

Promoting a Culture of Learning that is based on Internal Values in an Introductory Undergraduate Level Biology Course

Paper to be presented at the 14th biannual conference of the European Association for Research on Learning and Instruction (EARLI), August 2011.

Ornit Sagy¹, Yael Kali², Masha Tsaushu¹, Tali Tal¹, Dan Zilbersein¹, Shimon Gepstein¹

¹The Technion – Israel Institute of Technology, Israel

²The University of Haifa, Israel

Abstract

In recent years there is a growing concern regarding the quality of learning in undergraduate level education. We developed a framework which describes learning culture as a continuum ranging from learning driven by *external* values (passing a test) to *internal* values (the urge to learn). Teaching culture is described as encouraging learning with a similar range of values. We use this framework to explore the effect of an intervention in three levels, which was designed to gradually employ higher levels of internal values of teaching in a large-scale undergraduate Biology course. The study explores how the teaching culture affected the learning culture. We interviewed 30 students and analyzed interviews phenomenographically. Our findings show that students' learning culture represented higher levels of internal values in the interventions that were designed with higher levels of internal values of teaching, indicating a positive effect of teaching culture on learning culture. Moreover, the common assumption that undergraduate students typically hold external values of learning was refuted in this study. These findings have important implications regarding the design of large-scale undergraduate science courses that encourage students to develop "deep" conceptions of learning, intrinsic motivation, and learning-related (rather than performance-related) goals.

Rationale

In recent years a growing concern is expressed in the media and documented in research regarding the quality of learning at the undergraduate level (Arum & Roska, 2011). This concern is relevant for science education as well; research shows that many students in introductory science courses, in which instruction is based primarily on lectures, fail to develop conceptual understanding of complex ideas (McCray, DeHaan, & Schuck, 2003). It is clear that learning at the undergraduate level is affected by many factors. In fact, researchers have suggested to explore it as an ecosystem comprised of nested communities (e.g. students within departments within faculties), which can be viewed as communities of populations of organisms (Sullins, Hernandez, Fuller, & Tashiro, 2006).

Following this notion, we currently introduce a theoretical framework we call "The Ecology of Learning and Teaching Cultures" to explain the effect of an intervention that we have designed and implemented in a large-scale undergraduate level Biology course. In this introduction we first describe our framework and explain its underlying theoretical basis, and then describe the instructional model with which we intervened in the Biology course.

The Ecology of Learning and Teaching Cultures Framework

The term "culture" has many definitions, among which are Kluckhohn's (1954) definition of culture as "the collection of beliefs, values, behaviors, customs, and attitudes that distinguish the people of one society from those of another", and Hofstede's (1991) definition – "The collective programming of the mind that distinguishes the members of one human group from those of another". Based on these definitions we define the terms "learning culture" and "teaching culture" as ***the beliefs, values and behaviors a person or a group of people have with regards to their own "learning" or "teaching" in specific contexts.*** We describe learning culture using a continuum ranging from learning which is driven by *external* motives and values (e.g. passing a test, achieving more than others, getting the teacher's recognition) to learning that is driven by *internal* values (e.g. the urge to learn, follow one's interests). Similarly, we describe teaching culture as one that encourages learning with a similar range of values.

We include in the ecology of learning and teaching framework some major ideas from several research fields, namely the learning sciences, educational psychology and organizational psychology and sociology. We briefly describe these ideas and explain how each of them contributes to the framework, and enables gaining a holistic view of processes of learning and teaching in an academic institution. Figure 1 summarizes how each of these ideas fits into the learning culture continuum.

Conception of Learning. This framework deals with the way people view learning, what they think is involved in learning, and what they consider as good learning (Hadar, 2011; Marton, & Säljö, 1976a, 1976b; Prosser, Trigwell, & Taylor, 1994). We view students' conceptions of learning as a major aspect in understanding the learning processes in the Biology course. A basic construct of our framework is that only with what is considered a "deep" conception of learning, students can achieve meaningful learning.

Goal orientation (Dweck, 1986) and **Motivation** (Deci, 1972). These frameworks describe psychological aspects of learning and view the types of goals learners set for themselves – whether they are learning oriented (targeted for self growth) or performance oriented (targeted for external recognitions such as high grades). The main constructs of the learning culture continuum – external and internal values (figure 1)—were derived from these well established theoretical frameworks to explain the learning processes within the Biology course.

Dynamic multi-level culture model. This framework, not related specifically to learning, describes how an individual's culture (Erez & Efrati, 2004) is affected by the culture of groups he or she is part of. Cultures are nested, starting from the global culture, through national, organizational and team cultures, and down to the representation of culture at the individual level. Within this nesting, cultures affect each other through top-down as well as bottom-up processes. Embracing this notion into our framework enables us to understand learning and teaching as an ecological system, and to explain the learning processes in the Biology course not only in the context of the course itself, but also in a wider set of contexts (individual students' culture of learning, how it was affected by the culture of teaching that we designed, and even how our own decisions regarding the design of the intervention were affected by the teaching culture of the institution).

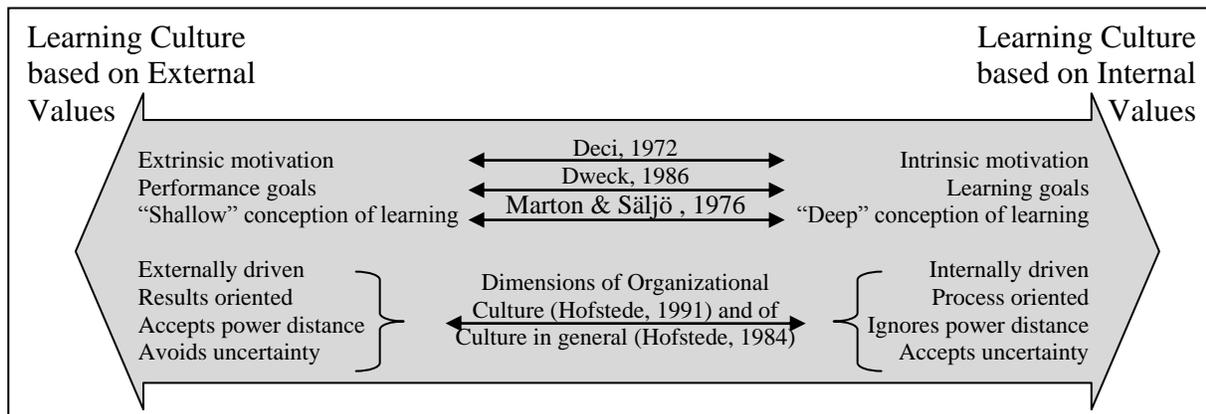


Figure 1. The learning culture continuum: From external to internal values

We would also like to note that the term “learning culture” is not new. Shepard (2000) described learning culture as a culture in which "students no longer feign competence or work to perform well on the test as an end separate from real learning" (p. 10). The framework we introduce is an extension of this notion, providing a wider range of values. Shepard’s description fits very well into the “learning culture based on internal values” of the continuum.

Context: The Intervention

The relationship between learning and teaching cultures was studied in this research in the context of an introductory semester long Biology course with about 350 biology major students each year. Prior to our intervention, this course was taught via traditional lectures. We developed three levels of an intervention model, each designed to promote more internal values of learning (and thus, representing a teaching culture with more internal values). The interventions took place in three consecutive years between the years 2008 to 2010.

All three levels of intervention included the use of a web-based tutorial which included videos of all course lectures, interactive visualizations and self feedback questions. In the 1st level of intervention (2008) the use of the tutorial was optional, and complemented the regular lectures. In the 2nd level (2009) students were required to learn contents via the web-based tutorial before each lesson. Lessons still took place as lectures, but students knew in advance that the instructor will skip informational contents, and delve deeper into more complex topics and abstract principles that cut across topics (e.g. the relation between structure and function). Since students were in charge of filling the gaps and learning some of the more informational content on their own, we view this as representing a more internal based culture of teaching; a culture that seeks to support students in gaining more ownership, or a "deep" conception of their own learning.

In the 3rd level (2010) students were required to learn most of the contents on their own using the web-based tutorial. From the beginning of the course they were divided into groups of about 30 by choosing a specific topic (e.g. cell organelles) to focus on. Each group was further divided to smaller teams that chose to focus on a specific aspect within a given topic (e.g. one organelle). Each team (about 5 students) worked for about 4 weeks to learn the contents and prepare a presentation about their aspect of the topic, which they presented to the rest of the group in a special "mini-conference" meeting facilitated by the instructor. These meetings, each time with a different group, replaced the regular lectures, so that each student learned most of the

topics from the web-based tutorial, and one topic via the collaborative learning and mini-conference format. We view this as a more internal value based culture of teaching because in this level, students who had a learning goal orientation (as opposed to a process goal) had the opportunity to pursue in more depth a topic they found intriguing. This level was designed to encourage even higher degrees of student ownership of their learning process, supporting "deeper" conceptions of learning.

Research Purpose

This research extends findings from our previous work in this project, which indicated that: (A) Student's final exam scores (multiple choice questions) remained similar following the different levels of intervention (Sagy et al., 2010). (B) The web-based tutorial was extensively used in all levels of the intervention, no significant differences were found between the levels (Sagy, et al., 2010). (C) Students' performance on higher order cognitive tasks (as expressed in an open-ended question that was added to the test) was significantly higher in the 3rd level of intervention (Tsaushu et al., 2011). The purpose of the current study was to examine the effect of the gradual change in the course design from another aspect – its influence on the students' learning culture. In other words, our aim was *to explore how the teaching culture affected the learning culture*.

Methods

Towards the end of each intervention we interviewed about 10 random students from the course. A total of 30 students were thus interviewed. The interviews, which lasted about 20-60 minutes each, were semi-structured and focused on students' views about the course and the way they experienced it. The interviews were audio-taped, transcribed verbatim and analyzed. Our focus in the analysis was not on how students described their actions for learning, but rather, on what they thought about these actions – what were the values through which they viewed their learning. Marton (1981) describes such a perspective as a second order perspective, which he suggests to analyze phenomenographically.

At first, 6 transcripts were studied and categorized by two researchers formulating the basic categories, and then the rest of the transcripts were analyzed once by one of the researches, refining the categories and their descriptions. The researchers met again for discussing the categories and their identification in the text. The process was repeated until it stabilized. Table 1 presents the basic learning culture index that was developed in this process (two examples of how these categories were used to code the data are provided below).

Table 1 – Basic learning culture index

Aspect	Learning culture based on internal values	Learning culture based on external values
Learning goal orientation*	Student seeks deep understanding, profundity, interest, expanding intellectual horizons, or personal growth.	Student seeks sufficient grade, fulfilling academic requirements
Willingness to invest an effort **	Student invests extra efforts in order to maximize the opportunities to learn	Student puts minimal efforts, looks for shortcuts
Attitude toward authority ***	Student seeks help wherever possible, not only from "authoritative" sources	Student seeks authority, attempts to please the instructor, the institution's regulation etc
Attitude toward uncertainty ****	Student tends to accept uncertainty and views it as an opportunity for self-growth.	Student is intimidated by uncertainty, attempts to avoid it and views it as an obstacle to the learning process.
Ownership of the learning process ****	Student accepts and even seeks ownership of his/her learning process	Student attempts to avoid ownership, and insists on the instructor's ownership

* Based on the following theoretical frames: Goal orientation (Dweck, 1986), motivation (Deci, 1972), and Hofstede's (1991) "internally vs. externally driven" organizational cultural dimension.

** Based on Hofstede's (1991) "Process vs. Results orientation" organizational cultural dimension.

*** Based on Hofstede's (1984) "Power distance" and "Uncertainty avoidance" cultural dimensions.

**** Based on conceptions of learning (Prosser, Trigwell and Taylor, 1994; Hadar, 2011)

An example of an utterance that was coded as representing a learning culture based on internal values: *"I started learning for a degree in molecular biotechnology without any background – I didn't study chemistry or biology and absorbing it all at once was a little difficult for me. I also realized that I'm attracted more to Biology ... I understood that my major should not be the one that I chose initially so I did the grand move [and switched to major in Biology]. I started again from scratch – first year, even though it's the second time"*. It is clear that this student is willing to work very hard (internal value regarding willingness to invest an effort) in order to follow her heart and learn what she is more attracted to (seeks interest – an internal value regarding learning goal orientation).

An example of an utterance that was coded as representing a learning culture based on external values: *"I need a rigid frame for optimal learning. I need it to be demanded of me, even though this is something that interests me a lot"*. This student is driven by external values for the following categories: Attitude toward authority (prefers that an authority will demand the learning); Attitude toward uncertainty (prefers a rigid frame); Ownership of the learning process (avoids ownership of her own learning process).

Looking at the referential and structural components of the categories (Prosser et al., 1994) two referential dimensions were found: indications of students' learning culture and references to specific features of the course. The structural components were inherently similar for both referential dimensions – based on internal values or on external values, but with some differences (e.g. a mixture is relevant only for students' learning culture, when several utterances indicate different types of values). As a result the indications of students' learning culture could either be "based on external values" (towards the left side of the continuum in Figure 1), "based on internal values" (towards the right side of the continuum in Figure 1), or "mixed values" (around the center of the continuum). References to course features were categorized only if they implied internal or external values.

The findings from the phenomenographic analysis were also quantified based on Chi's (1997) methodology in order to examine the effect of the gradual design of the course on student's learning culture.

Findings

Student characterization using the learning culture index

The analysis of the interview utterances enabled us to distinguish between students who were clearly identified as having either a learning culture based on internal values or on external ones (indicated by having most of their utterances classified as such using the learning culture index). Figure 2a shows that the ratio between them remained pretty similar in the three levels of the intervention. It also shows that these students comprised together about half of students in each of the interventions. The other half were either classified not indicative or "mixed" (showing a blend of internal and external values)

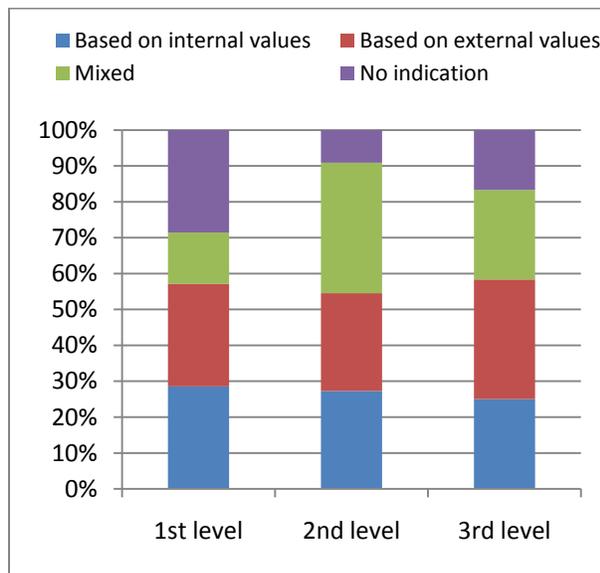


Figure 2a – Student's characterized learning culture in the different versions

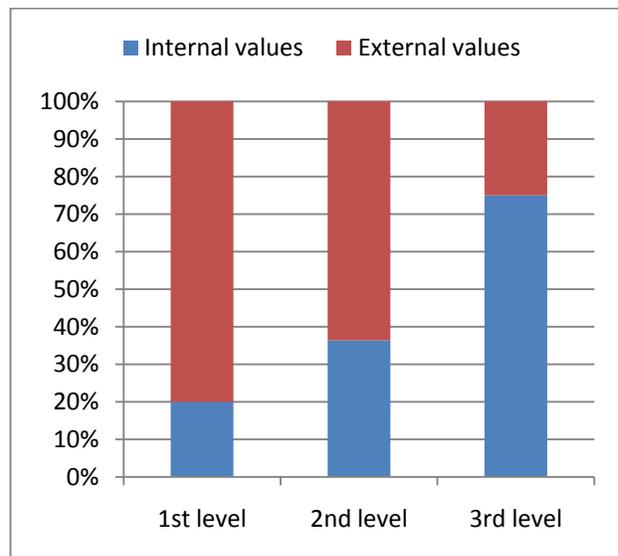


Figure 2b - Types of values used when referring to features in the intervention

Students' reference to course features

Error! Reference source not found. shows the type of values used by students when referring to features in the intervention. The figure shows that in the 1st level of intervention (when the web-based tutorial was available to students in addition to regular lectures) only 20% of the references to course features were through internal values while 80% implied external values (e.g. "The midterm exam forced us to learn"). In the 2nd level, in which there was a noticeable change in the course design (students were required to study the contents via the web-based tutorial in order to understand the more in-depth contents that the instructor went into during the lecture) about 35% of references were related to internal values. The major difference was in the 3rd level of intervention (teams presented sub-topics in mini-conference format meetings while learning most of the syllabus on their own via the tutorial) – about 75% of the references to different course features were through internal values (e.g.: "when I answer the test, I hope that I don't just rote and recite things, I want to get to a deep level of understanding", or – when

referring to the team learning: "*it is important because you may think of something but then another student would say 'no, listen, it is not like that', he can point out 'there is this problem in your theory' and this way we could eliminate all the irrelevant theories*").

Discussion and Implications

This research shows that a teaching culture in a course can affect students' learning culture; the learning culture was found to represent higher levels of internal values in the interventions that were designed with higher levels of internal values of teaching. As stated above, our aim when designing the course was to design a teaching culture that would affect the learning culture in a way that would foster deeper and more meaningful learning. Our findings show that the principles that guided our design were productive in encouraging students to find a good balance between internal and external values in their learning cultures, leaning to greater internal values. We would like to stress that we view the repertoire of values held by a student as a mix between internal and external values. We view a productive teaching culture as including some external values, such as grades, which are an important asset in reaching academic quality.

Our findings show that achieving a learning culture that is based on internal values, together with deeper and more meaningful learning is possible in large enrollment classes. Moreover, the assumption that the typical undergraduate student represents a learning culture based on external values (as implied by Arum and Roska 2010) was found not to be true in this study. Only 25% of the students were identified with such a learning culture. This encouraging finding has an important implication - if the culture of teaching in an academic institution is based on the assumption that most of the students represent a learning culture based on external values, then instructors might end up teaching through "traditional didactic lectures" (McCray, et al., 2003). In this manner, their belief about their students' culture of learning affects their own culture of teaching. But our findings show that the culture of learning is very much affected by the culture of teaching. Thus, it is clear that this can be a source of a feedback loop which can maintain the externally-based cultures of teaching and learning in introductory academic courses.

Finally, our unique "learning culture" prism, combining aspects from learning science, educational and organizational psychology, and sociology, provided a productive analysis tool which enabled us to look at the process not only in the context of a class, but also in a wider context – as part of an ecology of cultures. We believe that only in this wider context it would be possible to affect learning and teaching processes in higher education.

References

- Arum, R., & Roksa, J., (2011). *Academically adrift: Limited learning on college campuses*. Chicago: University of Chicago Press.
- Chi, M., T., H.,(1997). Quantifying qualitative analyses of verbal data: A practical guide. *The Journal of the Learning Sciences*, 6(3), 271-315
- Deci, E. L. (1972). Intrinsic motivation, extrinsic reinforcement, and inequity. *Journal of Personality and Social Psychology*, 22, 113-120
- Dweck, C., S., (1986). Motivational processes affecting learning, *American Psychologist*, 41(10), 1040-1048
- Erez, M. & Efrati, G., (2004). A dynamic, multi-level model of culture: From the micro level of the individual to the macro level of a global culture. *Applied Psychology: an International Review*, 53(4), 583–598
- Hadar, L., L., (2011). Adopting a “satisficing” model for school performance in students’ views of learning. *Educational Research and Evaluation* 17(3), 193–214
- Hofstede, G., (1984). *Culture's consequences: International differences in work-related values* (2nd ed.).Beverly Hills CA: SAGE Publications
- Hofstede, G., (1991). *Cultures and Organizations: Software of the Mind*. New York: McGraw-Hill.
- Kluckhohn, C., (1954). *Culture and Behavior*. New York: Free Press.
- Marton, F. (1981). Phenomenography - describing conceptions of the world around us. *Instructional Science*, 10, 177-200.
- Marton, F., & Säljö , R., (1976a). On qualitative differences in learning: I – Outcome and process. *British Journal of Educational Psychology*, 46, 4–11.
- Marton, F., & Säljö , R., (1976b). On qualitative differences in learning – II Outcome as a function of the learner’s conception of the task. *British Journal of Educational Psychology*, 46, 115–127.
- McCray, R. A., DeHaan, R. L., & Schuck, J. A., (2003). *Improving undergraduate instruction in science, technology, engineering, and mathematics: Report of a workshop: National Research Council*. Washington, DC : National Academies Press
- Prosser, M., Trigwell, K., & Taylor, P., (1994). A Phenomenographic study of academics’ conceptions of science learning and teaching. *Learning and Instruction*, 4, 217-231.
- Sagy, O., Kali, Y., Zilberstein, D., Tsaushu, M., Tal, T., & Gepstein, S., (2010). What to assess in large scale Web-based instruction: Student satisfaction vs. performance. *Proceedings of the 5th Chais conference on instructional technologies research*. Raanana: The Open University
- Shepard, L., A., (2000). The role of assessment in a learning culture. *Educational Researcher*, 29(7), 4–14
- Sullins, E., S., Hernandez, D., Fuller, C., & Tashiro, J., S., (2006). Predicting who will major in a science discipline: Expectancy–value theory as part of an ecological model for studying academic communities. *Journal of Research in Science Teaching*, 32(1), 99-119.
- Tsaushu, M., Tal, T., Sagy, O., Kali, Y., Gepstein, S., & Zilberstein, D., (2011). Reforming an introductory biology course: what's new? To be presented at the 9th ESERA (European Science Education Research Association) conference, 2011, september. Lyon, Centre de Congrès