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Teaching humanities and social sciences: from traditional approach to blended learning

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Abstract

Adding humanities and social sciences to technical universities curriculum is a very complicated and actual problem. Modern society requires a careful balance between humanitarian and technical education to develop well-rounded individuals with general knowledge of a wide range of subjects and with mastery of a range of transferable skills. The role of an engineer in modern society is changing. Engineering science and practice can actually transform development of society and, as a result, responsibilities of an engineer to the society are significantly increasing. Unfortunately, most technical universities do not manage to incorporate humanities and social sciences into their curriculum as the number of hours taught is limited. One of the possible solution of the issue is to achieve a balance between technical and social sciences using blended learning.

Keywords: Education; blended learning; humanities; social sciences; engineering.

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1. Introduction

We live in a world increasingly dominated by science. Still, there is a growing awareness that professional engineers need a substantial acquaintance with a variety of subjects traditionally taught within the humanities. The thing is engineering and the humanities differ not just in subject matter but in the very kinds of thinking they encourage.

A number of engineering students take humanities courses thinking that they are wasting their time. They want to pursue a career in engineering and want to learn as much science and math as they can, because those skills can help them get a great job. But it is precisely because science is so powerful that we need the humanities now more than ever. By its very nature, engineering is creative and directed to human uses. All too often, however, engineering education postpones or overlooks both. Instead, it is presented as a process of absorption, followed only much later by the production of something new. Students master routine solving of well-understood problems. Textbooks present current knowledge as timeless truths, as if they had been handed down by divine revelation. Students are told to be creative only at the very end of their studies, in a senior thesis or a design project (Ottino, 2016).

Modern society needs a closer co-ordination between humanitarian and technical education to develop well-rounded individuals with general knowledge of a wide range of subjects and with mastery of a range of transferable skills. The role of an engineer in modern society is changing. Today engineers represent not only technical but also social and political progress. Engineering science and practice can actually transform development of society and, as a result, responsibilities of an engineer to the society are significantly increasing. Unfortunately, most technical universities do not manage to incorporate humanities and social sciences into their curriculum as the number of hours taught is limited. There is a gap between the humanities and the engineering that needs to be bridged.

Adding humanities and social sciences to technical universities curriculum is a burning issue in the academic world of Russia, too. Government and university authorities are still under the delusion that humanities and social sciences should be taught to liberal, language and fine arts students only. This is not true. Humanities and social sciences implemented properly into technical universities curriculum can teach many of the skills (i.e. critical thinking, creativity, self-assertion, etc.) required for success in a wide variety of careers.

That is the reason why humanities faculty believe that they have much to contribute to the revitalization of the undergraduate engineering curriculum. We want to bridge this gap and help create a new system where the two areas (STEM: Science, Technology, Engineering, and Math) vs. HSS: Humanities and Social Sciences) are not separate but are essential to each other. One of the possible solution of the issue is to achieve a balance between STEM and HSS using blended learning. Such a balance will help students to become ‘global citizens’, with the capacity to pursue lifelong learning and become valuable members of their communities.

2. Literature review

There is a general international acknowledgement concerning the value of humanities and social sciences in engineering education and drawing attention to the humanistic side of engineering is not without precedent.

In the United States, the innovations in this area have primarily focused on change at the college level of engineering education leaving few clear examples of how a humanistic approach might look at the K-12 level. Most American educators posit there is a lack of systematic research investigating exactly how and why such an appeal to the humanistic side of engineering can positively influence both the skills and abilities of students and the recruitment and retention of students into engineering from

elementary school through college. Morgan Hynes and Jessica Swenson argue for a more systematic inclusion of social science and humanities knowledge in the introduction of engineering to K-12 students. As part of this argument, they present a construct for framing the humanistic side of engineering with illustrative examples of what appealing to the humanistic side of engineering can look like in a classroom setting, and opportunities for research that examines the dynamics that the humanistic side of engineering introduces into engineering learning and teaching (Hynes & Swenson, 2013).

Dr. A. Khalid with his team analyzes the importance of humanities in engineering curriculum stating that engineers are thought to be experts in their field of interest and that is often where their expertise ends. Engineers on one hand are good critical thinkers but on the other often lack in communication and interpersonal skills. This lack of interpersonal and communication skills may be attributed to the lack of importance given to these disciplines during their engineering education. Emphasis on liberal arts and humanities, on the other hand, can prepare engineers to fulfill their cultural and civic responsibilities. For an engineering educator, it is vital to inculcate in the engineering students, the importance of studying humanities that can open up their minds to the use of creative ideas from great minds outside of science. Humanists claim that the state-of-the-art scientific knowledge techniques that engineers learn in their college curriculum have a limited shelf life. If they master the humanities, it can provide tools for extending that shelf life (Khalid, 2013).

The argument is often made that engineers need more exposure to the humanities. This position reflects the claim put forth on many fronts that modern, scientific technology poses many questions of a highly value laden nature that can only be addressed using the methods and insights of the humanities. The solution proposed is the creation of formal intellectual alliances between humanists and engineers to foster the reflective discourse needed to impute humanistic concerns into the problem-solving strategies of engineers (Sjursen, 2007).

This situation is nether unique nor geographically limited. Josef Rojter is also sure that there is an excessive emphasis focused on highly technical matters in engineering curricula which not only excludes greater technical diversity but also skills and knowledge of human affairs necessary in engineering practice. He suggests that the role of humanities in engineering curriculum needs to be observed through two main perspectives, which are: the nature of humanities and social science subjects in engineering curriculum; and proportional allocation of engineering curriculum to humanities and social sciences (Rojter, 2004).

In Europe as well, even if with slower concrete results, there is a growing sensibility to this topic, as manifested in 2002 at the thirtieth congress of the European Society for Engineering Education (Borri 2002). A decade ago literature on this topic showed that the inclusion of humanities in engineering education was considered indispensable for regaining the human factor in technological questions (Russo 2007). But European countries still face the question of whether universities should be a place that will produce graduates with multilateral technical knowledge and expertise, but also with knowledge from the humanities and social sciences, or whether they should provide highly specialized, unilaterally professionally oriented experts as there are still a number of reasons supporting each variant (Palenícková, 2015).

Thus, engineering education faces incipient crises on two fronts: the pressure created by rapidly changing technology to include additional topics in the bachelors' programme and the growing requirement for engineers to be able to make responsible cultural, political and social decisions that

shape the future of the world. We believe this awareness suggests a need for curriculum reform to offer adequate exposure to the humanities.

3. Current situation in Russia

From a historical point of view, until the mid-19th century, the humanities (i.e., grammar, rhetoric, history, literature, languages, and moral philosophy) held the upper hand. Then the tradition was broken and many technical educational institutions were formed all around the world. StilliIn the time of the Soviet Union there used to be a great variety of humanities in engineering education, e.g., compulsory subjects such as social sciences (philosophy, history, phycology, sociology, ethics, communication skills and others), economics, political sciences, physical training, Russian and foreign languages. That was quite a limited approach as the term 'humanities' includes, but is not limited to, the study of: modern and classical languages, linguistics; literature; history; law; philosophy; comparative religion; ethics; the history, criticism and theory of the arts; those aspects of social sciences which have humanistic content and employ humanities methods; and the study and application of the humanities to the human environment with particular attention to reflecting our diverse heritage, traditions, and history and to the relevance of the humanities to the current conditions of national life."

Around the end of the twentieth century, technological development lead to an inversion regarding the formation of engineers and the number of HSS was lowered. The main argument there was that humanities were not so important for future engineers; they only took time and effort of students. Still engineering students at that period of time got a specialist degree and had to study for 5 years and the overall amount of time devoted to humanities was considerably satisfying. In 2009-2011 all Russian universities adopted a two-level system of higher education. Since then, they have been offering Bachelor's (4 years) and Master's (2 years) programs (figures corresponding to education period for full-time students). Because of that over the past 6 years the proportion of HSS in engineering courses decreased from 30 percent to approximately 12-15 percent. Some technical universities in their desire to keep all STEM from previous curricular limited variety of HSS to four compulsory subjects (the so-called "Federal component of University curriculum"): philosophy, foreign languages, national history and physical training (which we exclude from our following discussion as it is not, strictly speaking, a humanitarian or a social subject). Former Samara State University of Architecture and Civil Engineering includes other courses (Economics, Health and safety training course, Theory and practice of social skills and Management & marketing), each being only a term long. Totally cover about 12,5 percent of bachelor students' study time (see Table 1). If we compare these figures with those recommended in other countries, we'll see they cannot meet the minimum requirement in the United States for the allocation of engineering curricula to humanities and social sciences – 24 percent (Rojter, 2004).

Table 1. Time proportion (%) of engineering curriculum at the Institute of Architecture and Civil Engineering, Samara State Technical University (former Samara State University of Architecture and Civil Engineering) allocated to HSS.

	Percentage allocation to humanities, social sciences and management subjects in engineering curriculum			
Time period	1980th	2000	2011	2016
HSS	27-30%	18-20%	7-8%	12,5%

In response to reviews into engineering education in other countries for greater inclusion of humanities and social sciences, in 2015, Ministry of Education and Science of the Russian Federation

began to require the teaching of other HSS in programs seeking technical accreditation. From such concerns the awareness of the importance of the humanities and liberal arts in engineering education has emerged.

Further analysis shows that despite many recommendations over the past couple of year to expand the allocation of the engineering curriculum to areas of social sciences and humanities, the expansion of the non-technical areas, has been slow to take anchor within technical universities.

4. Looking Beyond Traditional Scopes: Blended Learning

Engineering is a very diverse profession which requires a large number of skills. Encyclopædia Britannica defines engineering as application of scientific principles in developing, constructing, operating or even forecasting different industrial structures or processes (Encyclopædia Britannica: Engineering). An engineer has to perform various tasks, namely, technical supervision, personnel management, project development, equipment diagnostics, etc. Moreover, in today's global world, an engineer is to be capable of intercultural communication in order to work with international partners and to run joint projects. Therefore, engineering education aims at training a specialist who has all these practical skills. Engineers can also be distinguished from other professions by their ability to solve complex problems and implement solutions in cost effective and practical ways (Rasul, 2012). This ability to face a problem, work through various thoughts and abstract ideas and then translating them into reality is what is so exciting about engineering. STEM disciplines can make a bridge stand up, but the humanities tell us why it exists. For this purpose, providing only technical knowledge in the field of the profession is not sufficient. It is HSS that can help in developing special traits necessary for performing all engineering functions, and it is through humanities that character training can be incorporated into engineering education. (Osipov, 2010). Solving engineering problems requires knowledge from a variety of domains and benefits from teams of individuals bringing multiple perspectives.

Another important aspect of engineering is effective communication, both verbal and written (Khalid, 2013). Humanities study can strengthen the ability of engineers to work and communicate with others. The process of continuous course improvement, common to all education and training institutions, provides the framework for the approach to curriculum and course development introduced in this work. In many cases, universities develop a curriculum in terms of the expertise available, or historical requirements that no longer apply, or learner characteristics that have changed.

These are dilemmas for engineering education. Students need more science and advanced mathematics in order to prepare for the sophisticated, advanced and innovative engineering work that will shape the future. The rigour and intensity of this kind of study is such that it cannot simply be added to the curriculum. The required curriculum in engineering education is expanding beyond the point where programme revision can absorb all of the new demands. The relationship between engineering and the humanities is one that traditionally has not been close, and for the reasons pointed out, the engineering curriculum cannot add new humanities courses to its already crowded programme. Surely, curriculum change regarding the relation between engineering programmes and the humanities is called for. Thus, we see that remarkable opportunities exist at the intersection of engineering and humanities. But a simple curricular solution cannot address adequately these profound challenges.

The solution may be based either upon a carefully considered partnership between the humanities and engineering or upon implementing new learning experiences, such as blended learning. Blended courses (also known as hybrid or mixed-mode courses) are classes where a portion of the traditional face-to-face instruction is replaced by web-based online learning. Blended learning combines online and face-to-face lessons to make learning and teaching more flexible. With reference to blended learning in higher education, it has been defined as: 'a combination of technology and classroom instruction in a flexible approach to learning that recognises the benefits of delivering some training and assessment

online but also uses other modes to make up a complete training programme which can improve learning outcomes and/or save costs' (Banados, 2006).

We believe that in teaching HSS to engineering students blended learning is about finding better ways of supporting students in achieving the learning objectives and providing them with the best possible learning and teaching experiences, as well as supporting teachers in their role (including the management and administration of courses). Of course, the integration of blended learning in courses will naturally vary according to such factors as: discipline, year level, student characteristics and needs, course or program learning objectives, as well as the academic's approach to teaching, and confidence and experience in using technology (Bath, 2010).

Courses can be blended in many ways and for the following three main reasons: improved pedagogy; increased access/flexibility; increased cost effectiveness and others (Tomlinson 2013). In this very case the main reasons for employing blended learning in teaching HSS to engineers apart from restricted curriculum options are also learners' expectations (as learners nowadays expect technology to be integrated into their classes, and flexibility – learners expect to be able to fit learning into their busy lives, especially professional university students.

5. Reserch in Progress

Fortunately, teaching in engineering has evolved significantly over the past decade or so, though not in all places and not all at the same rate. Instead of simply passing on knowledge, the best programs now try to foster experiential learning. Teams rule, and in place of homogenous courses with all engineers in the same discipline, new courses pull together teams from multiple disciplines, including many outside of engineering (Ottino, 2016). The fate of higher education is increasingly being shaped not only by state and federal policy but also by technological advances and trends like the "unbundling" of the role of the professor with the rise of online education and interactive courseware.

Contemporary engineering curricula in the Institute of Architecture and Civil Engineering now include courses which have traditionally belonged to the humanities such as ethics, phycology, sociology, or foreign languages communication skills, but they do no fully serve their purpose because of the time-limits or students' involvement into these courses.

We are sure that much of what is needed in engineering education can be provided through new modalities of instruction. Thus, experimental online courses can foster cross-disciplinary approaches to solving the problems mentioned above. As all novelties need time to be introduced, we decided to start with one humanitarian course – English. We understand that the acquisition of good communication skills for engineering students is, of course, international in nature. Modern researchers assume its importance irrespective of language (McKay, 2007). Russian engineering students should have competent communication and writing skills in Russian, German engineering students in German, Greek engineering students in Greek and so on. However, beyond the requirement of language competency and communication skills in a student's first language are the advantages of foreign language acquisition. Foreign language proficiency, particularly for engineering professionals provides an invaluable tool in the world's increasingly inter-cultural, cross-border, and global-market environment. An English language course, a part of many engineering curricula throughout the non-English speaking world, provides a unique venue where many issues in humanities may be integrated into the English language course content.

A foreign language has become an indispensable part of engineering education, being a tool for intercultural communication. Scientists and engineers today work in a global market: the primary sources in the cutting edge engineering innovations are published in other languages, English being the most popular language. Engineering professionals take part in international consortia, they import and

export leading technologies, thus often finding themselves interacting across national, cultural, and linguistic borders. Industrial enterprises often prefer to employ applicants who are proficient in a foreign language. In these circumstances it is necessary for every specialist to possess intercultural competence, that is, to know the rules and instruments of developing joint projects with people from other countries.

A survey, conducted by the Department of Linguistics, Intercultural communication and Russian as a Foreign Language at Samara State Technical University revealed that knowledge of languages as a desirable attribute of engineering graduates was placed highly by the respondents. But there is a concern that Russian engineering graduates would have difficulty competing with their multi-lingual European counterparts on the international stage as their level in English is very low, and a traditional course of English can hardly improve it.

In the traditional first course at many universities, students typically review general English Grammar and learn by heart the so-called topics (stories “About myself”, “My country”, “My university”, “London”, “Moscow” and so on) that are of no practical use and adds nothing to students’ ability to communicate. In the second English course, students learn to summarize and paraphrase special technical texts, and the greater part of their time is given to translation. Classwork rarely include group activities or discussions. Usually classes are limited to 15-18 students, with two hours a week for class-work. Neither the class nor the teacher has any chance to speak or use outside the classroom. Students get their mark in the end of each term and almost always immediately forget what they have learnt during the term.

This time-frame of the traditional one-semester course poses other disadvantages. The teacher does not really know students' strengths and weaknesses well until the semester is almost over. Any follow up and reinforcement of skills is impossible. The traditional program allows students no flexibility because their course is strictly limited by the curriculum to two hours a week, and they have no choice but to drill grammar or learn texts just to finish their term successfully.

Advances in technology provide new opportunities for teachers to design and deliver their courses in ways that support and enhance the students’ individual cognitive experiences. In many cases the act of “blending” achieves better student outcomes, and more efficient teaching and course management practices. It can involve a mix of delivery modes, teaching approaches and learning styles. Taking a considered and programmatic approach to designing technology-enhanced learning experiences is crucial to the ultimate success of such experiences, particularly in relation to quality learning. As with any curriculum, the learning and teaching activities need to be meaningful and relevant for the students’ learning. They also need to be clearly valued and supported by the teacher, and well integrated into the whole course experience.

In the beginning of this academic year (that is, autumn of 2016) professors and teachers of the Department of Linguistics, Intercultural communication and Russian as a Foreign Language at Samara State Technical University set out to test blended learning while implementing it into HSS teaching. It was decided to take two pilot groups (20 students each), measure blended learning impact on students learning, and observe the effects on their level of English. For each course, one meeting a week is given to in-class instruction.

The first pilot group left traditional books and face-to-face classes for Touchstone – an Innovative Cambridge four level course, customizable between online and print. Touchstone presents natural language in authentic contexts, and explicitly develops conversation strategies so learners speak with fluency and confidence. Touchstone provides fully-flexible blended learning, which means that you can choose the best blend of class work and online work to suit your teaching situation and the needs of your learners. There are three modes of study with Touchstone, from which the third was chosen: Touchstone Premium Blended = Online Course + Student Book + Online Workbook. The unique fully

flexible approach to blended learning means that every lesson can be completed either in class with the Student's Book, or the same course can be done as self-study with the Touchstone Online Course or a combination of the two. Online access means instant access anytime, anywhere. Online Activities are carefully scaffolded to provide students with the building blocks they need in order to develop their language ability in gradual steps, incorporating the key stages of illustration, induction, and interaction. This helps students to achieve the same learning outcomes as they would do in class.

In Touchstone, every unit contains four lessons:

Lesson A – Grammar, pronunciation, and speaking;

Lesson B – Vocabulary, grammar, and speaking;

Lesson C – Conversation strategies, listening, and speaking;

Lesson D – Reading, writing, listening, and speaking.

All of the lessons can be done either in class (using the Student's Book) or online (using the Online Course). This is possible because the online course teaches new language and gives students plenty of opportunity to practice it:

- The Online Course teaches new language through animated presentations of the language, Help Notes, learning tips and inductive activities in which students are challenged to notice and figure out grammar structures and usage.

- Students practice the language through guided communicative practice activities, interactive online activities such as blogs and forums, as well as additional material such as the Online Workbook, Grammar Extra, Games, and Video activities. If students need extra review of lessons they studied in class, they can use the lessons from the Online Course as extra practice too.

A teacher here has to plan how to implement blended learning, to decide what to do in class and what to do online on a unit-by-unit basis (or even a lesson-by-lesson basis). The role of a teacher is minimized as progress tracking lets teachers monitor students work and plan classes around students' needs and automatic grading gives students instant feedback on their work. Teachers have no possibility either to use materials or techniques they are used to or change the content of the course. Besides, Touchstone requires a license for every student using it + a teachers' pack.

In the second blended model, the Internet is used in the online mode together with the learning management system (LMS) to support teaching and learning. These courses are being designed in conjunction with an e-learning platforms, Moodle, which is said to promote self-directed learning and autonomy, an educational bonus for the prospective engineer. This course is being design by consolidated efforts of the teachers of the Department. This work is still in progress as it is very time-consuming. Here designing for blended learning requires a systematic approach, starting with:

1. Planning for integrating blended learning into a course;

2. Designing and developing the blended learning elements;

3. Implementing the blended learning design;

4. Reviewing (evaluating) the effectiveness of your blended learning design;

5. Planning for the next delivery of your course then involves improving the blended learning experience for both staff and students (Bath, 2010).

The Moodle e-learning platform has proven to be propitious for a diversified population of students. With us, the course (consisting of 3 modules at the moment) can be accessed through the web site of

the Samara State Technical University and provide an online learning environment conducive to both self-directed and group focused learning. Teachers here can assign digital content to existing programs, use any existing authentic content which is available or choose their methods of assessment. Although much of the material is used in direct association with engineering, there are many resources from which students can choose according to their preferences. Some students feel comfortable with traditional paper-based worksheets, while other opt for the challenge of watching a film with or working with a podcast. Whether written texts or audio-visual format, authentic material can provide relevant topics, suitable vocabulary exposure and appropriate style for the course in question. They also place potential graduates within the 'real world' context of the engineering environment that they will face as professionals. In this course The role of a teacher is more important as he acts not only as a facilitator or an instructor of a course but also as a designer who has to select appropriate materials, methods of assessment and so on.

Both pilot groups have just finished their term and the first thing we observed students' increased sense of responsibility for learning. The traditional classroom too often pits the teacher and student on opposite sides of the learning process: the teacher has the knowledge, transmits it to the student, and then assesses understanding. By contrast, in a blended learning class, the teacher and student became partners on the path of discovery. The teacher is able to guide students and confer with them when they struggle. They are on the same team, working to achieve the same goals. A three-month pilot is not enough time to reach definite conclusions, but the project team observed that the quality and adaptability of online courses as well as students' involvement is a key factor of success. Based on the preliminary results, students from the 25% group agree that blending learning has benefited them in terms of doing more self-study and self-learning as they spent more time reading and learning. We hope to present evaluation findings from the first year of the pilot in the end of the next term.

6. Conclusions

Authorities both within and outside of science have expressed concern that scientists do not learn enough about the humanities as the world needs truly well-rounded engineers. In order to develop them, universities should repair the bridge that used to connect STEM (science, technology, engineering and math) and the humanities and social sciences. The purpose of inducing more HSS in engineering study is to lay a well-built foundation of basic concepts for various engineering disciplines. Developing more-flexible individuals together with engineering excellence should become the goal of engineering education today.

Unfortunately, most technical universities do not manage to incorporate humanities and social sciences into their curriculum as the number of hours taught is limited. One of the possible solution of the issue is to achieve a balance between technical and social sciences using blended learning. Implementation of new modes of learning in an engineering university provides high competitiveness of the graduates in the international market. The conventional technologies of teaching and learning retain a significant place in the modern curriculum, but some activities can be replaced by introducing more use of digital technologies. Thus, we are moving HSS online to engage students in meaningful, intellectually stimulating learning.

We don't have an "action plan" here, but share our first experience. Last year we started two new modes of blended learning with two pilot groups of technical students. Students appreciate being able to communicate online, listen to podcasts, etc. and welcome an opportunity to practice language skills and receive feedback at a comfortable pace. The deeper challenge here is to integrate these changes into curriculum design and assessment as we continue to look for ways to engage students in meaningful, intellectually stimulating learning of other HSS. Through HSS we hope to further promote

self-knowledge, intelligent citizenship, and critical participation in public life, turning a technical education into an expansively human one.

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