The Formative Evaluation of a Web-Based Course-Management System Within a University Setting
Author(s): Ralf Maslowski, Adrie J. Visscher, Betty Collis and Paul P. M. Bloemen
Source: Educational Technology, Vol. 40, No. 3 (May-June 2000), pp. 5-19
Published by: Educational Technology Publications, Inc.
Stable URL: https://www.jstor.org/stable/44428597
Accessed: 08-12-2020 13:28 UTC

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at https://about.jstor.org/terms

Educational Technology Publications, Inc. is collaborating with JSTOR to digitize, preserve and extend access to Educational Technology

This content downloaded from 130.89.3.19 on Tue, 08 Dec 2020 13:28:45 UTC
All use subject to https://about.jstor.org/terms
Web-based course-management systems (W-CMSs) are increasingly being considered by institutions of higher education as important tools. Interest is also developing in military and corporate-training sectors. A W-CMS is seen as likely to have administrative benefits for these institutions, as well as bringing instructional and individual benefits for students (Williams & Peters, 1997). A W-CMS is a system that combines database and Web functionalities in order to support the efficient management of Web-based support in the teaching and learning process of an institution. Usually this involves creating and maintaining Web-based course-support sites for some or all of the courses offered by the institution as well as other functions that can directly or indirectly relate to the teaching-and-learning process. W-CMSs include back-office and front-office aspects.

Back-office aspects are those which involve the security of the system, the assignment of access rights and privileges to different categories of users, and the procedures needed to integrate database and http server functionalities. Typically, only the system administrators can access the back-office aspects of a W-CMS, which can lead to delays and frustrations for instructors and students who wish to improve some aspects of the usability and utility of the system to better fit their own needs.

Front-office aspects are those seen and manipulated by the instructors and students. Of particular importance are the tools and functionalities available to the instructor. Ideally, an instructor should be able to use a W-CMS as a personal tool, to tailor the sorts of Web-based support that are most appropriate to his or her own courses and students in a direct and simple manner. At the same time as instructors require tailorability, they also require ease of use with the need for as little technical skill as possible.

Since about 1995, W-CMSs have become available and are continually evolving in terms of both back-office and front-office aspects. There are various sources that monitor such systems, such as Landon's (1999), and an increasing number of sources that seek to evaluate such systems. In the W3LS Project in The Netherlands (Van der Veen & De Boer, 1999), for example, an evaluation methodology was developed and validated for W-CMSs, based on the sorts of instructional activities an institution may wish to support as well the implications of a W-CMS for the institution involved. The latter includes cost aspects and concerns relating to the integration of the W-CMS with other technology in the institution. Many individual institutions have developed their own evaluation criteria for the selection of an externally produced W-CMS for their internal use. Lazenby
(1999), for example, at the University of Pretoria in South Africa, describes a checklist of attributes used by that university to choose between five commercially available W-CMSs. However, these approaches are based on the idea of a selection among available products. They are not so directly applicable to those who choose to design and develop their own system. For those, formative evaluation during the design and development period is a critical tool.

Unfortunately, due to the fact that W-CMSs are so new, there is little or no established methodology for such a formative evaluation. What is needed is an extraction of the most pertinent aspects of the formative evaluation of complex systems for computer-based learning support in general, and the adaptation and application of these aspects to the special and new case of W-CMSs. In this article, we review these most pertinent aspects and illustrate the process of how formative evaluation has been adapted and is being used in a particular university faculty that chose to design and develop its own W-CMS.

The Role of Formative Evaluation in the Design and Development of Complex Systems

The term formative evaluation originated from the field of program evaluation, where it was first used in the 1960s. At that time, with the advent of large-scale educational projects, designers began to conceive program design as a continuous process of tryout and development for improvement. Cronbach (1963) made a plea for the inclusion of evaluation in program design: “Evaluation, used to improve the course while it is still fluid, contributes more to improvement of education than evaluation used to appraise a product already placed on the market” (p. 236). Cronbach’s ‘evaluation for improvement’ was later labeled ‘formative evaluation’ by Scriven (1967). Scriven used the term ‘formative’ to distinguish between the evaluation of a program during its developmental stages and the processes involved in determining the effectiveness of a program after its completion, which he labeled ‘summative evaluation.’

Formative evaluation is intended to support the process of improvement while a program is still under development, and is normally commissioned or done by, and delivered to, someone who can use the results to aid in the shaping of the program. Ideally, it is an integral part of the development process as it provides continual feedback to assist in planning and then producing a particular program. Formative evaluation is performed “to inform the decision-making process during the design, production, and implementation...of an educational program with the purpose of improving the program” (Flagg, 1990, p. 23).

Formative Evaluation and the Improvement of Educational Programs

Although formative evaluation is aimed at determining the strengths and weaknesses of an educational program in order to generate suggestions for improvement, it in itself is an insufficient base for improvement recommendations (Scriven, 1991b). Conceptually, a distinction can be drawn between the description, the formative evaluation, the diagnosis, the causation, and the continued development of a program. Figure 1 shows how these phases have been traditionally visualized.

In the description phase, information on a program is collected and analyzed. In the case of a W-CMS, for example, a specification of the available aspects or features of such a system may be given, but these aspects and features are not classified as satisfactory or unsatisfactory at this stage. This is subject to the formative-evaluation phase, which results in the identification of a program’s shortcomings as well as strengths. These strengths and shortcomings still have to be linked to each other, interpreted, and matched to patterns of desired performance or disorder. A diagnosis aims at finding the best ‘label’ for the observed deficits while enhancing strengths.

Although the diagnosis of a program’s deficits can include knowledge of their underlying causes, there may be no obvious explanation, in which case causation of the problems needs to be investigated further. Insight into the cause of the program’s deficits is necessary for identifying a remediation (prescription). The fact that a program has its shortcomings, nevertheless, does not imply that improvement is possible and feasible. Besides information on what caused the program’s deficit, it is necessary to have a remedy at one’s disposal. Furthermore, the severity of a detected problem is related to the quality of the program as a whole; it may, for instance, be relatively small in comparison to the overall quality. The benefits of the revision may not justify the costs, or remediation of the problem may cause side-effects that are as severe as the detected problem itself. In addition to identifying potential problems in a program, formative evaluation also has the task of bringing out aspects that are likely to be particularly successful, so that these can be optimized in the continuing design process. Formative evaluation can also have the function of serving as a means for better articulation about what users eventually want in a complex program, and thus...
Figures 1. Five phases in the process of design improvement.

Contribute input for the on-going shaping of the object under development.

From a conceptual point of view, formative evaluation is a necessary but insufficient condition for generating recommendations for improvement and evolution of a program. In addition to the evaluation of the program, improvement requires pre-evaluative (i.e., description) as well as post-evaluative (i.e., diagnosis, causation, and prescription) actions. Therefore, a formative evaluation ideally provides information on the seriousness and cause of the problem, information on levers for improvement, and indications of the expected costs of remediation, in addition to the mere specification of the program's deficits (Tessmer, 1993).

Stated otherwise, formative research should be conducted in such a way that information is provided that directs or strengthens the diagnosis, causation, and revision of observed shortcomings in the design, while at the same time identifies aspects of most positive impact, for their enhancement.

It is important to note that the formative-evaluation cycle shown in Figure 1 is not a one-time event for the design and development of a complex system. In software-design methodology, it is well established that such cycles need to occur again and again, at many levels of granularity, throughout the design and development process. Rapid prototyping is a common software-design methodology built around on-going formative evaluation (Moonen, 1999) in which as many instances of contact with potential users as possible during these iterative cycles are desired.

Requirements for Evaluation

Scriven (1991b) has argued that the process of evaluation essentially consists of five core activities. First, the characteristics and boundaries of the object that will be evaluated have to be determined. In the case of a W-CMS, one may at different times focus on the functioning of one of the tools offered to students, on the presentation of the text in the 'course information' section, or on any other aspects of the front-office or back-office functionality. However, with respect to W-CMSs, it is the overall integration of these aspects that must always be kept in perspective, even while subparts as being considered. In Scriven's view, too often the evaluation subject is poorly marked out, which leads in most instances to an incomplete or unsystematic evaluation.

Second, after the evaluation subject has been determined, evaluation or quality dimensions should be selected. Determining the quality of a complex system such as a W-CMS requires the availability of dimensions that guide the process of judgment. Masłowski and Visscher (1999) refer to four basic dimensions relevant in this context: problem coverage, scientific basis, usability, and effectiveness. Evaluation on these four dimensions enhances the likelihood that the most critical aspects of the evaluation subject are addressed.

In addition to quality dimensions, formative evaluation requires the availability of standards according to which the value and merit of the W-CMS can be determined. These standards may be absolute or relative (Scriven, 1991b). Absolute standards consist of predetermined norms that the W-CMS has to meet in order to be judged as sufficient or satisfactory. Relative standards are being used if, for example, instructors judge that the courses supported by a W-CMS will be likely to offer aspects of improvement compared to the existing 'traditional' courses.

The fourth step in the evaluation process consists of determining or predicting the performance of the W-CMS on the selected evaluation dimensions according to the standards that have been identified. This refers to the previously mentioned description stage in Scriven's 'process of design improvement.' Information on the functioning of the W-CMS is gathered and these data are compared with the chosen standards. This results in the qualification of the W-CMS as either sufficient or not, and in the determination of the degree to which the environment is sufficient according to the applied standards.

As Scriven (1991b) argues, a fifth step is needed to
determine the actual quality of the design at hand. He notes that in most instances, a rather straightforward approach is followed: If the design meets the criteria, no further actions have to be taken; if not, improvement actions are required. This is, however, not so simple with complex systems. If a specific part of a W-CMS, for example, shows low performance on a particular standard, it may be necessary to consider the interaction of many variables outside the system itself, such as human variables, to better understand the cause of the low performance.

Methods and Techniques for Formative Evaluation

Sweeney, Maguire, and Shackel (1993) make a distinction between three classes of formative evaluation on the basis of the source of the information used: theory-based, expert-based, and user-based evaluations. Theory-based evaluation concerns the testing of a design by means of theoretical models. On the basis of prescriptive or descriptive theories, a pronouncement is formulated on the scientific foundation, the expected usability, and the effectiveness of the design. In case of expert-based evaluation, the quality of the design is judged on the basis of expert opinions. Field studies are based on data from persons who have to work with the eventual product, and are therefore denoted as user-based evaluations. Below, each of these three methods and techniques is discussed.

Testing based on theoretical models. A design can be judged on its scientific foundation by means of scientific-theoretical criteria. A first theoretical criterion refers to the precision of the concepts used in the design: Is it clear what the concepts used mean? Another criterion refers to the information content of the design. A design is informative when it has been operationalized, implying that it can be applied and tested in practice. The third criterion, internal consistency, reflects the degree to which the assumptions on which a design is based match. The last criterion concerns the empirical content and indicates the extent to which a design is supported by the results of social scientific research.

An important advantage of theory-based evaluations is that they can be carried out by the designer (and thus are efficient). It is relatively simple for the designer to compare design alternatives. Moreover, this evaluation is done non-reactively, meaning that users are not unnecessarily confronted with a design that has serious shortcomings. Such a strategy prevents future users from developing a rejective attitude with regard to a design.

A problem of theory-based evaluations, however, is that forecasts on the effectiveness of the design are based on a theoretical model or on extrapolations from the actual situation. In other words, the validity of the results is strongly dependent on the correctness and completeness of the variables included in a checklist or a simulation model and the relationships between them.

Expert consultation. Consultation of experts is a frequently used method to judge the quality of designs prior to their implementation. Experts can judge the extent of problem coverage as well as the scientific foundation of a design, and evaluate the expected design usability and effectiveness. Among the different types of expert appraisal that can be utilized are individual evaluations and panel evaluations (Worthen & Sanders, 1987). In the case of individual evaluation, an expert is asked to judge a design or part of it on the basis of his expertise. In a panel evaluation a number of experts are asked to reach a program judgement in a panel discussion.

An important advantage of consulting experts is that many different quality aspects of the design can be judged at the same time. Experts can focus in their evaluation on the internal consistency of the design, its expected usability, and the expected effectiveness of designs in an interrelated way. Another advantage is that experts can provide feasible suggestions for improvement.

Field studies. With complex systems, designs are introduced in phases or partially. Thus, it can be judged at an early stage, prior to the full implementation of the design, to what extent a design will be experienced by users as usable, and which preliminary results particular design aspects may produce. Field studies can also be of great value for adapting a design after its preliminary introduction. In the latter case, the boundary between formative evaluation and summative evaluation is touched.

An important advantage of user-based evaluations carried out in the environment for which a design has been developed is that they provide information on the actual usability and effectiveness of a design, whereas other methods involve only predictions of its usability and effectiveness. In the case of the design of a W-CMS, it can be investigated to what degree various of the performance goals are likely to be met.

Nevertheless, field studies also involve certain problems. Measuring effects, for example, is usually not possible. Since some effects do not show up immediately, a large number of intervening and intermediate variables cannot be controlled, and, as a result, information on effects can seldom be related in a concise manner to the design choices that were made. As a consequence, often little can be said during the design and development phase about the impact of particular design aspects of a complex system such as a W-CMS on eventual criteria, such as improvement of instruction.
Formative Evaluation as a Complex of Actions

Rather than a linear action, formative evaluation should be conceived of as an iterative and fluid complex of evaluative actions during the design-and-development process. As Flagg (1990) stresses, the nature of a program often changes considerably during the design and development process, which has consequences for the evaluative actions to be taken. Also, the evaluation focus will shift from checking the design specifications with the objectives of the program in the early stages of the design process towards the practicality and effectiveness of the program in the final stages of the design process, although this is also an iterative process, as some aspects of a complex system will be stabilized while others are only emerging.

Nieveen (1997) has identified four main stages in the process of program development, each requiring a different mode of evaluation. The first stage is denoted as the ‘design-specification stage.’ At this stage, only a general description of the program is available, containing the rationale of the program, its aims and objectives, as well as its rough content and modes of transaction. The main focus of the mostly theory- and/or expert-based evaluations at this stage will be on the degree to which the proposed plan actually relates to the problem at hand (problem coverage) and the probability of solving the problem through these actions (empirical foundation).

In the second stage of program development, the ‘global program stage,’ a first elaboration of the program is at hand. At this stage, some or all of program’s components are given a concrete form. Although it is clear what form the program will eventually take, it is not yet ready to be used in practice. While at this stage, attention still will be given to the empirical foundation of the measures, the evaluation will also be directed to a certain degree at the practicality and practicality of the proposed design. Maslowski and Visscher (1997) refer to the latter dimensions as elements of the extrinsic quality or worth of the program. At this stage, evaluations are especially of a theory- and expert-based nature.

The extrinsic quality of the program becomes even more important in the evaluation of the program at the ‘partially detailed stage’ (Nieveen, 1997). At this stage, a delineated part of the program has been developed in detail. The evaluation, mostly consisting of field studies in combination with theory- and expert-based evaluations, will focus on the feasibility and maybe also on the effectiveness of this design.

In the fourth stage, the evaluation focus will be on the extrinsic quality of the program. At this stage, enough components of the program have been developed in detail so that the program is ready to be implemented. Formative evaluation will take the form of field studies, in which the program is evaluated in an operational form in one or more representative settings.

Given this overview of formative evaluation and some of its requirements and methods, its adaptation and application to the new form of complex system, the W-CMS, can now be considered in more detail. This will be done through the example of how formative evaluation is being carried out in a particular faculty designing and developing its own W-CMS.

TeLeTOP as an Example of a Web-Based Course-Management System

Since August of 1998, the Faculty of Educational Science and Technology at the University of Twente has been offering its courses in a new style, using a W-CMS as a key facilitating tool. This new style is called C@mpus+ and has as its main characteristics: (a) extending the benefits of the good instructor and fine campus environment, (b) increasing the flexibility of participation in the faculty’s courses, (c) increasing the level of activity and engagement of students in the learning process, and (d) increasing the contact between instructors and students via more personal communication and less lecturing. An important practical goal of C@mpus+ is to facilitate the addition of a new cohort of students, working students who will only physically attend the campus once every two weeks (thus called part-time students), and to do this in a way that is manageable for the instructors. Thus, an important operational principle of C@mpus+ is that an instructor does not have to offer courses two times, once for the regular students and once for the part-time students, but instead offers one course, adapted as appropriate to the needs of different student cohorts. In this way, the fact that the new cohort of students are to be added onto the existing work load of the instructors with no compensation in time or support can be hoped to be manageable. This relates to a major strategic goal of C@mpus+, that of instructor engagement. If instructors do not endorse the C@mpus+ approach and are not willing to carry it out via new instructional methods and the use of a W-CMS, none of the overall goals of the faculty with regard to new methods of teaching and learning and educational delivery will be met.

The project charged with the task to operationalize the C@mpus+ approach is called TeLeTOP (“Tele-Learning TO Project” where TO represents the initials of the name of our faculty in the Dutch language). Among the tasks of TeLeTOP was to acquire or design and develop a W-CMS to support the goals of C@mpus+ and to fit with the existing experience and culture of the faculty. The system it built is called the TeLeTOP system. A major task of TeLeTOP is to build the W-CMS in a way that will maximize the chance of getting all instructors involved and engaged; a task more difficult than the W-CMS development in itself.

While the original examples in the faculty of use of
individual Web environments to support courses were
those of enthusiastic pioneer instructors, the TeLeTOP
Project has to deal with a more difficult target group:
All instructors, including the less-interested, less-
motivated, and skeptical, are to be supported in the re-
design of their courses and their design of a Web enviroment using a W-CMS to support their courses.
Given these two basic aspects—empower, not replace,
the instructor with technology; and engage all
instructors with a wide variation in computer skills as
well as a wide variety of levels of interest in the use of
technology in their own teaching—as well as their own
previous experience with the design and use of
W-CMSs, the TeLeTOP team developed the following
set of criteria to guide the selection or design of its W-
CMS (Tiemelans & Collis, 1999):
1. To make the threshold of use as low as possible
for the instructors, the W-CMS must be usable
by the instructors and students without needing
a special training course and as easily as they
handle a word processor and a Web browser.
2. Similarly, the instructors and students must be
able to do everything they wish with the system
through an ordinary Web browser; no special
authoring software, no special client.
3. By the principle “empowerment of the good
instructor,” the instructor must be able to
choose for him or herself the way that a Web
site will be used to support his or her course.
There is no standard pedagogical model that all
are expected to follow.
4. The W-CMS is not meant to replace textbooks
in the courses or make lectures unnecessary.
Instead, the purpose of the W-CMS is to help
the instructor add extra opportunities for
activity: student reflection, communication,
student contribution of additional learning
resources, peer interaction and peer
evaluation, as well as adding a “preparation
for” and “follow-up from” aspect to each face-
to-face session. Thus, the W-CMS must be an
information-communication exchange environ-
ment that can also be coupled with other
information systems of the faculty such as those
for student issues and administration.
5. The course-support environments generated by
the W-CMS must be capable of supporting a
large variety of different types of instructional
approaches, from those of courses focused on
reading and written assignments with classic
final examinations to courses with complicated
approaches to group work and project-based
education. Tools to support any instructional
approach must be available, including shared
workspaces, test banks, and discussion boards.
6. The system must work will all other Web
products; for example, Java applets and plug-
ins as well as those that will evolve in the future.
7. The instructor and students must be able to put
in and take out whatever is necessary in the
W-CMS without needing direct technical
support. Uploading and downloading attach-
ments of a variety of types including audio and
video files is particularly important.
8. The W-CMS must help instructors organize the
information streams within a course; instead of
student messages coming to the instructor’s
e-mail address, for example, they can be
posted directly into the course site, either as
private (only for the instructor to see) or public
(for all in the course to see). Feedback from
students or the instructor must follow the same
principle. Also, there should be easy-to-set-up
ways for messages to be sent to a group of
students, or all the students in the course, or
other groupings within the course, all from the
same Web environment.
9. Access to the system must be organized on the
basis of log-in data which are used by the
system database to tailor what can be seen and
not seen by each individual. Also, it must be
easy to leave the system and go to an external
site on the Web and then return to the system
without leaving the browser. Privileges must
therefore be regulated at the resource-
document level as to who has read and/or
write rights to any item in the database. The
author of an item should be able to decide
himself or herself who has rights to a submitted
item.
10. The system must be efficient to maintain; thus,
no labor-intensive handmade HTML pages, but
pages generated dynamically out of a database.
11. The system must handle multimedia resources
as well as text resources. Video and audio must
be streamed over the bandwidths available to
the students.
12. The faculty must be making use of the W-CMS,
within a one-year preparation period, with a
new cohort of part-time students participating
mostly via the W-CMS while staying at their
jobs and in their homes, as well as with the
regular on-campus students.

The first iteration of the TeLeTOP system was built
according to these specifications during the period
November–December 1997, utilizing a Lotus Domino
database engine (the same core technology which is
still used in the current iterations of the system). By
August of 1998, all first-year courses as well as a
number of other courses had been redesigned to reflect
the C@mpus+ approach and to make use of the
TeLeTOP system. Even during its first year, the system
worked according to the above specifications with no
technical breakdown. Instructors made considerable use of the functionalities in the W-CMS system, as shown in Table 1.

Table 1. Log data of the TeLeTOP system, August 1998–April 1999 (instructors and students only).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Successful Hits for Entire Site</td>
<td>446,125</td>
</tr>
<tr>
<td>Number of Page Views</td>
<td>383,039</td>
</tr>
<tr>
<td>Number of Users</td>
<td>375 students, 45 instructors*</td>
</tr>
<tr>
<td>Number of User Sessions</td>
<td>26,155</td>
</tr>
<tr>
<td>Average Number of Users per Day on Weekdays</td>
<td>192</td>
</tr>
<tr>
<td>Average Number of Hits per Day on Weekdays</td>
<td>3,303</td>
</tr>
<tr>
<td>Average Number of Users for the Entire Weekend</td>
<td>92</td>
</tr>
<tr>
<td>Average Number of Hits for the Entire Weekend</td>
<td>1,458</td>
</tr>
<tr>
<td>Average User Session Length</td>
<td>11:07 minutes</td>
</tr>
</tbody>
</table>

*Note: Many courses have more than one instructor. Also, students and instructors are counted separately for each course in which they are involved. Not included in these numbers are accesses by the TeLeTOP team members, the evaluation team, and 10 student assistants.

Usage data are not only a matter of quantitative tallies but also of changes in instructional patterns. In this respect, data were also collected from 25 courses relative to what instructors and students were actually doing while accessing the W-CMS. These data showed that all instructors chose the News option, with 84% using it often and 16% using it marginally. The Course Information option was another popular option, with 92% of the 25 courses using this option to give an extensive overview of the course, and the remaining 8% used it minimally. All but one of the courses (96%) used the E-mail Center to have an overview of all course participants and the instructors of a course. Some used the group option to send e-mail to different groups of students.

The Roster, a matrix with functionalities for the uploading and downloading of materials and feedback, is one of the most important options in the TeLeTOP system. Every instructor chose to use the roster as an institutional structure. Almost every instructor (92%) organized the roster relating to times and locations of face-to-face sessions, while 8% organized the roster around topic-based themes. The roster was used by 92% of the instructors for access to some kind of study material, PowerPoint slides, assignments during and after face-to-face sessions or particular topics, and the provision of Web links to related topics. Two instructors made extensive use of multiple-choice questions produced by the students and submitted within the roster. Two instructors integrated video segments of their presentations and student presentations in the roster.

Table 2 gives a more specific overview of the use of these options as used in the roster. The average number of follow-up assignments submitted via the roster was about five per course. In 12% of the courses, instructors made re-use of student materials as (self-) study materials for all students in the course. These materials could be found in the roster, as well as in other parts of the environment. The C@mpus+ approach, whereby both the regular and part-time students participated in the same activities and made use of the same learning resources, regardless of their location, is clearly shown in Table 2. Face-to-face sessions included the scheduled lectures, an average of three per course with two of these on the Fridays in which part-time students were physically at the campus, and on occasion extra sessions for the regular students.

Table 2. Use of the roster in 25 TeLeTOP courses during September 1998–April 1999.

<table>
<thead>
<tr>
<th>New Forms of Contact Supported in the Roster</th>
<th>Yes</th>
<th>Minimal or No</th>
</tr>
</thead>
<tbody>
<tr>
<td>To provide instructor-produced material for self-study</td>
<td>52%</td>
<td>48%</td>
</tr>
<tr>
<td>To provide instructor-produced text materials for a face-to-face session (and for use by the part-time students after the session)</td>
<td>64%</td>
<td>36%</td>
</tr>
<tr>
<td>To provide instructor-created PowerPoint slides</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>To provide instructor-selected links to external resources</td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td>For student submission of assignments during a face-to-face session (or after the session for part-time students)</td>
<td>56%</td>
<td>44%</td>
</tr>
<tr>
<td>For student submission of follow-up assignments</td>
<td>72%</td>
<td>28%</td>
</tr>
</tbody>
</table>

During the 1999–2000 academic year, the majority of the remainder of the courses in the faculty are being redesigned and supported by the TeLeTOP W-CMS, as well as the courses in other faculties within and outside the university. But although the system is in full implementation, it is still under continual evaluation.
Table 3. Information streams for formative evaluation of the TeLeTOP W-CMS.

<table>
<thead>
<tr>
<th>Information Stream</th>
<th>Major Instruments</th>
<th>Major Focus</th>
<th>Evaluation Class (Sweeney, Maguire, &amp; Shackel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Instructor choices and behaviors</td>
<td>(a) Decision Support Tools (DST) and interviews in which the DSTs are used; (b) Options for instructors to choose from in W-CMS and data about choices made</td>
<td>What do instructors choose when using a W-CMS? Why? How do they think about their courses and what are their instructional conditions, and how can these be reflected in the W-CMS?</td>
<td>User-based; Theory-based</td>
</tr>
<tr>
<td>2. State-of-the-art inventory and analysis</td>
<td>(a) On-going contacts with others using W-CMSs and with literature and research about W-CMSs; (b) Participation in national studies about W-CMSs</td>
<td>What are the major international and national trends with respect to W-CMSs and their implementation? What implementation model is most appropriate?</td>
<td>Expert-based; Theory-based</td>
</tr>
<tr>
<td>3. Field reactions (in addition to input related to Instructor Choices and Behaviors, #1 above)</td>
<td>(a) Questionnaires and interviews, instructors and students; (b) Reactions from implementation teams in other faculties making use of the TeLeTOP W-CMS; (c) Reactions given during demonstrations to persons from other institutions</td>
<td>What are opinions about the implementation process as it is being carried out? What aspects of the W-CMS are most important in the local context? How well are instructors making use of the W-CMS? What are the major differences in TeLeTOP and other W-CMSs with which persons are familiar? How should TeLeTOP be revised?</td>
<td>User-based; Expert-based</td>
</tr>
</tbody>
</table>

and revision. Formative evaluation has been and remains a key and central aspect to the design and development of the TeLeTOP system.

The Formative Evaluation of the TeLeTOP W-CMS

There are three main ways in which formative evaluation takes place within the design and development process of the TeLeTOP W-CMS. In this section, these ways will be described and related to the more general discussion of formative evaluation that occurred earlier in this article. The way that the requirements for evaluation, as first identified by Scriven (1991b), have been worked out for the TeLeTOP W-CMS will be discussed. The relationship of the TeLeTOP formative-evaluation approach to the five-phase process of design improvement shown in Figure 1 and to Nieveen’s (1997) four stages of program development will also be commented upon.

Methods

The relationship of the TeLeTOP formative evaluation to the three information streams for formative evaluation of Sweeney, Maguire, and Shackel (1993) is given in Table 3. Each of the these three main categories of information streams will next be described.

1. Instructor choices and behaviors. A basic requirement for the TeLeTOP W-CMS seems self-evident: that instructors make use of it. The usage data summarized earlier show that this is occurring. A key factor for this is the way formative evaluation based on instructor choices and behaviors is built into the TeLeTOP implementation process. Based on the extensive literature about factors that influence instructor reactions to and uptake of technology (for a summary, see Collis & Pals, in press), a key principle for TeLeTOP is that instructors can easily use the W-CMS to shape course-support sites for their own
courses that reflect the instructors’ own personal views of teaching. This in turn means that instructors must know what options are possible for using Web and database functionalities, are able to make choices as to what they want, and are able to revise these choices as often and easily as possible. In turn, as instructors are offered choices, their reactions, their choices, and their use of the choices provide a powerful source of information that supports a major, and unique, method of formative evaluation in TeLeTOP. This process involves the TeLeTOP Decision Support Tools (DSTs) (Collis & DeBoer, 1998).

The TeLeTOP DSTs are Web-based tools integrated with the TeLeTOP W-CMS that contain a large number of examples of ways in which aspects of a W-CMS can be used to support university teaching and learning, organized around questions to the instructor about how he or she wishes to handle different aspects of his or her own course. These aspects are divided into six categories: (a) general course institution, (b) face-to-face sessions, (c) self-study, (d) assignments, (e) testing, and (f) communication of various types. For each of these categories, there are a series of questions in the DST addressed to the instructor, such as “Do you want your students to work in groups on their assignment?” and “Do you want to make certain items of your feedback available to all students?” For each of these questions, there is a link to an example of how such a technique is being carried out by one of the faculty members using TeLeTOP W-CMS support. The link goes directly to an existing course and shows an example from the instructor’s own colleagues. If the instructor thinks such an approach is something he or she would like to try, a “yes” input is entered into the DST. This process occurs in an interview setting, with members of the TeLeTOP team and the instructor. In this way, the members of the TeLeTOP team are able to interact intensively with each instructor whose course is being re-designed, trying to identify which ideas and approaches are most likely to be acceptable and interesting to him or her, and to respond with ideas and suggestions, as well as to skip suggestions which do not seem like they will be comfortable for the instructor. Most importantly, the interview serves as a powerful source of formative-evaluation data in terms of what the instructors ask, respond to, and how they respond.

After completion of responses to all pertinent questions in the DST, the database which underlies the DST automatically generates a unique Web page with the specific answers and the options chosen by the user. In this way, instructors immediately can see via the Web browser or a printout what they have chosen and can continue to examine the examples in their own offices, simply by loading the Web pages which were generated for them.

Via the homepage of the DST all instructors can find their courses and the pages that were generated containing the choices made by the instructors during the DST sessions. The instructors are able to compare the choices they have made with the choices of their colleagues. By comparing their own courses and the chosen options of the other courses, the instructors can get more ideas for their own courses. Each instructor has the option to reconsider his or her own choices during the subsequent rapid-prototyping cycles. The option of changing the decisions is always there, so that instructors do not need to feel locked into choices made when they work with the DST.

The “decisions made” form, which is unique for every individual instructor, is also the base for the next step of the TeLeTOP rapid-prototyping method. Within a few days after the DST session, the TeLeTOP team makes a next prototype of the specific course-support environment, based on the decisions made by the instructor. After the development of this prototype, two members of the TeLeTOP team visit the instructor in his or her office, and conduct a second interview via a walk-through of the first prototype of the course Web site, further discussing the ideas and reactions of the instructor, and adjusting the prototype.

Approximately one month before the start of the instructor’s course, a second DST-interview process occurs, this time using a simplified DST that only reflects major choices made by the instructor. Although changes can still be made, the major purpose of this interview is to discuss with the instructor what he or she really plans on doing with the choices made, not only so that the team can better assist the instructor but also as another round of input for on-going formative evaluation. Thus, contact with the instructor during the preparation of his or her course has been the most important source of input for formative evaluation for the TeLeTOP team, not only for improvements to the utility and usability of the W-CMS, but also to shape the on-going evolution of the system. The DST provides a way to directly couple a series of personal interviews for formative evaluation with the on-going development of personalized Web course-support sites, and the parallel evolution of the W-CMS itself.

The instructor can continue to make and change decisions, even while a course is in progress. The TeLeTOP team keeps available to the instructor a menu of the most popular tools and choices, based on what all the instructors are currently choosing, so that the instructor can simply click on any of these if he or she wishes to add them to (or remove them from) their course environments. All choices made by instructors are tallied, and inventoried by the TeLeTOP team and used for on-going revision of the system.

Through the use of the DSTs, and a careful recording of all decisions made, and not made, by the instructors, the TeLeTOP team has a powerful information stream to address its main question: “What will instructors use?” Through a continual analysis of the responses and
choices made by the instructors, the TeLeTOP team regularly changes the functionalities offered in the W-CMS, offering more refinements to functionalities to which instructors show a particular interest and dropping functionalities that instructors do not choose.

2. State-of-the-art inventory. A second major input for the ongoing formative evaluation of TeLeTOP is the extensive amount of inventory and parallel scientific involvement carried out by the TeLeTOP team with regard to national and international experiences and trends with respect to W-CMSs. Members of the TeLeTOP team have been involved with national and international studies and seminars related to these topics, and are acknowledged as experts themselves, for example, in carrying out a national study in The Netherlands on the evaluation of W-CMSs (Van der Veen & De Boer, 1999); in editing special issues of international journals focused on the topics (Collis, 1999; Collis & Ring, 1999); and in organizing and leading an international seminar on the topics attended by over 175 persons with experience with W-CMSs during the ED-MEDIA ’99 conference in Seattle in June of 1999. Thus, there is a continual flow of input of new developments in W-CMSs to the team, and a continual further development of the W-CMS based on this information. This flow of input began well before the TeLeTOP project, and served as the basis for the 12 design criteria noted earlier (Tielemans & Collis, 1999).

3. Field input. In addition to the systematic collection and examination of data relating to instructors’ choices of functionalities for their Web sites, there are also a number of other important streams of input to inform the formative evaluation of the TeLeTOP W-CMS. These include the comments and experiences of other implementation teams making use of the TeLeTOP system or becoming familiar with the TeLeTOP system. For example, a formative evaluation was performed on the use of the TeLeTOP system by the Telematics Department at the University of Twente, the first of the faculties outside of Educational Science and Technology that are making use of the system. This evaluation was carried out by the educational center of the university, and involved student and instructor interviews as well as input from those involved with the implementation (Fisser, Van de Kamp, & Slot, 1999). In addition, an extensive series of demonstrations and seminars with qualified persons from outside the faculty has occurred since the first days of TeLeTOP, and also serves a major and on-going source of input for formative evaluation.

A major source of input in the field-studies category has been a series of formative-evaluation activities carried out during the 1998–99 academic year by a six-person evaluation team not under the leadership of the TeLeTOP team. This series of activities was organized around four themes: (a) the consequences of the new educational practice for teachers and students; (b) the tools and technical facilities of TeLeTOP; (c) the planning and institution of the new educational program; and (d) the implementation process of TeLeTOP (Van de Kamp, Fisser, Remmers, De Boer, & Carleer, 1998). For respondents, the team of evaluators focused on the students and instructors of first-year courses during the first year of the TeLeTOP system and the C@mpus+ approach (September 1998–August 1999). The following methods were used:

- Observations. Two or three lectures of each first-year course were observed by a member of the evaluation team. Furthermore, a member of the evaluation team participated in the regular support and information meetings with instructors. The results of these observations were discussed in detail during the regular meetings of the evaluation team.
- Questionnaires. Each instructor of a first-year course filled in a questionnaire about his or her expectations about the C@mpus+ approach and the use of the TeLeTOP W-CMS at the beginning of the academic year. The same questionnaire was used to measure the attitudes of instructors after using the TeLeTOP system in their course. Furthermore, students had to fill in a questionnaire for each course. This questionnaire measured their opinions on various aspects of the specific course.
- Interviews. Each instructor of a first-year course was interviewed after his or her course ended. These interviews were planned after the questionnaires were returned by the instructors. The main purpose of these interviews was to clarify and further elaborate on the information provided in the questionnaires. Similarly, group interviews with a sample of students were held after each course to elaborate on the findings taken from the student questionnaires. For this purpose, separate samples of full-time and part-time students were drawn.
- Log files. Student and instructor log files were analyzed to get an impression of the actions of individual students and teachers, and to gather information on the use of specific components and tools within the course environment (for example, the visitation frequency, the length of their visits, and the actions taken).

The results were made available to the TeLeTOP team a number of months after the data had been collected; the length of time needed for the processing of all the data meant that the results became available in most cases later than they were optimally useful for formative evaluation (an interim report appeared about six months after the first collection of data; the second and final report was received in November of 1999 for the courses which finished in June of 1999). The final-

EDUCATIONAL TECHNOLOGY/May–June 2000
W-CMS and the actions taken on the basis of these results were:

- The user friendliness of the TeLeTOP W-CMS was evaluated by the users as good.
- The flexibility of the roster (in the first version of TeLeTOP) needed improvement (this occurred in the second version of TeLeTOP, implemented before the evaluation results were processed and presented).
- Students made considerable use of the W-CMS and it was for them the most important source of information about their courses.
- Students need a clearer way to get an overview of what it expected of them in all their courses, not just in each course separately (this is technically complicated, but is being done in the third version of TeLeTOP, to be released in early 2000).
- Instructors need to continue to develop their ideas about how to use the W-CMS for added value educationally (plans are underway for a new round of contact with instructors).

Given the on-going revision and continual development of the TeLeTOP W-CMS, the specifics in the reports were not of as much impact as the sorts of feedback received directly by the team in the other forms of formative evaluation relying on other streams of input; the comments from the evaluation team when they did appear most often paralleled and substantiated this information but at a six-month time lag. For example, the comments about the flexibility of the roster related to the first version of the system, a version which had already been updated and replaced six months before the final report of the formative evaluation was submitted. This experience shows that systematic data capture in formative evaluation needs to be streamlined so that potentially valuable results can be quickly and directly funneled back into the design and development process if optimal input into a rapid-prototyping process is to occur.

Requirements for Formative Evaluation

Earlier in this article, five requirements for formative evaluation (Scriven, 1991b) were noted. How have these requirements been realized in the case of the TeLeTOP W-CMS?

First, it was argued that the object of evaluation has to explicitly be determined in order to be able to direct the evaluation at those aspects or facets that are crucial. This has been a problem for the formative evaluation of the TeLeTOP W-CMS, because of the interrelationship of this system with the TeLeTOP implementation method and the C@mpus+ approach. For example, it has been difficult to separate instructor reaction to the methods used by the faculty administration to introduce the C@mpus+ approach from reactions of the instructors to the W-CMS. The evaluation carried out by the six-person team reflected this difficulty in that it focused upon four themes: (a) the consequences of the new educational practice for teachers and students; (b) the tools and technical facilities of TeLeTOP; (c) the planning and institution of the new educational program; and (d) the implementation process of TeLeTOP (Van de Kamp, Fisser, Remmers, De Boer, & Carleer, 1998), only one of which (b) was actually the TeLeTOP W-CMS. Much of the results given in the reports of this evaluation team were in fact related to the C@mpus+ approach or the implementation approach, not the W-CMS, and thus served little direct input to the on-going design and revision of the system itself.

But this does not mean that the broader context should not be considered when generating information for the formative evaluation of a W-CMS, because the system’s utility and usability are integrally related to the larger human and institutional environment in which it is used. The major questions for formative evaluation should be: What are the conditions in this situation that will affect the use of the W-CMS by instructors and students? How should the W-CMS be designed to fit those conditions? The latter questions have been and remain a major focus for the on-going evaluation of the TeLeTOP W-CMS.

The second, third, and fourth requirements for systematic evaluation concerned the formulation of evaluation dimensions, of standards for the evaluation of these aspects, and for criteria for the determination of the system’s performance. In terms of the formulation of evaluation dimensions we identified four basic types: problem coverage (utility), scientific basis, usability, and effectiveness. The 12 criteria for the TeLeTOP system identified earlier (Tielemans & Collis, 1999) can be used as the basis for these dimensions and of standards and criteria for evaluating the system’s performance according to the dimension. Table 4 indicates the requirements, expresses them in terms of standards and given performance indicators, as well as results of various components of the formative evaluation of the TeLeTOP W-CMS.

Finally, it has been argued that the value or merit of the evaluation findings has to be determined. In the case of the TeLeTOP W-CMS itself, the value of the findings that come from the team’s direct contact with instructors and with observation of what instructors do with the system has been extremely important to the on-going development of the system. Of equal importance has been the steady input of expert opinion coming out of our many interactions with others with experience in the area. Most of the performance indicators identified in Table 4 are based on expert-based and theory-based input, not on direct comment from users. Of lesser importance have been the findings from the evaluation team, in that the length of time that elapsed between the moment of its observations and...
the presentation of the results has been too long for much direct input into the on-going design process (Version 2 was already long in use and Version 3 ready for development when comments about Version 1 appeared in the final report). The questions asked specifically about the W-CMS were of a general nature, and thus not able to give much operational input relative to the 12 criteria shown in Table 4. The overall value of the reports may well be strongest via the process of their development, as an important mechanism for expression of user perspectives.

Relationship of the TeLeTOP Formative Evaluation to Stages in Design and Program Improvement

In our general characterization of formative-evaluation methods, we noted that in a generic view of a design project, theoretical models and expert consultations are used mainly in the primary stages of development, whereas field studies become the major focus towards the end of the design process. However, with complex systems such as W-CMSs and a rapid-prototyping approach, this division is not so much linear but iterative and cyclical. Thus, the steps shown in Figure 1 of this article have not been traversed in a single, linear stream, as suggested by the diagram, but in fact have been repeatedly and non-linearly experienced. In particular, the diagram suggests that a full specification of desired functionalities can and should occur before a formative evaluation phase begins. In the case of a W-CMS, it is precisely through many rounds of formative evaluation that the desired functionalities become specified. The idea that a design team can and should predetermine all that the users will want is not appropriate. Instead, formative evaluation should shape the specification process, as well as the development process.

Another aspect of Figure 1 needs re-interpretation in the case of the design and development of complex systems such as W-CMSs. The terms used in Phases 3, 4, and 5 (Diagnosis, Causation, Prescription) may give the impression that problems are the only focus of study with formative evaluation. This is not the case. As has been already noted, a major contribution of formative evaluation is to help users become more involved in, and more articulate about, the product that they will eventually use. Also, another contribution of formative evaluation is to steer the evolution of the system in terms of the features that are proving most appreciated by users, so that these can be extended and optimized. The ovals in Figure 1 can be understood in this broader sense, but it may also be helpful to label them more explicitly so that formative evaluation as a design tool becomes more apparent.

While Figure 1 identified phases of design improvement, we also discussed in a general sense the role of formative evaluation in the process of program development. Nieven (1997) identified four main stages in this process and argued a shift in the focus of formative evaluation during these stages. This argument also needs nuancing in the case of complex systems such as W-CMSs. The major reason here is that such a system does not develop as an entity but instead is always a mixture of different stages of maturity, with some aspects reaching stability at the same time as other aspects are just at the conception stage.

Conclusion

The evolution of the TeLeTOP Web-based course-management system has proceeded in a cyclical, iterative fashion but based on a set of 12 criteria that have not needed revision. In this article, we argue that formative evaluation should be an integral part of the design and development of such a W-CMS, and also should proceed in a cyclical, iterative fashion, but also with some stable requirements. Just as W-CMSs have evolved from earlier types of complex systems, including authoring systems and tools such as word processors, the methodology for W-CMSs also needs to evolve from earlier views of formative evaluation.

Among the aspects of traditional formative evaluation which should remain present in the application to a W-CMS is the importance of including both instructors and students for user-based evaluation (Tessmer, 1993). Instructors not only will use the W-CMS, but also will use it for different purposes and with other expectations than will students. Instructors will have to implement their courses within the W-CMS and will have to integrate their instructional strategies and didactic approaches with the new type of instrumentation (Hughes & Hewson, 1998). Similarly, students have to be able to get access to the resources that become available to them, both in the learning environment that the instructor has created and from the Web as a whole. This requires not only an ability to use all the functions and tools the W-CMS offers, but also it assumes a different way of information acquaintance. This implies that a formative evaluation should not only involve instructors as well as students, but it should also address both groups in a different way, by focusing on different topics and observing different types of behaviors. In the TeLeTOP case, considerable attention has been paid to the instructors, but perhaps not enough to the students, an imbalance to be improved upon during the year 2000.

With regard to methodologies for formative evaluation, the triad (user-based, expert-based, theory-based) described by Sweeny, Maguire, and Shackel (1993) is still valid for W-CMSs. However, it is probably useful to expand on the term “expert” in order to include those involved with the back-office as well as the front-office aspects of such systems. Often, those
Table 4. Dimensions for formative evaluation of the TeLeTOP W-CMS.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Type of Dimension</th>
<th>Standards and Performance Indicators</th>
<th>(On-going) Results of the Formative Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Threshold of use as low as possible</td>
<td>Usability</td>
<td>Measured by the skills needed, those of using a word processor, file handling, using a Web browser</td>
<td>Minor revisions in editing/typing-in procedures based on observations of use and expert analysis</td>
</tr>
<tr>
<td>2. Only an ordinary Web browser is needed</td>
<td>Usability</td>
<td>Measured by the extent to which all system functions can be accessed via only a Web browser regardless of location and computer used</td>
<td>System in itself succeeds; some problems with network capacity and access especially for video</td>
</tr>
<tr>
<td>3. Instructor makes choices about features to include</td>
<td>Utility, scientific basis, usability</td>
<td>Measured by the extent to which instructors' wishes can be accommodated</td>
<td>In most cases, successful, but on-going enhancements occur; difficulty in accommodating changes in user interface</td>
</tr>
<tr>
<td>4. Extend, not replace, books and lectures</td>
<td>Utility, usability, effectiveness</td>
<td>Measured by quantitative and qualitative measures of use of the roster</td>
<td>Data (see Table 2) show the functionalities are being used; more attention now needs to be given to how the functionalities are used</td>
</tr>
<tr>
<td>5. Tools to support any instructional approach must be available</td>
<td>Utility, scientific basis, usability</td>
<td>Measured by ability to supply whatever instructors request, and by instructors being able to make use of what is supplied</td>
<td>Supply has been successful; usability is being improved for some tools, such as the quiz tool and shared workspace</td>
</tr>
<tr>
<td>6. Expansion to include any product accessible via the Web</td>
<td>Utility</td>
<td>Measured by ability to call up any Web product requested by instructors</td>
<td>Difficulties with student products involving multiple files in folders, such as projects involving Web sites provided by the students; a form of shared work space has been produced</td>
</tr>
<tr>
<td>7. Uploading and downloading must be simple</td>
<td>Usability</td>
<td>Measured by the problems encountered by users</td>
<td>Some revisions to uploading and downloading have occurred</td>
</tr>
<tr>
<td>8. Instructor can organize communication streams</td>
<td>Usability, effectiveness</td>
<td>Measured by usage, instructor, and student satisfaction</td>
<td>Complaints by students most related to deficiencies in instructors' practice, such as slowness in responding, unclear responses, etc.</td>
</tr>
<tr>
<td>9. Access organized around log-in data</td>
<td>Utility, effectiveness</td>
<td>Measured by accuracy of access, based on user characteristics</td>
<td>Revisions needed for external users, persons having different roles</td>
</tr>
<tr>
<td>10. Maintainability</td>
<td>Utility (system perspective)</td>
<td>Measured by opinion of system master</td>
<td>Hand entry of registration, individual templates were most time-consuming; extensive upgrade</td>
</tr>
<tr>
<td>11. Multimedia data needs to be handled same as text data</td>
<td>Utility, usability</td>
<td>Performance indicators: speed, quality</td>
<td>Full compatibility with video server; network access problems for persons outside of Netherlands</td>
</tr>
<tr>
<td>12. Instructors and students are using the system</td>
<td>Usability, utility</td>
<td>Measured by usage and robustness</td>
<td>See Table 1; all first- and second-year courses, as well as others; no technical crashes or slowdowns, but continual improvements in back-up and other back-office features</td>
</tr>
</tbody>
</table>
only interacting with a system through the front-office functionalities are not aware of issues involved with the back-office architecture; both aspects need to be considered in harmony during the design and development of a W-CMS. A sample of users is not enough for a full range of necessary input.

The basic premise of formative evaluation—to provide input that can be operationalized during the development of a program or system—is still valid with respect to W-CMSs, but again needs some adjustment. A complex system evolves over time, over different versions beginning with prototypes, and is often only partially specified in its first iterations. Thus, the input that comes from formative evaluation is not only input relating to problems or deficiencies in a system, but more broadly is input for the further growth of the system. This growth is also based on responding to aspects that are well received and accentuating or expanding them, as much as it is based on aspects needing adjustment. The growth is also based on new developments occurring elsewhere, on the increasingly mature understanding of all involved as to what is reasonable to expect in such a system, and on creative bursts coming out of the synthesis of so many different streams of input. Thus all aspects of formative evaluation need to be closely aligned with each other and open to all those involved in the design and development process.

There are complexities in the formative evaluation of W-CMSs. One of these is the interrelationship of the W-CMS with the surrounding context, and its cultural, social, technical, and institutional aspects. How far the designers of the W-CMS can be held accountable for the results of these interrelationships is difficult to determine. Clearly they must be sensitive to the aspects, and design the W-CMS to be flexible enough to fit the most salient characteristics of those aspects, but where to draw the boundary with respect to keeping a well-defined evaluation focus will remain a problem.

A number of comments can be made about the institutional context of the faculty or institution in which the W-CMS is used. Besides educational motives, the implementation of a W-CMS system also will be rooted in the institution’s strategic reasons for such a system, such as to enhance the attractiveness of its courses to a broader base of learners or to emphasize the technological profile of the faculty. Both of these were important motivations for the commissioning of the TeLeTOP W-CMS, and need to be also considered in the evaluation. One of the implications of these strategic priorities for the TeLeTOP system was that it was ensured that the TeLeTOP system will be used for the next few years. Unless severe problems arose, it was understood that the formative evaluation of the TeLeTOP W-CMS was not a vehicle to determine the continuation of the system, but rather the continued development of the system. This highlights the importance of taking strategic factors into account when the merits of W-CMSs are examined.

Two aspects of traditional approaches to formative evaluation definitely need nuancing in the case of W-CMSs. One of these is the presumption that design and development proceed in a linear fashion, and that formative evaluation can take place at a particular moment in this linear progression. The other is that the specifications of a design can and should be clearly given before design, development, and formative evaluation begin. Design and development will not and should not take place in such a way, because this would suggest that the system is not being sufficiently responsive to the reactions of the users or to new developments and experiences in the field which occur on an on-going basis. There will be many loops and iterative cycles of design and development, with some aspects of a system reaching stability and others only at the creative-thought stage at any given time. Also, the ability of the users to understand and contribute to the evolution of the product needs to grow with time and experience. Thus, any visualization of formative evaluation for W-CMSs should be drawn to reflect this non-linear, iterative process. Reactions of users to the utility of a W-CMS must be seen in the context of their familiarity with such systems; however, their appraisal of the usability of the system is valid whatever their level of experience. Usability for a novice will be different than usability for a power user, but both perspectives are valid and important.

Many institutions will choose to buy or license existing W-CMSs, rather than design and develop their own. However, others will be dissatisfied with the constraints of externally marketed systems and will decide instead to produce their own. As this base of experience evolves, the triangulation of input streams shown in Table 3 will become more familiar and the methodologies generating them more refined. Part of this process is the articulation of those methodologies as they evolve in practice. In our view, the TeLeTOP experience can make a contribution to this articulation.

References


EDUCATIONAL TECHNOLOGY/May–June 2000
individual's use of a telematics application. International Journal of Telecommunications in Education.


Cronbach, L. J. (1963). Course improvement through evaluation. Teachers College Record, 64, 672-683.


Masłowski, R., & Visscher, A. J. (1997). Methoden en technieken voor formative evaluatie in sociaal-wetenschappelijke ontwerpsituaties [Methods and techniques for formative evaluation in social scientific design situations]. Faculty of Educational Science and Technology, University of Twente.


Subscription Order Form

Educational Technology Publications
700 Palisade Avenue
Englewood Cliffs, New Jersey 07632

Please enter my subscription to Educational Technology for the following term (check appropriate boxes):

Domestic USA

☐ 1-year subscription $119.00
☐ 3-year subscription $319.00

Foreign

☐ 1-year subscription $139.00
☐ 3-year subscription $369.00

Name .................................................................
Address ................................................................
City ...................................... State ........... Zip ..........