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Marketing Approach and the Naïve Perception

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Abstract: Coping with science topics often develops into a substantial challenge for many students. The way scientific phenomena are perceived by students reflects their early concepts, beliefs, intuition and experience (referred to as "naïve perception"). This perception tends to contradict the scientific positions held by faculty and experts. The paper examines the effect of introductory courses in the social and exact sciences on students' conceptual change. The courses were found to only have a small impact on narrowing the gap. The article's recommendations deal with the importance of the lecturer adopting the marketing approach: being aware of the students' dichotomy, and apply appropriate methods in order to reduce it.

Key-Words: - marketing, student, science, web, naïve perception, active learning

1 Introduction

Lecturers tend to believe that a well-constructed and exciting lecture will enhance the transfer of theories and scientific ideas to their audience. Sometimes, however, there are cognitive and hidden barriers that prevent the students from effective implementation of the issues under discussion. Research has shown that one of the more common barriers in the learning process is the student's initial attitude to the issue under discussion, namely his early concepts, beliefs, intuition and experience. In the professional literature this initial attitude is referred to as "naïve perception". For example, there are those who believe that the sun orbits the earth and they will not accept established scientific truth, even though they pay it homage through lip service [1].

Naïve perceptions are fashioned in the course of daily experience and the influences exerted by a person's milieu and cultural environment. A person holding naïve perceptions tends to over-generalize, and stubbornly cling to his perceptions, contrary to the scientific approach based on methodical research and perpetual skepticism. It is possible to relate to naïve perception as a kind of 'life wisdom' inconsistent with scientific knowledge. The student's exposure to models and scientific theories in introductory courses commonly produces dissonance and opposition to the acceptance of scientific knowledge. This causes the student to function on two levels: 1) the course level in which he needs to fulfill the formal requirements and 2) the daily level in which his/her naïve perceptions take precedence. This dichotomy impedes scientific learning processes.

2 Common Sense Versus Scientific Law

Redish [1] related how in one introductory science course the lecturer was pondering aloud on the matter of our place in the universe. Do we orbit the sun the same way the electron orbits the atom's nucleus? Or, quite to the contrary, is our position in fact at the center of the system? After exploring the issue presented to the young listeners, there was no doubt about their unanimous position that the sun is at the center. They took this position despite the obvious fact that the sun rises in the east, moves along its heavenly course during the day and sets in the west. The lecturer continued to investigate and asked the class, “Why do you think so?” The silence was deafening. Not one student could explain the “scientific truth” – that the earth goes around the sun – which they had learned when they still in kindergarten. This confusion is an indication of the way in which knowledge is transferred, which, practically speaking, is unacceptable, but is deeply instilled in all of us.

The gap between accepted knowledge and the scientific approach, between daily experience and critical generalization, between ordinary speech and exact terminology in its context, between common sense and precise scientific doctrine have occupied ‘learning processes’ researchers for the last two decades, just as they have bothered philosophers for the last two thousand years. The high rate of failure in teaching the basic subjects in institutions of higher learning, both in Israel and throughout the world, disturbs many staff members [2]. In our opinion, an important component of the difficulties encountered when confronting a scientific culture is linked to students’ adherence to naïve perceptions.

Naïve perceptions regarding the construction of the world and its function are transmitted to us in the framework of the society into which we live. These perceptions are related to methods of healing diseases, coping with financial difficulties, attitudes toward the environment in which we function, and making plans while considering the risks versus the opportunities. The marketing discipline, for example, has entered the world of academic sciences in recent decades and theories and models have been developed that place the consumer and his needs at the center of the firm’s business focus and attention. The organization, so say the principles of marketing, should direct itself to designing a proper response to customer needs. This is a lengthy process that involves investing resources in order to understand the specific needs and designing the proper responses. However, it turns out that the general public holds a naïve perception in everything that is said about marketing principles. It seems that the public perceives the business organization as a body that places the accumulation of profits as its first and foremost goal. Issues such as customer needs, ethics and long-term thinking are seen, by the public, as being less important to the organization.

Naïve perceptions also appear with regard to scientific fields hundreds of years old. Galileo faced this problem in his attempt to defend his revolutionary declaration that the earth traveled at a speed of 100,000 kilometers per hour in its orbit around the sun [3]. Nobody would believe him. From the experience of the residents of Bologna in the 17th century, traveling in a horse-drawn wagon at a speed of 10 kilometers per hour illustrated perfectly the difference between movement and standing in place. They could not see how it was possible to be traveling huge distances – standing on the orbiting earth – and still have no sensation of movement. It would be more reasonable to assume that the earth rests at the center of the universe. In order to deal with this problem, Galileo revealed the law of inertia, stating that bodies will continue to move at very high speeds if no other force is exerted on them, and that in order to slightly change their speed, sometimes great forces must be exerted. But in spite of the long known law of inertia, it was impossible to transmit it from the lecturer’s speech to the student’s brain [4].

Not only marketing (a young science) and physics (an old science) force students to face up to scientific laws that do not conform to their basic understanding about the environment in which they function. Chemistry and the model of molecules, which are contrary to the clearly visible theory of continuity, and which changed our cosmos to a world seeded with particles of material, also force students to deal with contradictory ideas. So too does biology, which has divided our bodies into tissues, cells, and tiny organs. Mathematics has led to the investigation of infinity and imaginary numbers. One student in a ‘quantum theory’ course said in protest, “I’ve never in my life been in a course where I have to accept such a large number of inconceivable axioms that defy logic in such a short time.” This frustration is not reserved only for students of quantum theory. It is a reaction invoked by all science students.

How is it possible to conduct a dialog with naïve perceptions that refuse to make space for scientific theories? How can we convince the student – who all his life has been exposed to advertisements – that a company’s goal is not exclusively to sell, but to respond to customers’ true needs, some of which they may not have even recognized? How can we help the student believe that the chair on which he is sitting or the person he is embracing is nothing but an illusion from a molecular point of view, caused by the limitations of visual senses. These senses ‘refuse’ to believe that the chair and the person are, virtually, vacant space.

3 Difficulties in Surrendering Thinking Patterns

In many introductory courses it is necessary to teach large amounts of material. Students are required, therefore, to review, study in depth and absorb the material over many hours. In spite of the many hours the students invest in developing knowledge, lecturers complain that the students do not understand the study material as they should. Looking at the examinations taken by students [5] strengthens this opinion. In these tests students were asked to observe a particular occurrence and predict what would happen in certain conditions, without the need for any complex calculations; for example, how a rocket in space will move after its motor is shut down; or, how a population will react under famine conditions. DiSessa examined a group of 20 MIT students after completion of basic courses, and identified a series of basic beliefs they held [6]. Sometimes, their beliefs managed to explain the observed phenomena, but in many cases they misled the students who gave erroneous explanations. Nevertheless, the students preferred to utilize them any time they encountered an unfamiliar problem. These beliefs hamper the acceptance of sophisticated models that demand clarification of the surrounding conditions. Students who observed colliding wagons were asked by the lecturer about the forces that each of the wagons exert upon collision. The majority of the students held one of two possible beliefs. One claimed, “The larger wagon exerts more force because it is more massive.” The other explanation declared, “The lighter wagon exerts a greater force because it moves more quickly after the collision.” These were the students’ positions even after learning about the law of action and reaction according to which the intensity of the power exerted by one entity on another is equal in intensity to the power exerted by the second entity on the first. The beliefs that “Bigger is stronger” and “Faster is stronger” prevailed over the law of action and reaction.

In recent decades, many research tools have been developed for examining students’ attitudes about basic scientific laws. One of these tools, the FCI (Force Concept Inventory), is designed to examine basic understanding of Newton’s Laws [7]. The FCI questionnaire is based on thirty multiple-choice questions. Incorrect answers that were taken from interviews with hundreds of students, articulated their naïve attitudes about the situation portrayed in the question (ibid). Success in answering conceptual questions required exercising thinking that relies on scientific laws, and surrendering naïve opinions. The results showed that students studying science, whose naïve perceptions were not challenged by scientific law, tended, when answering the questions, to stick to their earlier understanding and not to use the scientific law that they should have activated in analyzing the question. That is to say, ideas that are experienced in real life are preferable to theoretical ones learned in class and that are needed to pass final exams.

4 How Does One Cope with Basic Course Failures?

The high failure rate in basic courses worries the institutes of higher learning throughout the world. This is also true in the leading universities in which students have to meet rigorous entrance requirements. In order to help alleviate the situation, Mazur from Harvard, among others, decided to challenge students’ naïve perceptions through “Peer Instruction” [8]. Students were presented with conceptual questions and a set of a few possible answers – consistent with naïve perceptions or with scientific perceptions – for each question. The students were requested, during the lecture, to individually choose what they considered the correct answer. This was followed by a short discussion among the students, at which point they were again asked to choose the answer they felt was suitable. It was shown that, following the discussion, many students disowned the naïve approach to the problem presented and adopted the scientific solution. They did so after examining their positions in light of the attitudes of their peers who favored the scientific perception. In Mazur’s opinion, the confrontation between different perceptions allows students to view scientific approach thinking not only as a way to solve a complex exercise problem, but also as a means for

answering qualitative questions such as those that students will meet in their daily lives.
In order to generate a perceptual change of this type, an interesting lecture is not enough. Posner [9] presented four necessary conditions for a change in perception. These are:
1. The existing perception causes dissatisfaction.
2. The new perception is intelligible.
3. The new perception is plausible.
4. The new perception is fruitful and allows coping with a wider variety of problems in comparison with previous perceptions.

At the University of North Carolina, Bichner developed another approach – SCALE-UP (Student-Centered Activities for Large Enrollment University Physics) – that allows students to examine, for most of the class time, their naïve perceptions in comparison to scientific perceptions that use a learning method based on research techniques and team work [10]. According to his approach, the teacher's function is to direct the learning process and prompt students to examine their attitudes in relation to the challenges they face.

At MIT, physics teaching was turned over to the best lecturers who dazzled their enthusiastic students with examples, demonstrations and theatrics. Nonetheless, there was no substantial change in the high rate of failures – approximately 20%. This bothersome situation brought Belcher and Dori to submit an innovative proposal for altering teaching patterns in the institute [2]. In accordance to Bichner's approach, the lecture hall was exchanged for a classroom workshop setting in which there were about one hundred students sitting in groups of nine at round tables, and most of the time occupied with research activities. The lecturer repositioned himself; he moved from standing in front of the class where he had previously been spending most of the lesson time, to standing next to his students. From this location, it was easier for him to help them in bridging the gap between naïve perceptions and scientific ones. In spite of the academic freedom allowed in MIT, student must attend electricity courses, where it was always the goal to have them confront those naïve perceptions of theirs that refuse to disappear. As a result of this method's application, which has been in use at MIT for three years, the failure rate in these courses dropped from about 20% to, approximately, 8%.

5 Sales Versus Customer Needs

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:

- - Marketing that focuses on customer needs.
- - Marketing as a planning tool in the
- organization.
- - Marketing as an inborn talent vs. a learned
- skill.
- - Marketing as a work ethic in the organization.
- - Marketing as a means for promoting sales.
- - 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 [11].

$$g = (f-i)/(100-i)$$

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:
1) A low improvement level where $g<0.3$;
2) A medium improvement level where $0.3\leq g<0.6$); and
3) A high improvement level for $g\geq 0.6$.

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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

Table I – Distribution of student perceptions in the Introduction to Marketing course (in percentage) relative to different marketing aspects, at the beginning of the course and at its conclusion, and the improvement index ‘g’

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 (see Table I). 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.

6 Traditional versus active

Research results that have been presented thus far show that changes in naïve perceptions should not be expected if a special effort is not made to change them.

Presenting powerful examples as proof of a scientific law is not enough to topple the naïve perception based on the student’s experience. In order to succeed in a course a student will be prepared, sometimes, to adopt ad-hoc ideas that evaporate with the course’s conclusion [5].

In an attempt to test effective teaching methods, Hake conducted a comprehensive study in which 6,542 students registered in 62 mechanics courses took part. He compared ‘activation of students’ teaching that leads to interaction between them and traditional teaching, in which the teacher focuses on lectures as an instruction tool. Every student filled out the FCI (Force Concept Inventory) research questionnaire regarding his perceptions in the matter of forces and movement.

Hake tested the degree of improvement that occurred in students’ attitudes between the beginning of the course and its conclusion. The research results were clear and conclusive. Activating the students brought about an improvement that was twice as large in comparison (g=0.48) to traditional teaching that concentrates on the lecture’s performance (g=0.24).

7 Giving up naïve perceptions

Naïve perceptions are a necessary stepping stone on the way to scientific perception. They are a required tool in explaining reality and constructing a personal model that serves the person functioning in a technological society. By analogy, they can be compared to factors that delay seeds from sprouting, which fulfill a necessary function in protecting the seed from early germination in unsuitable conditions, and whose early removal could damage the sprouting process. In the process of moving from naïve to scientific perceptions, a balance has to be maintained between the student’s belief that he can develop intuition [12] and his critical thinking about this intuition. There is evidence that students who did not separate themselves from their naïve perceptions operate in two environments:

The first environment is the course environment in which students operate. Here they surrender their naïve perceptions and replace them with a technical approach, without trying to develop a scientific understanding. In this way they bind themselves to an automatic response in familiar situations. These students only recognize the way shown to them in class by the lecturer and they do not stray from it in order to find their way through new situations, which the scientific theory would solve.

The other environment is the daily environment, where the naïve perception continues to rule. The teaching processes that allow the student to maintain an ongoing dialog between naïve perceptions and scientific laws create opportunities for constructing a model in which both perceptions can co-exist equally [13]. Surrendering the naïve perception will only occur after recognizing its importance and understanding its limitations. Here is exactly where the teacher should adopt the marketing approach - understands his students’ dichotomy and apply appropriate methods in order to reduce it.

The Ort-Braude College of Engineering in Israel has been investing great efforts implementing this innovative approach, which asserts that activating students will bring them to understand scientific principles [14]. 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. In this method, the lecture hall is exchanged for a classroom workshop setup in which students sit at circular tables. 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 at 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 challenge.

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.

The departure from the lecturer's traditional 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 standing at the gates of institutions of higher learning. The teaching staff shares the same fear.

References:

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

[2] Y. Dori, J. Belcher. Visualizations and Active Learning MIT Students' Understanding of Electromagnetism. Announcer 32(2) 2002. pp. 134.

[3] G. Galileo. Dialogue Concerning the Two Chief World Systems. University of California Press; 2nd ed, Ed. Stillman Drake, tr., Berkeley. 1967.

[4] M. McCloskey, Naïve theories of motion, in Mental Models, edited by D. Gentner and A. Stevens (Lawrence Erlbaum, NJ) 299-324. 1983.

[5] A. Van Heuvelen, Learning to think like a physicist: A review of research-based instructional strategies, American Journal of Physics 59 1991. pp. 891-897.

[6] A. A diSessa,. Towards an epistemology of physics, Cognition and Instruction 10, 1993. pp. 105- 225.

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

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

[9] G.J. Posner, K.A. Strike, P.W. Hewson, and W.A. Gertzog, Accommodation of a scientific conception: Toward a theory of conceptual change, Science Education 66(2) 1982. pp. 211-227.

[10] 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. 2000.

[11] 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 1998. pp 64-74.

[12] D. Tirosh, R. Stavy, and S. Cohen, Cognitive conflict and intuitive rules, International Journal of Science Education 20, 1998. pp.1257-1269.

[13] J. Clement, Using bridging analogies and anchoring intuitions to deal with students' preconceptions in physics, Journal of Research in Science Teaching 30(10) 1993. pp. 1241-1257. .

[14] 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.