MEASUREMENT OF EFFECTIVENESS IN OPEN AND DISTANCE LEARNING

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Some Open and Distance Learning (ODL) initiatives are created as a replacement for face-to-face tutorials and treated as the primary teaching medium. Others are accomplished for purposes relating to student access to learning centers and as complimentary learning tools. Most attempts to implement ODL courses in educational settings have added them on to already existing course materials rather than revising course structure and content. To address the issue of different learning styles of the engineering population and to adapt the ODL materials a survey was carried out and some measurements were made to assess the effectiveness of the proposed products.

1. Ventures of Open and Distance Learning

Technology developments have been influencing daily life at an unexpected rate and with tremendous changes in the areas of learning and teaching. The media used in communication are playing an important role changing the format and the quantity of information available for educational purposes[1]. These changes require a series of reflections and thoughts about the future role of learners and teachers. A specific area where transformations are more radical is Open and Distance Learning (ODL).

One of the most used media systems to be adopted for use in ODL is based on computers, including communication using electronic mail, data collected from the WWW, CD-ROM, dedicated software and connections with other audiovisual media using voice and image[2]. ODL uses this electronic environment to make available educational resources to those who would otherwise not have access to them.

Other important media in ODL are TV and video recorders, manuals, satellite transmissions, direct mailing and printed material. Learners have presently the possibility of continuous access to specific information and dedicated learning tools. Therefore teachers, researchers and administrators in a classical educational system must face this rapid change in education methodologies regarding course profiles, teaching procedures and other institutional issues that are connected with ODL practice.

1.1. Flexibility

Some materials for the courses are requested by a number of learners with very different educational backgrounds. Therefore the courses have to be prepared with enough flexibility to support a range of different learning demands. The materials need a degree of user friendliness to meet many different attitudes towards the learning medium used, such as people being afraid of using computers or falling asleep watching an educational video.

1.2. Universality

The ODL materials have production costs that can only be met if their use is as large as possible, and must therefore be prepared for a mass audience enabling a potential use that guarantees the elimination of geographical frontiers. This means that they must also consider cultural and educational characteristics inside or outside the country(ies) of production that may represent a barrier to the use of ODL materials.

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1.3. Innovative Models

The new technologies available for ODL courses are in some cases the opposite of traditional courses in terms of structure, organization and evaluation. The teaching and learning models adopted have to be innovative and adapted to these media and tools so that courses make use of the full potential of ODL. There is a great need to rethink the teaching models in the design and delivery stage and to create new pedagogical guidelines to achieve proper learning.

1.4. Cooperation

The production of ODL courses and their materials have to be produced in cooperation with other institutions and groups of users, such as industrial and associations of professionals. In this way the product will be guaranteed a certain degree of success in terms of destination group. The industry and other sectors of society have a cooperative role that may improve the quality of the courses and their use. Cooperation between teachers from different institutions is also highly desirable since it will contribute to lower costs and increase the potential target group of the courses.

1.5. Teaching activities

These are the most difficult challenges since the motivation of academia to change their teaching methods is traditionally low. The new activities have to be considered as new tasks for the instructors and not as additional work on top of the existing t asks. When it is an additional task it should be rewarded in accordance. In cases where it is a new type of work for the instructors there must be an adequate training phase where they are also learners of the new learning and teaching technologies.

1.6. Organizational infrastructures

The production of ODL materials requires new administrative infrastructures together with equipment facilities for the delivery of this type of course. The established system will suffer considerable changes that must be addressed adequately by the administration allowing the ODL teaching and tutoring functions to be implemented with the necessary support including proper technicians to manipulate the new equipment and technologies.

1.7. Learning evaluation

ODL needs a proper and new system of quantifying the learning progress. Considering the different forms of learning achievements such as skills, knowledge acquisition or understanding, the assessment and evaluation has to be designed to measure the full amount of learning achieved by the learner. This evaluation can be done on an open mod e but it must address the characteristics of the ODL course.

2. Characteristics of ODL Courses

Some ODL initiatives are created as a replacement for face-to-face tutorials and treated as the primary teaching medium. Others are accomplished for purposes relating to student access to learning centers and as complimentary learning tools. Some important questions relate to the availability of computers and to technical support and the allocation of teaching staff to produce these materials. Most attempts to implement ODL courses in educational settings have added it on to already existing course materials rather than revising course structure and content. Generally, ODL materials become more integrated when the course is designed specifically for the particular medium[3].

Factors to be considered for ODL course design is the maturity and profile of students, the interface friendliness, the interaction with other students and tutors, and the flexibility of the learning pace. Another typical characteristic of ODL is that it may promote cooperation between learners if a group is set regularly to address joint projects

or questions. This is a fundamental change from the vertical structure of classical education al systems and in some cases, such as adult education, may represent an enormous added value to teaching and learning.

In ODL courses there is a material that is permanent and reusable, unlike face to face instruction. This has advantages such as the chance for all learners to have access to the whole set of information and for students to study at their own pace. Other conveniences are that for ODL courses to be better prepared than traditional ones and for enabling interaction between learners and tutors in a more open communication environment. For teachers the overload of students may be unbearable if there is no fixed upper limit to the number of learners interacting with each ODL course tutor. As additional tasks to the traditional teaching responsibilities, it may be a heavy burden if the workload is not adequately defined and limited. Since learners can incorporate outside resource materials into their response, it can improve the level of discussion but also increase the complexity of the tutoring process. In some cases this a barrier for the involvement of tutors in ODL, for instance if learners are active professionals.

ODL teaching requires some reorganization, despite the fact that much of an instructor's expertise in face-to-face interaction or distance teaching will have to be generalized properly to the ODL environment. ODL tutor training might occur through manual s that include the differences between ODL and face-to-face interaction, a basic list of right ways and wrong ways, examples of ODL interactions and analyses of basic communication problems and possible solutions. Some issues are particularly relevant such as the techniques used to moderate and facilitate discussion and interaction between the learners and tutors or the adequate procedure to train instructors in effective ways to teach using ODL. Another concern is the effective pace of work of the learners using ODL material that has to be chosen and controlled so that it will meet the deadlines or learning rate qualifying factors and pedagogical requirements.

ODL courses and materials are an inevitable development for the future of the teaching activities and must be faced as soon as possible. The consequence of being outdated on this issue may mean that universities lose the functions because others have already prepared ODL materials that may fit the needs of the expected customers. Another danger is the decrease of traditional teaching leading possibly to unemployment since the learners in Continuing Education are in most cases capable of using the ODL material and the information technologies without direct tutoring.

Quality assurance has not been present in most ODL courses produced and that has been a major obstacle to the acceptance of this type of learning by the teachers and learners. Some of the ODL courses have been designed based on the innovative capabilities of the supporting medium instead of the course pedagogical value[4]. The challenge of quality evaluation and learning effectiveness of the ODL courses must be a priority in the course design and delivery. Without a generalized quality control of the OD L courses the learning achievements will not be guaranteed just by the use of sophisticated media.

It is envisaged that teachers will be trained in ODL technologies and pedagogy together with organizational changes that allow the implementation of ODL courses in the classical teaching institutions[5]. These are complex issues that need rethinking and adaptation but the future of the learning environment is evolving rather rapidly. The future o f ODL courses is not only in Continuing Education, where the learners are working and educated are therefore more likely to succeed, but also in the traditional basic education. The attitude of Lifelong Learning must be adopted by all and first of all b y the teachers, who have the duty and the responsibility of being the leaders in this change of attitude.

3. Learning Characteristics of the Engineering Population

To face the challenges described above it was necessary to define the learning styles of the possible users of ODL in Continuing Engineering Education (CEE) courses. It was difficult to research the active professional population so the study was carried using data about the student population in the last year of their degree in Engineering. The data used was obtained in the period between 1993 and 1997 with a voluntary survey among the students at the beginning of the year. The use of this data is conditioned, for instance, by the possible differences between the student population and the active professionals in terms of learning styles. However this is the only consistent data available for the purpose of designing the CEE ODL materials.

The adopted learning theory was the one proposed by Kolb designated as Learning cycle [6]. He developed a two-dimensional circular model of how people learn. The model considers, in a first dimension, active experimentation (AE) versus reflective observation (RO) and it tries to address the question of how individuals transform experience into knowledge. The second dimension is the choice between abstract conceptualization (AC) and concrete experience (CE) and attempts to tackle how an individual absorbs information. Characteristics are shown in Table 1[7].

1.When I learn	I like to watch and listen	I like to think about ideas	I like to be doing things	I like to deal with my feelings
2. I learn best when	I listen and watch carefully	I rely on logical thinking	I work hard to get things done	I trust my hunches and feelings
3. When I am learning	I am quiet and reserved	I tend to reason things out	I am responsible about things	I have strong feelings and reactions
4. I learn by	watching	thinking	doing	feeling
5. When I learn	I look at all sides of issues	I like to analyze things, break them into parts	I like to try things out	I am open to new experiences
6. When I am learning	I am an observing person	I am a logical person	I am an active person	I am an intuitive person
7. I learn best from	observation	rational theories	a chance to try out and practice	personal relationships
8. When I learn	I take my time before acting	I like ideas and theories	I like to see results from my work	I feel personally involved in things
9. I learn best when	I rely on my observations	I rely on my ideas	I can try out things for myself	I rely on my feelings
10. When I am learning	I am a reserved person	I am a rational person	I am a responsible person	I am an accepting person
11. When I learn	I like to observe	I evaluate things	I like to be active	I get involved
12. I learn best when	I am careful	I analyze ideas	I am practical	I am receptive and open minded
Totals for each learning mode	RO Reflective Observation	AC Abstract Con-ceptualization	AE Active Experimentation	CE Concrete Experience

Table 1. Learning Mode Assessment

The four areas are considered steps in learning as a complete cycle for complete learning although each individual has preference for some of them. The style preferences of each student were assessed using a questionnaire with twelve questions about the predilections in the learning environment. The questions of the sample used are presented in Table 1 and the marking consisted of ordering the four options for each question from 1 to 4 where the highest number was the most preferred and the lowest was the least favored. The sum for each column would give the score for each aspect of the Kolb Learning cycle. These values represent the importance for each learning style based on the individual awareness and reflect the relative status at the moment when the questionnaire is answered. It is important to underline that each individual may develop each one of the learning styles at different paces and change these results..
According to these scores and considering the relationship between the two dimensions the learning style is classified as shown in Table 2 as accommodator, diverger, assimilator or converger[8]. The accommodator prefers active experimentation and concrete experience (salesman), the assimilator likes abstract conceptualization and reflective observation (scientist), the diverger favors concrete experience and reflective observation (artist) and the converger chooses abstract conceptualization and active experimentation (engineer).

AC-CE	AE-RO	
	-36 to 6	6 to 36
-36 to 4	Diverger	Accommodator
4 to 36	Assimilator	Converger

Table 2. Dominant Learning Style.

The results of the survey for the five consecutive years had a total response of 146 students. Results are shown in Figure 1 according to the mentioned classification criteria. It should be underlined that the calibration of the values of Table 2 was made with a population of about 1500 engineering students in the countries of Benelux and some bias may exist due to cultural and to curriculum differences.

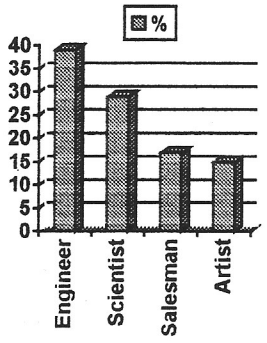

Figure 1. Distribution of Students per Learning Styles.

4. Evaluation of ODL Effectiveness

The ODL courses were designed taking into account the type of the two most frequent learning styles converger and assimilator. The materials transformed on ODL made part of a course on computer aided design. The main aspects that were considered were homework problems and simulations for the converger type and reading and computer

demonstrations for the assimilator kind. These were based on the notion that the engineer type enjoys logic and practical applications of theories and the scientist kind likes inductive reasoning and is better at understanding information. Therefore the ODL materials were developed for a computer environment consisting of course content with the text organized with logical hyperlinks and of questions, problems and puzzles from concrete situations in engineering design.
The effectiveness measurement was made following Mager's principle [9] that states that the learning objective is met if the description of the desired behavior from the learner is obtained after undergoing the learning process. In this case this evaluation of the performance was assessed comparing the grading of the students using the ODL materials with the average grading of students in the previous years. It was also compared in terms of the learning styles for the same two groups and the results are presented in Table 3. The grading scale is 0 to 20 with 10 as minimum passing grade.

Students	Total	Engineer	Scientist	Salesman	Artist
ODL users	13.3	15.1	13.9	11.2	10.3
Previous years	13.1	14.2	13.3	12.8	11.7

Table 3. Comparison of Results.

5. Conclusions

The data shows that these ODL materials were beneficial for the students from the two types of learning styles with greater representation (assimilator and converger) but not adaptable to the other types of students. This fact shows evidence that all possible learning styles should be incorporated in the ODL materials if a larger population is considered as target. This survey is very limited and further research is needed to improve the common acceptance of ODL materials. A possible reason for the fact that ODL courses are not very effective is due to the fact that the latest technological advancements are usually present but often they lack convenient pedagogical design.

6. References

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