Proceedings of the 5th WSEAS Int. Conf. on DISTANCE LEARNING AND WEB ENGINEERING, Corfu, Greece, August 23-25, 2005 (pp71-76)

Integrating the Marketing Concept into Science Learning

ARIE MAHARSHAK
Department of Industrial Engineering and Management
Ort Braude Engineering College
81 Snunit St. Karmiel
ISRAEL

DAVID PUNDAK
Jordan Valley College
School of Engineering
Jordan Valley
ISRAEL

Abstract: - While traditional learning appears to be a challenging obstacle for science students, today's technology enables 'tailoring' the learning process to the student's needs, even in large classes. This reflects the essence of the marketing concept – viewing the student as a customer whose special needs have to be met during and after the study period. The utilization of the Web techniques represents both the realization of the 'Just in Time' philosophy and the implementation of the marketing concept. This means the immediate identification of the student's needs and difficulties, the application of modern pedagogy by utilizing the Web mechanism, and the design of a proper approach within a fruitful discussion between the lecturer, the students and the class. The following paper presents a pilot in which the Marketing-Web concept was applied, and reports its preliminary results.

Key-Words: - science, active learning, student, marketing, web, just in time

1 Introduction

Most academic institutions around the world still teach science using the conventional approach, based on a pre-set syllabus and frontal presentation [1],[2]. In the conventional approach the student is required to adapt himself to systems that do not necessarily have any commitment to getting to know him or recognize his abilities [3],[4]. Rather, the student has to meet standard criteria that are routinely checked only at the conclusion of the course.

From a marketing viewpoint, teaching physics is merely a single case of a marketing event: an interaction between the providers and receivers of the service. In this interaction, customers, marketers, a product (that in this case is a service), and stakeholders (the college, Council for Higher Education, places of employment and others) participate. The event occurs at a certain time and place, defining the venue of interaction. For example, environment developed by Bernstein in Psychology at Nebraska University [5], or by Sandefur in Mathematics at Georgetown University [6] or by Mazur in Harvard [7].

The marketing discipline attributes great importance to the fact that the actual provision of the service and its consumption are done in direct dialog between the "seller" and the "buyer". The dialog is the essence of the service. The seller's ability to "read" the buyer's needs in real-time, and respond to his feelings – and sometimes to his distress – during the process represents the deciding factor in the success of the "sale"[8]. The failure of the seller to provide an effective and efficient response at the relevant point in time diminishes the quality of the product and hurts the customer. Therefore it is the responsibility of the seller to know totally his product, demonstrate empathy toward the customer, to be at his best, understand the difficulties of the process, and to be ready to provide feedback and ongoing support during the interaction [9]. Support for this claim can be found in David Hestenes' Fifth Principle [10], according to which intelligible and critical feedback is structured in the learning process.

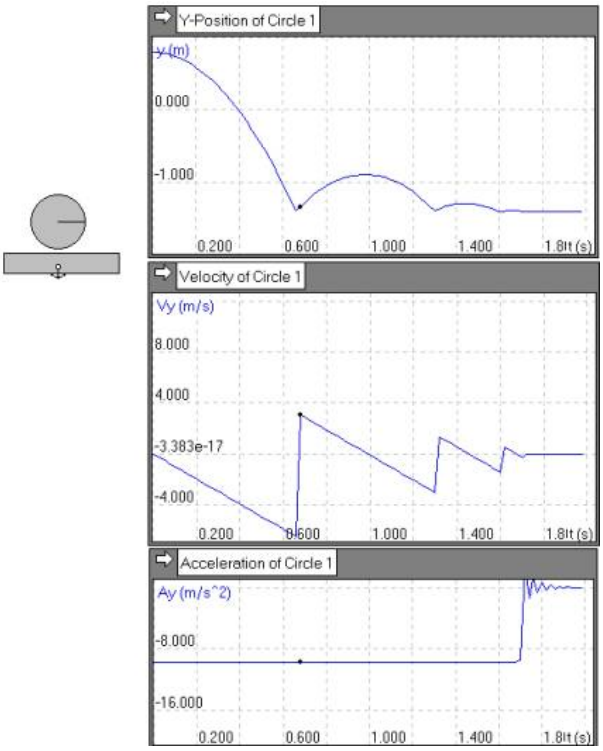
2 Ignoring Student Needs

The shortcoming of conventional teaching is that it does not take the student's needs into account. Even more so, many science courses are divided into three components – lecture, practice, and laboratory work. Sometimes, a different teacher teaches each of the components. The result is that the connection between the course components is not always evident [11].

Many students learning science courses sense that the assignments are beyond their capacities. They receive too little support through the course and too little instruction in acquiring the necessary skills for succeeding in the course. This approach does not look at the mistakes that the students make in the manner they solve the assigned problems nor does it relate to their ways of thinking. The presentation of problems is abstract, usually mathematical, and bears no relationship to daily life [12]. Among a portion of the students, this phenomenon reinforces the idea that science is really a theoretical subject, meant for scientists and geniuses, and not essential to their profession as engineers. In the meantime, they adopt survival techniques; one of them is searching for a formula that will rescue them from the bothersome problem placed in their path.

In the conventional fashion, physics does not train students for working in groups. The teacher perceives the student, over the entire studies process, as an isolated unit for whom teamwork would be difficult. For his part, the teacher finds it hard to assess the student's achievements [13]. This is totally contrary to the demands of future employers and even to the findings of researchers of teaching the subject. Heller and Harbaugh [14] found that students who worked in groups for practice exercises were successful in coping with questions that lecturers in the conventional way avoided presenting to students, because they were too difficult. They found that interactive classes were 20% more effective than frontal lecture classes. In the conventional approach, students must display talent in solving theoretical problems, but they don't have an opportunity to plan how to confront problems related to their daily life, such as the problems they will confront at the conclusion of their studies. It is possible to construct problems that demand planning, as was done at the University of Ohio [15]. Students in the physics labs are required to design experiments that are meant to achieve goals or test system characteristics. A study has reviled a great deal of difficulty making the connection between motion events and the graphs representing that motion [18].

Fig.1 – A simulation of of Interactive Physics. The purpose of this simulation is to help students make the connection and see an example of the strengths and shortcomings of Interactive Physics simulation software. Adopted from Beichner [18]



3 Utilizing Web Technology Integrating the Marketing Concept

3.1 Web Technology and Active Learning

Active teaching methods have been developed in opposition to the conventional approach. For the last twenty years, these new methods have been successful in dealing with the students' difficulties and developing their learning skills. Due to the fact that science needs to be learned by a large population of students who lack high abilities for abstraction needed by scientists, alternative learning methods that do not rely on lectures must be developed. Downs [16] describes strategies that could be integrated into learning systems at all stages in order to help students become effective learners. These strategies are presented in the following table.

Table 1 - Learning-to-learn strategies contrasted with conventional educational practice. Adopted from Downs [16]

Conventional	Developing learning skills
Skills of learning are covert hidden!	Skills of learning are made overt and discussed
The instructor explains concepts	Learners develop concepts
Learner is passive	Learner is active
Mistakes are mostly avoided	Mistakes are viewed as useful learning opportunities
Instructor poses questions and provides solutions	Instructor poses problems and discusses learner's solutions
Assessment concerns primarily the product	Concerned with the product and the process—both are important

These non-conventional methods, based on the Web technology, encourage the active involvement of the student and demonstrate a significant improvement in learning [17], [18].

3.2 The Marketing Approach

The marketing concept places the customer, i.e. the student, at the center. Success in marketing, according to this idea, is contingent on the readiness and capability to understand and reason the customers' needs and preferences, to analyze them, and then to design an appropriate response.

Viewing students as a customers who come to the college "to formulate knowledge" (and in our case – to create self-knowledge of the principles of Newtonian reasoning) demands an investment of time and resources in understanding the needs in the science learning process and the formulation of a creative approach by investing in IT infrastructure [7].

Adopting the marketing concept in the field of teaching science demands that the educational establishment relate and invest the required resources to meet their needs [19].

The academic institution is evaluated on its ability to offer a quality product that meets the needs of the customer and the objective quality standards. Thus, a solution to the problem of teaching science in college is of mutual interest to both the students and the college. Therefore, the proposed approach calls for the adoption of the marketing concept by both college and students, and mainly, for a complete application of its principles as part of the college management outlook [20], [21].

The situation described above creates a special challenge to those responsible for the teaching of science in the academic institution: design of a course that is suitable and "tailor-made" for the needs of the students in the course. These students may have homogenous skills and background, but differ in their capabilities. Assuming continual improvement in a course from year to year, this challenge is a condition if a new course is to be planned. The intention is to respond to the annual profile of students for whom learning the science course is compulsory, and also keep in step with developments in teaching science throughout the world.

A study of naïve perceptions held by students was recently conducted by the authors of this article at two colleges. The study checked the readiness of 207 students to give up their naïve positions in connection with marketing theory, after they had taken the course "Introduction to Marketing". The authors examined six general aspects:

1. Marketing that focuses on customer needs.
2. Marketing as a planning tool in the organization.
3. Marketing as an inborn talent vs. a learned skill.
4. Marketing as a work ethic in the organization.
5. Marketing as a means for promoting sales.
6. Marketing as an ongoing obligation.

Following interviews with students, and based on professional and pedagogic literature dealing with teaching marketing, a research tool was developed that contains 36 statements about marketing. Each one of the six general aspects was represented in the questionnaire by four to nine statements. Each statement expressed a naïve or scientific idea, and examined the student's perception of the marketing profession. The student was asked to rank the statement on a scale of 1 to 5. The questionnaire was implemented two times – once at the beginning of the semester and, again, at the semester's conclusion. The course lecturers who examined the research questionnaire estimated that after they had completed the course there would be substantial differences in the students' attitudes and that most of them would adopt a scientific perception toward the marketing

profession. To examine the degree of change in student attitudes, Hakes Improvement Index - g - was adopted (Hakes, 1998).
g = (f-i)/(100-i),
where:
i = the percent of students holding scientific perceptions at the beginning of the course;
f = the percent of students holding scientific perceptions at the end of the course.

Hake distinguished three improvement levels:
A low improvement level where $g<0.3$;
A medium improvement level where $0.3\leq g<0.6$); and
A high improvement level for $g\geq 0.6$.

Table 2 - Distribution of student perceptions in the ' Introduction to Marketing' course in percentages relative to different marketing aspects, at the beginning of the course and at its conclusion, and the improvement index 'g'.

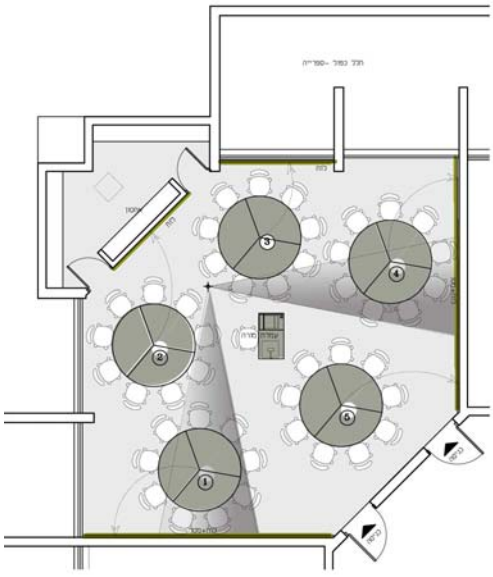
Questionnaire time	Perception / view	Customer needs	Organi-zation plan	Acquired skill	Work ethic	Sales	Ongoing obligation
Beginning of course	Scientific	68	62	39	57	28	68
	Naive	15	13	36	16	52	12
End of course	Scientific	71	63	36	59	28	70
	Naive	11	14	36	16	51	9
'g'		0.094	0.026	-0.049	0.047	0.000	0.063

The research results show that, in fact, there was no substantial improvement in the ratio of naïve perceptions to scientific perceptions at the end the course compared to its beginning. The courses and lecturers, who won high grades in the students' feedback, did not bring about a substantial change regarding the central perceptions in the field of marketing. For example, most of the students still viewed marketing as an inborn talent rather than an acquired skill.

3.3 The Pilot – Applying the Suggested Approach

The Ort-Braude College of Engineering in Karmiel has invested great efforts in implementing this innovative approach, which asserts that activating students will bring them to understand scientific principles [23]. Adoption of this approach involves casting off of teaching methods that are familiar to the staff members and adoption of successful methods such as the 'SCALE-UP' method developed by Bichner [18]. In this method, the lecture hall is exchanged for a classroom workshop setup in which students sit at circular tables (see Fig. 2). The lecturer positioned at the front of the hall on a raised stage is moved to the middle of the workshop. During most of the lesson time, the students contend with assignments and work by solving problems and conducting laboratory investigation. The classroom functions as a research group in which different teams report on their activities and findings. The lecturer's job is focused on planning the teaching environment, motivating the students and providing effective feedback in real time, while the students cope with the challenges. The learning activities in the classroom are aided by a communications network running between the lecturer and the students and among the students themselves. This network permits assignments to be distributed, computerized models to be displayed, problems to be presented, feedback to be provided, group discussions to be held and more.

Fig. 2 - Design of the classroom after changing to the Scale-up method.



4 Conclusions

The departure from the lecturer's conventional function and the adoption of an innovative teaching method is not easy for most teaching staff members. Even with the success of this approach in teaching physics at MIT and at dozens of other universities in the United States, which has resulted in an improvement in student achievements, this method yet to be implemented in many other academic institutions world wide. The fear of surrendering a familiar model and confronting a challenging and complex learning environment is not exclusively held by students, but is also felt by the teaching staff.

References:

[1] E. Boyer, *Scholarship reconsidered*: Priorities of the professoriate. Carnegie Foundation for the Advancement of Teaching. 1990.

[2] R Diamond., & B. Adams, *The disciplines speak*: Rewarding the scholarly, professional, and creative work of faculty. Washington, DC: American Association for Higher Education. 1995.

[3] Clement, J. Using bridging analogies and anchoring intuitions to deal with students' preconceptions in physics, *Journal of Research in Science Teaching* Vol. 30, No.10, 1993, pp.1241-1257.

[4] F. E. Redish, *Teaching Physics – with the Physics Suite*. Wiley, NY. 2004.

[5] D. Bernstein, "Bernstein project summary – Januray 2000". http://www.unl.edu/peerrev/examples/bernstein/index.html.

[6] J. Sandefur, Foundations of Mathematics, http://cndls.georgetown.edu/projects/posters/sandefur/

[7] E. Mazur, *Peer Instruction*. Prentice Hall, New Jersey, 1997.

[8] T .Levitt, Marketing Myopia. *Harvard Business review*, Vol. 38, No. 4, 1960. pp. 45-56.

[9] R.R. Klink, & G.A Athaide,. Implementing Service Learning in the Principles of Marketing Course**.** *Journal of Marketing Education,* Vol. 26, No. 2, 2004. pp. 145-153

[10] D. Hestenes. Reforming the mathematical language of physics. *American Journal of Physics.* Vol. 71, No. 2, 2003. pp. 104-121.

[11] D. Pundak, & A. Maharshak, Teaching Physics – The Marketing Concept. *Announcer*. Vol. 33, No. 4, 2003. pp. 135

[12] P. Carmichael, R. Driver, B. Holding, I. Phillips, D. Twigger, & M. Watts, *Research on students' conceptions in science*: *a bibliography*, Centre for Studies in Science and Mathematics Education, University of Leeds, Leeds. 1990.

[13] E.F. Redish, Implications of cognitive studies for teaching physics. *American Journal of Physics.* Vol. 62**,** No. 11, 1994. pp. 796-803.

[14] P. Heller, & M. Hollabaugh (1992). Teaching problem solving through coorperative grouping. Part 2: Designing problems and structuring groups. *American Journal of Physics*, Vol. 60, No. 7, 1992. pp. 637-644

[15] K. Heller, & P. Heller *The Competent Problem Solver*. University of Minnesota. 1992.

[16] S.S. Downs, ''Developing learning skills,'' in *Learning Management: Emerging Directions for Learning to Learn in the Workplace*, edited by M.E. Cheren. Ohio State University, Columbus, OH, 1987. p. 37.

[17] Y.J. Dori, & , J.W. Belcher. How does technology-enabled active learning affect students' understanding of scientific concepts? *The Journal of the Learning Sciences,* Vol. 14, No. 2, 2005. pp. 243-279.

[18] R.J. Beichner, , J.M. Saul, , R.J. Allain, D.L. Deardorff, & D.S. Abbott, *Introduction to SCALE UP: Student-Centered Activities for Large Enrollment University physics.* Proceedings of the 2000 Annual meeting of the American Society for Engineering Education.

[19] A. Van Heuvelen. The Workplace, Student Minds, and Physics Learning Systems. *American Journal of Physics*, Vol. 69, No. 11, 2001. pp. 1139-1146.

[20] D. Pundak, A. Maharshak, S. Rozner, Successful Pedagogy with Web Assignments Checker. *Journal of Educational Technology Systems*, Baywood Publishing Company, Inc., NY. Vol. 33, No. 1, 2004. pp. 67-80. 2004.

[21] Laws,P. *Workshop Physics: Activity Guide.* Wiley. 1999.

[22] R.R. Hake, Interactive-engagement vs traditional methods: a six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics* Vol. 66, No. 1 pp 64-74. 1998

[23] A. Maharshak, D. Pundak, Active Physics Learning – Combining the Marketing Concept with Information Technology. *Journal of Educational Technology Systems*, Baywood Publishing Company, Inc., NY. Vol. 32, No. 4, 2004. pp 399-418. 2004.

Proceedings of the 5th WSEAS Int. Conf. on DISTANCE LEARNING AND WEB ENGINEERING, Corfu, Greece, August 23-25, 2005 (pp71-76)