МИНИСТЕРСТВО ВЫСШЕГО И СРЕДНЕГО
СПЕЦИАЛЬНОГО ОБРАЗОВАНИЯ РЕСПУБЛИКИ
УЗБЕКИСТАН
ХАКИМИЯТ АНДИЖАНСКОЙ ОБЛАСТИ
АНДИЖАНСКИЙ МАШИНОСТРОИТЕЛЬНЫЙ
ИНСТИТУТ
ЗАО “GM-UZBEKISTAN”

СБОРНИК МАТЕРИАЛОВ МЕЖДУНАРОДНОЙ
НАУЧНО-ПРАКТИЧЕСКОЙ КОНФЕРЕНЦИИ
НА ТЕМУ: "СОВРЕМЕННЫЕ МАТЕРИАЛЫ,
ТЕХНИКА И ТЕХНОЛОГИИ В МАШИНОСТРОЕНИИ"
19-20 АПРЕЛЯ 2012 ГОДА

АНДИЖАН – 2012

1
машинах в среде MathCAD .................................................. 592
158. X. Тарабева, K.X. Ахмадов, B.H. Ганнаров. Технологические аспекты
реализации компетентностного подхода в профессиональном образовании. 595
159. A.Z. Эргашев. Совершенствование подготовки инженеров для
современного производства ................................................. 598
160. U.A. Мирзаалимов. Основные требования к организации обучения
студентов по специальности 600
СЕКЦИЯ-5.
ИННОВАЦИОННЫЕ ТЕХНОЛОГИИ В ОБРАЗОВАНИИ

130. Б.Ф. Мишнев. Современные проблемы развития инженерного образования в Европе. 493

131. А.К. Шадымов, Г.У. Назаров, З.В. Юсупова. Инновационные технологии в подготовке будущих врачей в Андижанском медицинском институте. 499

132. Н.Ф. Зикриев, С.С. Насиридинов, А.А. Худайбергов. Техника соединения фасадных щитов виртуал лабораторией. 502

133. К.А. Каримов, Ф.Т. Тураев. «Назарий механика» фанниции юкм жарахия инновационных технологий в системе образования. 505

134. Т. Haertel, C.Terkowsky. Where have all the inventors gone? The lack of spirit of research in engineering education. 507

135. Л. Шамкулова. Возможности использования баз данных учебных макетов для самостоятельной работы студентов специалитета и дополнительной промышленной практики. 512

136. Б.Ш. Усмонов. Инженерное образование и информационные технологии. 515

137. D. Sigrid, L. Shamkulidina. Summer school – a program to round out professional skills. 518

138. А. Абдулатов, М.А. Абдулаев. Инновационные технологии в системе высшего образования. 523

139. С. Абидинов. Использование моделей в системе высшего образования. 527

140. К.Х. Акхоров. Макеты для физики новейший физический фанарион ташкент физики учителя и физических учителей. 530

141. В.М. Шаков, З.М. Курбанова. О применении компьютерных технологий обучения при проведении интерактивного практического занятия по теоретической механике. 536

142. Г.У. Назаров, М.Б. Бокуев, З.В. Юсупова, Ж.М. Худайбергенов, Ш. Бортоев. Интерактивные методы обучения студентов медицинскому образованию. 539

143. М. Назаров. Философия высшего образования. 541

144. А. Абдулаев. Философия высшего образования как важный фактор рационального совершенствования личности. 545

145. Х.Т. Тогаева, К.Х. Акхоров, У. М. Акхорова. Механика в классе. 547

146. В.М. Шаков, З.М. Курбанова. Об проблемной системе в теоретической механике. 551

147. В. Абдулатов, О.А. Акхоров. Педагогика и методика ашыккызячы теории и инновации. 554

148. М. Назаров. Культура как фактор обеспечения интеллектуальных и духовных потребностей личности. 557

149. Э. Турунова, С.Ш. Хаббулатова. К проблеме использования активных методов обучения в высшей школе. 561

150. Б.Р. Туктев. Педагогическая технология проблемно-поискового подхода. 567

151. С. Ш. Хаббулатова, С. Садикова. Диагностика и контроль учебного процесса в высших и средних специальных учебных учреждениях. 570

152. М.Р. Аксёнова, Д.М. Тулышова. Применение информационных технологий в обучении иностранному языку. 576

153. Х.Р. Хайдарова, Х. Мугорова. Тайны юридов и философов: история и современность. 579

154. С. Усмонов, М.С. Усмонов, Б.Ш. Убайдуллаев, М. Усмонова. Тайны юридов: инновационные технологии в сопровождении юридической практики. 582

155. Б.И. Уразов, З.А. Акрамов, У. М. Акхорова. Удуксу и таанмашааны вепи ашыккызячы теории и инновации. 586

156. Ф. Юсупов, Д. Мадаминова. Информатика фанниции кас-кунтар колоскумдарын компьютерысга технологиина физикасы үйкүнүн жарахиясы. 589

157. Р.И. Каримов, Р.З. Шакобуллаев. Проектирование велосипедов.
WHERE HAVE ALL THE INVENTORS GONE? THE LACK OF SPIRIT OF RESEARCH IN ENGINEERING EDUCATION

Dr. Tobias Haertel, Claudius Terkowsky - Center for Higher Education, TU Dortmund University (Germany), Project “Excellent Teaching and Learning in Engineering Education” (ELLI)

The European Union has declared 2009 the European Year of Creativity and Innovation. Facing tremendous problems, creativity and innovation were seen at the heart of the strategy to transform Europe into a knowledge-based society that is able to cope with ongoing and future problems. For example, new techniques to tackle climate change are urgently needed, new ideas on how to retain mobility of people, new concepts for energy production without fossil fuels. Engineers play an important role in addressing these challenges. Their ideas, their inventions, their creativity have brought Europe’s prosperity, and it will depend on their inventions and creativity to ensure that progress in the future.

This raises the question in what way universities contribute to educate creative engineers nowadays. The results of the German research project “Da Vinci – fostering creativity in higher education” (supported by the German Federal Ministry of Education and Research BMBF, 2008-2011) show, that creativity in higher education (across all disciplines) consists of six different aspects (Haertel/Jahnke 2011a; Haertel/Jahnke 2011b; Jahnke/Haertel/Winkler 2011; Jahnke/Haertel 2010):

1) self-reflective learning – learners break out of their receptive habits and start to question any information given by the teacher. An internal dialogue takes place and knowledge becomes "constructed" rather than "adopted".

2) independent learning – teachers stop to determine the way students learn. Instead, students start for example to search for relevant literature on their own, they make their own decisions about structuring a text or they even find their own research questions and chose the adequate methods to answer it.

3) curiosity and motivation – this aspect relates to all measures that contribute to increased motivation, for instance the linking of a theoretical question to a practical example or presenting.

4) learning by doing – students learn by creating a sort of "product". Depending on the discipline, this might be a presentation, an interview, a questionnaire, a machine, a website, a computer program or similar. Students act like "real" researchers.

507
Everything that was said by teachers about creativity in higher education fits in one or more of these six aspects. This suggests that these six aspects in their entirety describe what constitutes creativity in higher education. But it was also shown that different disciplines tend to focus on different aspects.

Against this background, we analyzed the module descriptions of two engineering courses (Manufacturing Engineering and Electrical and Electronic Engineering IT) of three German universities (Aachen, Bochum, Dortmund) in order to get to know which aspects of creativity are fostered in today's engineering education. As a result, fostering the creativity-aspects 1 (self-reflective thinking), 3 (curiosity and motivation), and 4 (learning by doing) is highly developed in both courses of all three universities. With one exception these aspects have shares of over 50%. On the other hand, the aspects 2 (independent learning), 5 (multi-perspective thinking) and 6 (reach for original ideas) can be found only in small proportions with percentages below 50%, in aspects 5 and 6 with one exception even below 10% (see fig. 1).

To sum up, the analysis of the module descriptions shows that in the considered courses students were encouraged to think critically and self-reflective. They had to demonstrate motivation and commitment in their courses and they were trained to create something, to work practically. Independence, collaborative development of ideas and the exchange with other disciplines and open-minded discussions, scenarios and experiments, however, were almost not required and promoted. These results need to be treated very cautiously; they depend on a very small, arbitrary sample of only 2 courses from three different universities. Further studies need to be done urgently. But together with empirical experiences in engineering education a picture of diligent students, who rather work conscientiously on given tasks than finding new problems, questions and solutions on their own and in discussion with others, is emerging. Also, the fact that in some of the courses the students were not free to choose the topic of their thesis reinforces this picture. Instead, they have to choose it out of a pool of given topics developed by the teachers. In this way, many learning processes that require creativity weren't done by the students, but by the teachers: the detection of relevant research questions, the deliberation whether an issue is workable, the creation of a structure and the assessment of eligible methods. Due to this, students aren't able to see "big picture" of their discipline, which is only seen by the teachers. They don't get in touch with the "spirit of research": the (collaborative) reasoning about current issues in the community, setting up and discussing new (and sometimes as well risky) theories.

---

26 According to Spitzer (2000) brains are used to work with mental patterns. The more successful such a pattern is, the stronger it becomes and the more often it is remembered and used again. Considering Spitzer's theory, for example most adults' brains have saved a very strong mental pattern for brushing their teeth. Regarding the brain, this is very helpful and effective, because those adults don't need to figure out each morning how to brush their teeth. Regarding creativity, this is obstructive, because those adults won't ever invent a new, maybe more effective way of brushing teeth.

27 Within the DaVinci project, 20 qualitative expert interviews and an online-survey of all teachers from three universities in the Ruhr area were conducted.

28 These works were part of the ELLI-project ("Exzellentes Lernen und Lernen in den Ingenieurwissenschaften") 2011-2016 funded by the German Federal Ministry of Education and Research (BMBF) in combination with the project "Teaching Learning EU" 2010-2013 funded Stiftung Mercator and Volkswagen Foundation.
making of own decisions and seeking collegial advice. When students are able to see the “big picture”, they get a feeling about the value and importance of their work. Through these findings, the question arises whether this understanding of fostering creativity in engineering education is appropriate. However, students seem to have a different understanding of creativity. A (interdisciplinary) survey (n=320) at TU Dortmund University (Germany) shows that students regard “openness”, “freedom”, “stimulation”, “inspiration” and “empowerment” as factors that promote their creativity. Fortunately, there already are some beneficial approaches that meet these requirements. The didactical concept of the “Platform for E-Learning and Telemetric Experimentation” (PeTEX) (Pleu et al. 2011; Terekowsky et al. 2011a; Terekowsky et al. 2011b) is one example. PeTEX combines a tele-operated experimentation platform (material testing, particularly forming, cutting, and joining) with a collaborative learning environment. It provides three different learning levels: Students in the beginner-level are guided through the learning platform and are asked to carry out predefined experiments. In the intermediate-level, learners have to transfer their knowledge to given real-world scenarios and are encouraged to perform self-directed experiments. Learners at the advanced level have to design own research questions and to develop the appropriate experiments. The more the students have worked with PeTEX, the more freedom they get to define their own research problems and to find the answers on their own. Furthermore, PeTEX provides collaboration, not only with other students (from other universities and even other countries), but also with lifelong learners. In summary, PeTEX offers an important contribution to foster the “spirit of research”. Regrettably, it is only a flagship project, of which there are indeed several. But altogether, they still represent an exception in the reality of engineering education.

Radical Consequences

It remains unclear whether these points also play an important role from the perspective of the teachers and, furthermore, parts of the society: Does our economic society need diligent professionals who execute given tasks instead of developing their own initiatives? What is the role of a new thinking culture? Does our industry require graduates that are used to think multidisciplinarily? Are open experimentation and trying out new ideas, the search for the unknown really important for a society in a globalized world economy? What wishes and visions do teachers, researchers, industry representatives, professional association representatives have with regard to the education of tomorrow’s engineers and to their creativity and their “spirit of research”? What kind of education will be needed, if a society wants to bring up future inventors who are able to cope with the problem mentioned by the European Union? These questions should soon be discussed in a broad public debate.

The core of the questions raised here can also be found in a parable told by Hans-Jörg Bullinger on the opening of the hall of the Association of German Engineers (VDI) 2005: “Our students found the lectures on the meaning and purpose of DIN standards only limited fun. In a nice irony they told the story that a mathematics student and a physics student had just met an engineering student. They could not agree on the volume of a golf ball. So everyone picked up the methodology which corresponded to his field. The mathematician measured the diameter and the indentations on the surface and began to count. The physicist put the ball in a full glass of water and determined the displacement of water. And what did the engineer? He looked in the DIN standard for golf balls.”

Bibliographie


29 http://wiv.vdi-bezirksverein.de/mitbrie0604.htm (1/23/2012)