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The Value of Intercultural Communication Training in STEAM Education

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Abstract. In a global economy and in the globalized research paradigm within which we live, scientists, engineers and researchers in all scientific and technical areas are expected to work with colleagues in other countries in order to advance their careers. Intercultural communication training seeks to assist and support trainees in practicing good skills in these areas, aiding their success in cross-cultural interactions. Meanwhile STEAM education aims to promote soft skills such as teamwork, communication skills, critical thinking, and general emotional intelligence into the curriculum for science and technical students. The authors propose that introducing intercultural awareness and communication training into the curricula for science and technical universities will go much of the way to satisfying both needs. This research is carried out in the frame of the project «Capacity Building for Innovative Training Technical Specialists through STEAM education» (Grant No. AP09260338), funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan.

Keywords: STEAM education, higher education, intercultural communication, training technical specialists, curriculum, creative thinking, emotional intelligence, critical thinking, teambuilding, international integration.

Intercultural Communication Training

Intercultural communication is a symbolic, interpretive, transactional, contextual process, in which people from different cultures create shared meanings [1].

Intercultural communication training seeks to heighten awareness of cross-cultural issues and ways for people to communicate across and between cultures despite the existence of cultural differences. The purpose of intercultural communication (ICC) awareness and skills training is to do a number of things. Its first aim is to raise awareness of intercultural difference, with a particular emphasis on self-awareness. Beyond this it can provide skills and techniques for developing intercultural interactions and building relationships, with at the same time comparisons of different cultures and the various aspects and dimensions of difference that researchers have identified over the decades.

In addition to a set of specific skills and coping strategies, ICC training seeks to develop the traits of flexibility, tolerance for ambiguity, self-reflection, sensitivity, adaptability, open-mindedness, and creativity.

Taking these elements separately, ICC training first of all helps to build a great deal of emotional intelligence [2]. The development of self awareness skills and a recognition of one's own culture and ones own cultural biases and ways of perceiving the world (Moran, 2001), is very clearly connected to the development of EI (Emotional Intelligence). Emotional intelligence is arguably the foundation of successful communication and the ability to work together with others in a collaborative way.

Beyond this self-awareness and emotional intelligence, ICC training seeks to outline the features of successful communication, building skills in communication, and by extension in teamwork. The successful intercultural actor, seeks to meet his or her interlocutor half way, building a shared understanding, as it is sometimes referred to, a culture C [3].

Finally, through the work of Hofstede, Meyer, Hall, and others [4-7], the ICC trainee begins to build up a picture of the dimensions of cultural difference, again building self-awareness and a greater understanding of how other cultures function.

All these elements together can support the trainee in being a better more able communicator with a greater level of self-awareness and emotional intelligence, but in such a way that is both accessible and clearly applicable even to a shy or previously uncommunicative technical student.

Arguably all interactions are intercultural, but in this context, we are referring to those interactions which happen between peoples of different national cultures.

STEAM education

STEAM education values and highlights the addition of creativity, collaboration and inquiry to the teaching of science subjects.

The topic of integration of science, technology and art is one of the most relevant for the professional and technical society today, and industries based on creativity and intellectual capital have contributed to the discussion. Specialists in education have recently resorted to the practice of STEAM education, which is based on the interdisciplinarity and integration of five (Science, Technology, Engineering, Art and Mathematics) fields into a single training system for solving specific problems taken from real life. The obvious emphasis on the creative direction of the innovation economy today is manifested, in particular, in the fact that STEM education actively includes creative and artistic disciplines united by the general term arts.

The research considers the need for unity of the scientific/technical and arts approaches in education as an opportunity to improve the quality of training of technical specialists by building capacity for innovation and creativity integrated into technical training programs.

The objective of this aspect of the capacity building project is to develop and implement a training model for technical specialists through STEAM technologies to provide sustainable training programs in intercultural communication, creative industry and creative cooperation based on creativity and intellectual capital. An assessment of the potential needs of STEAM education, development, and implementation of measures for capacity building of training programs in technical specialties on the basis of development of specialized competencies will strengthen the qualifications and abilities of students and teachers at the international level.

Research into STEAM education around the world

A striking example of the implementation of STEAM education is China, where students are given the opportunity to solve production problems through examples of curriculum development and practical training, apply their innovative abilities, engineering design and problem-oriented situations to actively participate in real production practice. However, this has not always been the case, as China has faced a number of key challenges in the process of sustainable development, such as the lack of high-level specialists, the pressure of economic transformation, and the complexity of education reform. Accordingly, the country needed specialists with a high level of professional knowledge and skills [8].

Although the country has actively promoted education reform in recent years and has sought to create a favorable environment for the development of STEAM education, which combines technology, engineering education and arts and humanities education aimed at promoting innovation in technology-based learning, this reform is slow due to the lack of teachers with pioneering, innovative educational skills and makes it difficult to implement STEAM in the educational process [9].

Considering the experience of STEAM education in the U.S., in the early 21st century, a psychological study was conducted at Texas A&M University, which concluded that art education develops the skills of memory and attention in classes, improves the cognitive skills of students, as well as their social and academic skills. It was also decided in a number of states to apply a «creativity index», which would determine the level of students' creativity on an equal footing with the performance of standard tests. When hiring, companies prefer applicants who are able to take part in a variety of activities – brainstorming, rapid problem-solving, creative collaboration, generating and transmitting new ideas. Specialists involved in solving both technological and creative tasks say that the need for such workers grows day by day [10].

The issues raised are not only important in the U.S. context, but also for Russian education, where a STEAM approach is as yet mostly not used. In Russia, this model of education is only now beginning to receive priority attention. Higher school teachers are increasingly turning to STEAM education, which is based on interdisciplinarity and integration of the five fields into a single system of education for specific tasks taken from real life. According to employers, future university graduates believe that «STEAM is a synergy of theory and practice. A strong theoretical base cannot be considered as a guarantee of a successful career, because it is not only the possession of knowledge in the subject area that is important for employers, but also the ability to properly apply it. People who have received education according to STEAM-methodology are more independent and have higher potential in their careers, which also affects the level of income» [11].

For South Korea, integrated STEAM education is an approach to preparing a quality workforce and competent citizens for a high-tech society. The South Korean government has allocated a significant budget for education to promote STEAM in various areas. A literature review examined the STEAM educational initiative in South Korea and examined its impact on learning and teaching. Research in South Korea has shown that teacher training courses have increased confidence in teaching STEAM. They also introduced the term «convergent education», which means creating new ideas or products based on interdisciplinary thinking [12].

Since South Korean STEAM education builds on and is consistent with STEM initiatives in other countries, a review of STEM education in the international literature will provide context for understanding STEAM education in South Korea. Given the limited research, the training design for integrated STEM can be based on the literature

on problem-based learning (PBL). PBL is a well-researched and widely recognized student-centered learning approach that provides students with a poorly structured real-world problem to find viable solutions by applying knowledge and skills from a variety of sources [13].

PBL helps students develop problem-solving knowledge and cognitive skills such as critical and analytical thinking. Additional PBL characteristics, such as working in collaborative groups and participating in independent learning, lead to learning outcomes such as communicative competence and motivation to learn. They are also influenced by art education, which concerns design processes that reflect the practices of architects, graphic designers, industrial designers, and landscape architects. Many integrated STEM programs include tasks that require designing, in which students create a prototype or model as a solution. These programs offer students a set of design practices. This review has demonstrated that STEAM's integrated initiative in South Korea has achieved its goals to some extent, while identifying shortcomings in both research and practice. Since STEAM used PBL, the positive results were in line with the expectations of PBL [14].

In Kazakhstan, STEM education at the school level has been actively developing in recent years, namely, the presence of numerous scientific papers on the development and implementation of STEM education, as well as the introduction of robotics and computer design centers, including with the participation of foreign teachers, an example of which is Maker Space. However, in the scientific and educational literature there are no works on the issues of STEAM training, especially at the level of higher education, there are only partial works on the development of creative thinking in the process of teaching different disciplines, despite the high relevance of the development of creative industries.

The project is designed to create conditions for forming the basis of scientific knowledge and practical skills of the target audience through the technology of innovative training, as well as to build the capacity for innovation and creativity of training programs for technical specialists. The application of the STEAM education methodology in training technology will contribute to the development of key competencies of creative industry, namely creativity, collaboration, creative communication and critical thinking.

The results of our research will undoubtedly contribute to the development of social, educational, scientific and technological progress. Thus, in the development of a STEAM framework for capacity building for innovative training of technical personnel, we can clearly see the capacity to build a sustainable and promising curriculum for training technical specialists through the stimulation and development of creative culture of engineers.

This paper sets out to demonstrate the value of ICC as a key element to incorporate into a STEAM based education model – using this element in supporting the development of an engaging, creative, collaborative, problem-solving curriculum as part of the art component for future engineers' education

The value of ICC in STEAM

The obvious and most tangible value of intercultural communication for those students taking technical degree subjects is to prepare the students for their careers during which, in some form or another, they will need to communicate across cultures.

If such students remain in academia, they will need to be able to communicate with fellow academics around the world – partnering in research, and other forms of knowledge creation. Even within their home universities, they will likely have to interact with visiting professors, or others from other cultures

If, on the other hand, and more likely, they move into the professional sphere upon graduation, they will be required to work in teams, to connect with people in different cities and countries, and this is especially true if they take positions within multinational companies. For these reasons alone, the value of ICC awareness and skills will be extremely important for them.

However, slightly less obviously and tangibly, but no less importantly, intercultural communication training provides a number of the benefits of the STEAM education methodology. As mentioned, this kind of training provides for self-awareness and other emotional intelligence competences. In addition, it gives training in critical thinking skills as well, of course, as a wider perspective on the value of successful communication and the provision of skills in this area. It creates an understanding of teamwork and communication strategies in the workplace, the value of which is incalculable.

In addition, ICC can be an inherently motivating skill to learn and is seen as practical, which can sometimes be an issue for technical students in engaging with STEAM methodologies

Our proposal

Based on the above, and as part of a STEAM approach to developing soft skills in technical students, we recommend that ICC be included in the curriculum for technical universities in Kazakhstan.

The curriculum we propose may be a standalone module on intercultural awareness and communication, or may be part of a longer credit bearing course which not only includes ICC but is also aimed at emotional intelligence, teamwork, and other aspects of STEAM methodology.

The methodology that we propose to use with this curriculum, will include problem solving, reflection, teamwork, case studies, simulations, and other interactive activities, which will serve both to put across the key ideas most effectively but also to mirror the ideas within the curriculum as a form of loop input [15].

As part of a general curriculum that supports

Curriculum we envisage will include (but not be limited to) the following:		
	Subjects	**Objective**
1.	What is culture?	To open up the subject and provide some definitions of culture
2.	Awareness of oneself as a product of culture	To create a sense of self-awareness and reflection. To note that one of the aspects of culture is this sense of awareness
3.	KSAA framework (knowledge, skills, attitudes, awareness) (Moran, 2001)	To suggest a framework for intercultural understanding, onto which other models can be projected
4.	Aspects of culture • Hofstede's cultural dimensions (Hofstede, 1993) • Meyer's culture map (Meyer, 2014) • High and Low context (Hall)	To offer a series of models of cultural understanding, which will allow students the chance to think about how cultures differ and can therefore be interacted with
5.	ICC culture C model (Dodd, 1998)	To present a model of intercultural communication
6.	Intercultural teamwork	To develop models of team interactions and to analyze how intercultural considerations play into the work of a team
7.	ICC and emotional intelligence	To make explicit the links between ICC awareness and skills and the idea of emotional intelligence
8.	Strategies for communicating and working across cultures	To apply the knowledge gained so far in thinking about the workplace and communication in general

and supplements the technical skills of a student in a technical university, a supplemental curriculum that includes language skills, emotional intelligence, teamwork, critical thinking, and presentation skills, intercultural awareness and communication is a key element that will meet the needs of these students when they enter the workplace.

Conclusion

A STEAM approach to technical and scientific education is without doubt a more integrated and effective way of supporting the development of a new generation of well-rounded graduates who are prepared to be successful in the modern workplace. Within this STEAM paradigm, intercultural communication training is, we believe, a very valuable approach, providing a real-world and practical curriculum that by its nature involves the development of students who take thoughtful risks, engage in experiential learning, persist in problem-solving, embrace collaboration, and work through the creative process. It is these students who will be the innovators and successful specialists of the 21st century.

As part of our project «Capacity Building for Innovative Training Technical Specialists through STEAM education» (Grant No. AP09260338), funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan, we intend to incorporate this ICC strand in our STEAM education program, and to research its effectiveness.

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Steam-білім беру саласындағы мәдениетаралық коммуникацияны оқытудың құндылығы

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***Аңдатпа.** Жаһандық экономикамен біз өмір сүріп жатқан жаһанданған зерттеу парадигмасы аясында барлық ғылыми-техникалық салалардағы ғалымдар, инженерлер мен зерттеушілер мансаптық өсу үшін басқа елдердегі әріптестерімен жұмыс істейді деп күтілуде. Мәдениетаралық қарым-қатынасты оқыту арқылы тыңдаушыларға осы салаларда жақсы дағдыларды игеруге көмекпен қолдау көрсетуге, олардың мәдениетаралық қарым-қатынаста табысқа жетуіне ықпал етуге бағытталған. Сонымен қатар, STEAM-білімі жаратылыстану және техникалық ғылымдар студенттеріне арналған оқу бағдарламасы аясында топтық жұмыс, қарым-қатынас дағдылары, сыни ойлау және жалпы эмоционалды интеллект сияқты дағдыларды дамытуға бағытталған. Авторлар мәдениетаралық хабардарлық пен коммуникацияны оқытуды ғылыми және техникалық университеттердің оқу бағдарламаларына енгізу екі қажеттілікті де қанағаттандыруға ықпал етеді деп болжайды. Бұл зерттеу Қазақстан Республикасы Білім және Ғылым министрлігі жанындағы Ғылым комитеті қаржыландыратын «STEAM-білім беру арқылы техникалық мамандарды инновациялық даярлау үшін әлеуетті дамыту» (№ AP09260338 Грант) жобасының шеңберінде жүргізіледі.*

***Кілт сөздер:** STEAM-білімі, жоғарғы білім, мәдениетаралық коммуникация, техникалық бейіндегі мамандарды даярлау, оқу бағдарламасы, шығармашылық ойлау, эмоционалды интеллект, сыни тұрғыдан ойлау, тимбилдинг, халықаралық интеграция.*

Ценность обучения межкультурной коммуникации в STEAM-образовании

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***Аннотация.** В условиях глобальной экономики и в рамках глобализированной исследовательской парадигмы, в рамках которой мы живем, ожидается, что ученые, инженеры и исследователи во всех научно-технических областях будут работать с коллегами из других стран, чтобы продвигаться по карьерной лестнице. Обучение межкультурной коммуникации направлено на оказание помощи и поддержки слушателям в освоении хороших навыков в этих областях, способствуя их успеху в межкультурных взаимодействиях. В то же время STEAM-образование нацелено на развитие таких навыков, как командная работа, коммуникативные навыки, критическое мышление и общий эмоциональный интеллект, в рамках учебной программы для студентов, изучающих естественные и технические науки. Авторы предполагают, что включение обучения межкультурной осведомленности и коммуникации в учебные программы научных и технических университетов в значительной степени будет способствовать удовлетворению потребностей. Это исследование проводится в рамках проекта «Развитие потенциала для инновационной подготовки технических специалистов посредством STEAM-образования» (Грант № AP09260338), финансируемого Комитетом науки при Министерстве образования и науки Республики Казахстан.*

***Ключевые слова:** STEAM-образование, высшее образование, межкультурная коммуникация, подготовка специалистов технического профиля, учебная программа, креативное мышление, эмоциональный интеллект, критическое мышление, тимбилдинг, международная интеграция.*

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