No other student contribution is possible within this activity. The responses received are not displayed immediately, but are held on the server. The teacher can ‘peek’ at these responses at any time to peruse them and to decide when to switch templates. Once the teacher changes the template, with a comment on the responses and an invitation to discussion perhaps, all the responses are placed in a table, with student identifiers, which is inserted below the question and above the comment and invitation to discussion.

4.4 TASK SETTING

Another template available to teachers is task setting. This allows them to submit task instructions (such as “please read chapter five and tell me what you think it says about this issue”). The instructions are inserted at the end of the transcript and the final form changes to invite indications of completion, together with a comment. As these indications come in they are displayed with identifiers in a table. Eventually the teacher will decide to change templates to discuss the task, or perhaps to pose a question.

It was not our intention that all these templates would be employed equally in any group. Rather we wanted teachers and students to have a range of options available so that they were not unnecessarily constrained in their activities. In most instances the discussion template will support much of the interaction. Even when used at this level, the transcript layout and the availability of anonymity offers advantages over the standard tools.

In addition to the above options, teachers may close or reopen activities or conversations, with a comment. There is also a short answer quiz facility available to teachers for formative and summative purposes, and to students for private revision. The system converts URLs to links and can automatically insert images and 'mailto' tags, making these tasks, which are crucial to much Internet teaching, accessible to participants without special skills. There are also a number of other functions, but these are more of an administrative nature.

The WebTeach prototype is a tool to support enriched interactive educational communication on the web. It was designed to offer enhanced support to teachers and students as they begin to use the Internet as an educational environment. The true test of such a tool, apart from its contribution to learning outcomes, is the actual use to which it is put, the development of skill and method that it supports, and the satisfaction participants gain from the encounters it facilitates. It is therefore worthwhile to briefly survey the use of the WebTeach system in real teaching, and the patterns of use that have emerged. The system has been used by staff and students from a wide range of disciplines at UNSW and by groups of teachers from the secondary system in NSW.

5. WEBTEACH IN USE

The 'learning curve' for the WebTeach system is quite flat. Most teachers and students, whatever the discipline, find the system quite approachable and have little difficulty in learning how to initiate activities or contribute to them. Most begin by accepting the default template option in seminar activities, discussion. And for some this is all they require. Evaluative data is still being collected but initial indications are that the system is working well to support the transition to online teaching in a range of areas. It should be stressed that the prototype is not intended to provide a single solution to all teaching demands, but rather is a tool with particular strengths in specific settings. It would typically be integrated with more traditional resource based learning materials to form an overall design.

5.1 PHILOSOPHY

Several Philosophy groups are using the system for distance teaching. Long and lively contributions on all manner of topics are seen to be passing through our server. Initial examination of the group pages indicates that the teachers are regularly using the notice board and initiating seminar activities. Students start many coffee shop conversations and many of these are related to seminar topics, just as we think it should be in a lively educational setting. Discussion is the main method being employed in seminar activities, but this seems to suit the purposes and expectations of the groups. This is perhaps realistic given the traditional teaching methods and the textual orientation of the discipline. The teachers involved report high levels of satisfaction with the system, saying that it is enabling them to achieve their outcomes and to keep a sense of group cohesion alive.

5.2 PSYCHIATRY

A group of general medical practitioners from NSW are studying psychological medicine using the system. The university teachers involved are mainly using the discussion mode in seminar activities, but their employment of this mode has evolved considerably over time. Initially they posed a problem, usually a description of a patient as might be encountered in a practice, with a request to discuss the case. As time has gone by, they have used the evolving transcript to control the release of detail to the students as their considerations proceed. Thus after some discussion, new information may be revealed or options closed off so that students are required to consider additional issues or to make fresh decisions. It seems that these teachers are finding a way of adapting their traditional teaching method, the case study, to the new medium. The

'brainstorming' and 'pose a question' method options would also seem useful to these groups. After initial presentation of the case, issues arising could be brainstormed and then discussed. At crucial points questions could be posed and students asked to attempt answers, a diagnosis perhaps, before seeing the responses of others. These possibilities are being explored with the teachers during the evaluation of the initial implementation of the subject.

5.3 FRENCH

Several undergraduate groups learning French have used the system. Used as an adjunct to classroom teaching for 'conversation' practice, participants have struggled with the insertion of accents marks and have achieved quite significant interactions. The HTML language used by the Web allows for the inclusion of accent characters, which is a significant advance for language teachers. Again discussion is the main method in use, which is appropriate given the purpose of the groups. The teacher reports satisfaction with this form of interaction; indeed the halting utterances of beginning language students are somewhat more efficiently handled in the asynchronous medium. For those participating, valuable feedback and interaction with teachers and peers is available, with little demand on teacher time. In the future, the 'pose a question' method option and the short-answer quiz facility seem likely additions to the repertoire of these groups. Again the teacher reports high levels of satisfaction with the system.

5.4 STAFF DEVELOPMENT WITH SCHOOL TEACHERS

A group of schoolteachers from secondary schools in our State is using the system for staff development to address the issue of mentoring new teachers. Accessing the system from schools all over the state, via all manner of connections, their use again focuses on discussion of issues arising from their mentoring roles. As an effectively leaderless group this seems appropriate.

5.5 HIGHER EDUCATION

Many teachers in our own postgraduate program use the system to facilitate teaching in their own subjects. The patterns of use vary, from regular but not extensive use of the method options in some subjects, to use of the discussion option only in others. Some teachers begin several seminar activities on different topics at the beginning of the teaching session and accept contributions all through the session as students come to terms with the material in the course. Others control the timing of activities more closely, starting a seminar discussion in week three and closing it off in week five for example. Some, like us, use the system to replace classroom sessions, others as an additional medium of communication bringing together those who attend classes with those who cannot. In one subject the WebTeach group has replaced a one-hour synchronous teleconference since it offers more time to each student and is more flexible. Like most teachers we have had recourse to the anonymous function on a couple of occasions, especially as an aid in controlling the dynamics of a group – suggesting that someone is dominating the discussion, or that a comment was inappropriate for example. Students soon discover the use of the same function in masking their identities when asking possibly 'silly' questions.

6. CONCLUSION

It is clear from the brief survey above, and from discussions with teachers and students that the WebTeach prototype is effectively supporting enriched communication among class participants. While the adoption of some of the method options by teachers is a slow process, the development that is discernible, and the potential for development which yet exists indicates that the system is capable of supporting quite complex, linguistically rich and educationally sophisticated interactions. Given the degree of success being achieved by teachers who in no sense are enthusiasts or 'lone rangers', and given the sense of satisfaction they report, the system seems to be supporting the transition from classroom to online teaching quite well, and it is doing so with a familiar metaphor which draws on the existing skill and knowledge of teachers and students. The next stage of this project will involve the addition of support for an extended range of teaching methods and the development of a version capable of running on Windows based servers.

Technical note

The WebTeach prototype is written in HyperCard® and runs on a Mac server under WebStar®. It can theoretically support any number of class groups offering all the above facilities. A practical limit on numbers arises from hard disk space and processing speed restrictions. WebTeach requires only that students and teachers have access to a basic web browser capable of displaying tables, and to email. No access problems have been encountered in over two years' use. WebTeach groups are password protected using WebStar®'s password protection system and WebTeach supports online enrolments to WebStar® realms. The email notifications are handled by Eudora® Pro.

7. REFERENCES

- Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education* 32, 1-18.
- Biggs, J., & Collis, K. (1982). *Evaluating the Quality of Learning: The SOLO Taxonomy*. New York: Academic Press.
- Brookfield, S. D. (1986). *Understanding and Facilitating Adult Learning: A Comprehensive Analysis of Principles and Effective Practice*. San Francisco: Jossey-Bass.
- Gibbs, G. (1992). *Improving the Quality of Student Learning*. Bristol: Technical and Educational Services Ltd.
- Heron, J. (1989). *The Facilitator's Handbook*. London: Kogan Page.
- Jonassen, D. (1991). Objectivism versus Constructivism: Do We Need a New Philosophical Paradigm. *Educational Technology Research and Development*, 39:3, 5-14.

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