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# Innovations, Technologies and Research in Education

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# TEACH-GYM: GROW YOUR METHODOLOGIES

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## ABSTRACT

This paper reports on a recent initiative put in action within the long-lasting connection between a European University and a Central Asia Institution. An Uzbek Technical University, Turin Polytechnic University in Tashkent, has been created in 2009, offering double degree programs under the supervision of Politecnico di Torino, Italy. The differences and educational needs of the two involved countries stimulated a contest of ideas, aimed at supporting the redefinition of teaching methodologies and course contents in bachelor programs. The proposed project becomes a "GYM", with win-win benefits for both institutions. On one side, more specializing courses are offered, as required by the role of the undergraduate education in Uzbekistan, and on the other hand, the experience and methodology are going to be transferred within the Italian university. Both qualitative and quantitative data have been analysed and presented, based on the initial selection of the best projects which are implemented starting from the second semester of the current academic year.

*Keywords: engineering education, international connections, learning by doing, teaching methodology.*

## Introduction

Before the 1980s, inside the Soviet Union's academia and higher education, there were very little scientific interactions with the Western countries. In 1990, with the collapse of socialism, the Central Asia and Caucasus region is been organized in eight former Soviet republics: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan, and Tajikistan, following different reform paths (Çokgezen & Çokgezen, 2014).

In almost all of these countries the reform package included the reorganization of curricula, introduction of new standards in student assessments, decentralization and privatization of higher education, privatization and liberalization of textbook publishing, and reorganization of schools (Kirtchik, 2012).

Some universities and research institutions, established in the post-Soviet era, were set up in partnership with foreign institutions and financed by international NGOs, foundations, and local governments. They mostly hire Western educated locals or foreign staff and provide Western style education, usually in English, and more incentives and opportunities for research than the old, state institutions (Pleskovic et al., 2002).

In this context, in Uzbekistan the processes of internationalization of higher education started formally in 1991; but only in 1997, the new Act on Education and the National program on Personnel Training was approved by the government. This act redesigned the structure of higher education in favour of western educational systems, with 4-year Bachelor studies and 2-year Master courses, underlining the country's desires to be part of the international community (Eshchanov et al., 2011).

Therefore, thanks to these efforts, some foreign universities started their own branch in Uzbekistan. After some years the Uzavtosanoat SC, General Motors Corporation and Politecnico di Torino (PoliTo, Italy), one of the biggest technical universities in Europe, reached an agreement on the organization of Turin Polytechnic University in Tashkent (TTPU), the first example of Bachelor internationalization in the area of Engineering. This private institution was officially established in April 2009 and shortly became the main source of human resources not only for the automotive industry but also for construction and architecture, energy engineering and information technologies. TTPU professors are supported by PoliTo ones with training and exchange periods; PoliTo and TTPU professors are teaching in collaboration and students receive the diploma of both institutions (double degree) as indicated in Table 1 and the courses are delivered entirely in English.

According to the national Act directions, the study plan is developed over 4 years: a first preparatory year (PY) managed entirely by Uzbekistan lecturers, supervised by PoliTo, and a triennium (First, Second, Third level) in accordance with the Bologna Process with the courses jointly delivered by PoliTo and TTPU professors. All local lecturers are identified by TTPU and evaluated by PoliTo.

During the first academic year (a.y. 2009/10) the number of bachelor's admissible students was about 200. This maximum number has grown in the years until 350 students in the a.y. 2018/19 with 1200 students that applied for admission. The TTPU structure provides the admission through the TIL, Test in Laib, similar to that carried out at PoliTo main campus

in Italy (Ballatore, Montanaro, & Tabacco, 2018). Students that positively pass the test can choose among one of the 3 active study courses according to Table 1.

The student composition is mostly male both for cultural reasons and for the type of studies (gender issue in STEM). The Uzbekistan scholar system requires 11 years of school before entering university and, as a result, students mostly start university at 18 years old.

The first cohort of students (2009/10) graduated at the end of 2013. Table 2 shows the number of graduates per solar year with the details of the individual degree courses.

Usually bachelor graduates immediately enter in the working life and only a few of them are enrolling into Master of Science, either in Uzbekistan or abroad (around 10%).

This trend is the opposite to the Italian situation in which bachelor graduates for about 80% continue their studies and only 20% enter directly into the world of work.

**Table 1.** Active study courses with the relative number of admissible students

TTPU study course	Related PoliTo degree	Number of admissible students
Mechanical Engineering	Ingegneria Meccanica	200
Information Technology and Automation Systems in Industry	Ingegneria Informatica	100
Industrial and Civil Engineering and Architecture	Ingegneria Civile	50

Therefore, there are some different curriculum requirements on the bachelor design that need to fit this different scenario. In particular in Uzbekistan it is been registered a mismatch between expectations of graduates, from one side, and actual degree of satisfaction with the existing levels of developing employability competence areas, from the other (Nizamov & Nurjanova, 2017).

## Aim of the study

The 10 years of directional contribution from Italy to Uzbekistan have favoured some critical reflections on the type of internationalization in place and on the teaching methodology in light of the needs of local reality. Those thoughts can be formulated in the following research questions:

- How it is possible to make the connection between the two institutions a “win-win” link and not just a simple monodirectional relation from PoliTo to TTPU?

- In light of the mismatch between higher education expectation and working skills requirements, how can be reviewed the teaching methodologies and the course contents in bachelor courses?

These two points are strongly related as the second question is analysing an aspect of teaching not well developed in Italy. That is, the impact on higher education caused by the anticipation of working life after the bachelor graduation.

The Uzbek reality thus can become a “GYM”, in the sense that it offers the opportunity to train by experimenting with these new approaches in order to transfer the methodology and the experience acquired within PoliTo bachelors. Moreover, thanks to the difference in the size of the students’ population (some hundreds in TTPU and thousands in PoliTo), on one side these new approaches are expected to strengthen the in-depth preparation and job-oriented background, and, on the other hand, they will create a solid and proven tool for the application of a similar teaching framework to a larger group of students. Therefore, to address those research questions, a contest of ideas, the “Grow Your Methodology - GYM call”, is been set with financial support for the implementation of the winner projects.

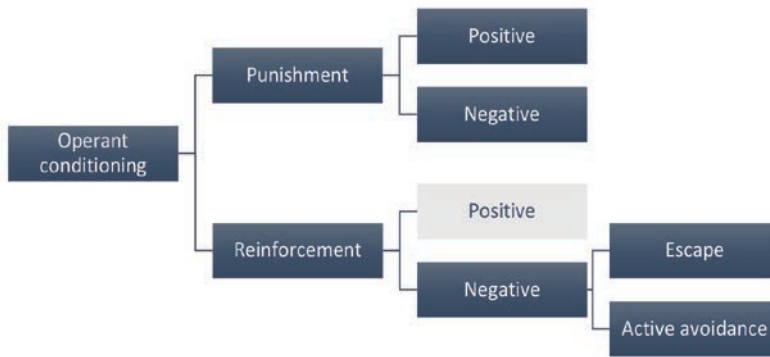
**Table 2.** Graduated students each year for study course

	2014	2015	2016	2017	2018	2019
Mechanical Engineering	68	97	68	64	64	
Information Technology and Automation Systems in Industry	18	15	17	29	13	
Industrial and Civil Engineering and Architecture	20	32	20	11	23	
Total	106	144	105	104	100	> 150

### Theoretical Framework

The internationalization process in place between PoliTo and TTPU try to include all the seven themes described by Teichler: (i) physical mobility of academic staff and students; (ii) recognition of study achievements across borders; (iii) different modes of transfer of knowledge across borders; (iv) internationality in the substance of higher education; (v) international orientation and attitudes, (vi) similarity of heterogeneity of national systems of higher education; (vii) internationalization as an argument for almost any higher education reform (Teichler, 2010).

Starting from those pillars, the project related to the research questions above, the GYM call, is primarily lying on two theories: one psychological,

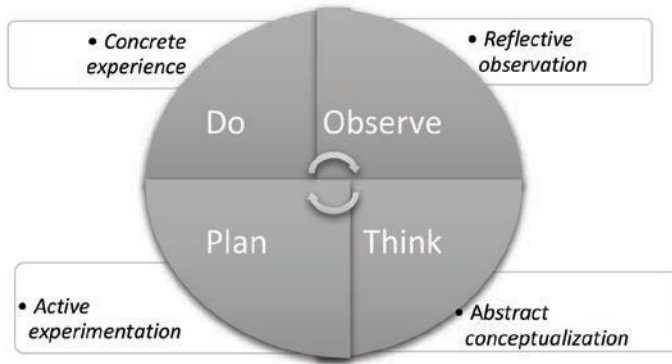


**Figure 1.** Diagram of operant conditioning

the operant conditioning (Skinner, 2011; Reynolds, 1975), and the other pedagogical, the learning by doing (Kolb, 1984).

The first one refers to a behaviourist theory in which an action is either incentivized through a *reinforcement* process or eliminated by a *punishment* (Figure 1). In particular, this research uses the effects that a positive reinforcement process produces. That is, if the individual behaves as desired, the reinforcers are favourable events or outcomes like praise and rewards. One of the key points behind this theory is that the response that follow a reinforcing stimulus is voluntary. Moreover, the GYM, as a call for idea, is itself the voluntary reward: it inspires and motivates professors in reviewing their teaching methodologies and test new strategies with academic support and coverage of possible extra costs. In this way, the voluntary response is more likely to be done by the individual.

On the pedagogical point of view, the theoretical framework adopted is the well-known experimental learning, also called learning by doing. The father of this theory, Kolb, believes “learning is the process whereby knowledge is created through the transformation of experience” (Kolb, 1984). Therefore, he theorized a cyclical model of learning, consisting of four stages (Figure 2): (i) do, (ii) observe, (iii) think, and (iv) plan. The process starts with a concrete experience in which learner actively does an activity or an experimentation. Then, there is a reflective observation where there is a conscious look back at that experience. The third stage is where the attempt to think and define a theory or model of what is performed, the abstract conceptualization, and, finally, the trying to plan how to test a model or theory or plan for a forthcoming experience, the so-called active experimentation. In this research the learners are professors willing to experience a new teaching style. The cycle starts with



**Figure 2.** Kolb's experimental learning cycle

the requirement of rethink about their courses both in contents and way of teaching in the Uzbekistan environment. Thanks to this exercise, as in a traditional gym, lecturers can see and judge the changes with the PoliTo technical support, and he/she can think how to generalize it in order to make the active experimentation also at the Italian campus.

## Materials and Methods

A mixed approach is going to be used in order to explain the need for a change in teaching practice and the overall effect of the new bidirectional connections. In particular, the students' career data have been quantitative analysed, whereas the call elements, i.e. structured projects, interviews and impact, are going to be considered for the qualitative approach.

In Uzbekistan, the anticipation of the entering the labour market makes urge experimentation and reformulation of the educational formats, progressively inviting to give space to new forms of experiential teaching, focused on the student and aligned with local needs, such as industrial environments and technology transfer for the growth of the country.

On the quantitative side the students' university careers are been considered, as well as their decision about whether to keep study through a Master or to work. In particular, the lesson frequency, and the rate of success are been analysed.

Therefore, it is possible to recognize the presence of two distinct needs: on the one hand to continue to ensure solid training, and on the other to foster the development of intermediate technical skills and a rapid integration into the world of work.

This study has been designed as a "gym" in which professors can grow their teaching methodologies in bachelor courses thanks to some first



job-oriented experimentation actually in place at the Master of Science in PoliTo and the support of the TEACH (Teaching Engineering Avant-garde Challenge Host) research group. Therefore, professors can train and explore those new ways of teaching in a smaller environment in order to feel more comfortable and implement them also in their Italian courses.

The call related to the GYM was sent to the entire PoliTo community of lecturers, both to the ones that already have the responsibility of a course in TTPU, 60 people, and to the remaining not yet involved in the Uzbekistan internationalization project 800 professors. The above numbers are an average over the 10 years' experience.

In order to participate, each candidate needed to fill an online survey with all the main information about their structured project ideas:

- the course addressing the change
- the portion of the course to be reviewed
- how he/she is willing to review it
- how and why is matching with the Uzbek context
- expected improvement
- interaction with locals (local lecturers, factories and partners)
- personal statement
- facilitator factors
- evaluation of the effectiveness of the new modalities
- sustainability after the project
- resources (human, economic and logistic).

Some constraints were set on the maximum value of economic resources available for each submission and about the creation of new courses, that were not eligible.

A commission judges each proposal and decides which one is mature to be implemented in practice at TTPU starting from March 2019. In the meantime, both a statistical and a meta-analysis is performed on the surveys' content.

## Results

In light of the 10 years of collaboration, a deep understanding of the Uzbekistan reality is in force of the PoliTo professors. Although it is well known that, in average, only approximately 10% of students decide to continue their education through a Master of Science, the teaching methodologies adopted are very similar to the one in use in Italy. Moreover, due to the high cost of graduate education in Uzbekistan, a portion of TTPU students generally needs to have some partial job during the Bachelor studies. This, together with some cultural aspects mainly related to the freedom of students in attending lectures, directly impact

the frequency of the lessons, that is stable around 30% for the majority of the course, and the duration of the career, which is extended to 5 years in average over the standard duration of 4.

As the students' reaction to changes is hard to predict and estimate, during the first semester (October-December 2018) some tentative approaches were made in two different courses. In both cases the new methodology was mainly based on a more experience-based learning through labs and simulations. Students response was very positive as the number of students attending the lessons every day almost double (around 60%). In the meantime, the course content was better understood as shows by the improvement on the rate of success, both in percentage (gain above 20%) and in grades (increase around 2/30) in these two trials.

This first partial experimentation clears up the potentiality behind the "GYM" project. In fact, on the student point of view it represents the possibility to receive a more job-oriented education that they found extremely interesting for their future career. In the meantime, professors that get involved were truly satisfied and found positively the external stimulation on reshaping their course both in contents and methods. The outcome of the project is hence expected to positively impact on both institutions, thus creating a win-win interrelation. On one side, PoliTo is going to receive a quantitative feedback on the effectiveness of the courses' reconfiguration in terms of acquired skills, active participation of students in the class and passing rate, with a direct impact on the redesign of the courses delivered in Italy. On the other hand, not only students but also TTPU professors and assistants are expected gain a lot in terms of experience useful for their future role in their home University, due to their deep involvement in all the phases of the project implementation and class activities.

Considering the requirement of residential that the project's participation indirectly imply, the call received a quite high number of submissions: 14 proposals have arrived. They were formulated by 9 out to 11 PoliTo departments, representing the variety of almost all the different scientific areas. These data also tell the desire of making auto-rethinking of each different discipline. All the proposal's leaders are or have been somehow already involved in the TTPU exchange, however in 4 cases the course reshape includes new people not yet been in the international mobility. The involvement of Uzbekistan lecturers is deepened in the 80% of the submissions requiring some mobility period for them at the Italian campus or the change in structure in order to better coordinate the contents.

Moreover, two submissions consist on an aggregated proposal of different courses, 4 in one case and 5 in the other. The idea behind is an interdisciplinary experiential project that includes interactive labs, computer-based simulations and coordination among the different

traditional lessons' topics. Half of the other 12 ideas were involving the full course, while the remaining 6 were proposing modification only to a portion of the course (Figure 3).



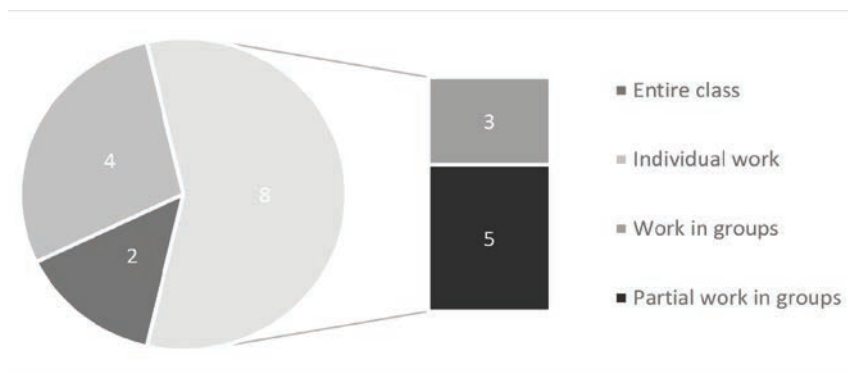
**Figure 3.** Distribution of proposals based on the portion of the course

If one considers the type of proposal based on their impact, the distribution about the content of each proposal can affect the course structure, the methodology or the examination process. Almost all the projects, 13 out of 14, want to modify the teaching methods; 10 submissions propose a review on the structure; 8 also suggest a review of the examination stage.

An in deep literature research was performed by all proposals in order to better match the labor work skills requirements in light of the experience already in place around the world. Based on this, the ideas are been categorized by the approach proposed, that is experimental and labs, problem-based-learning, study support, external expertise. The majority of the proposals can be found on the first group as 9 of them consider the experimental teaching as a possible reinforcement of the skills required by the labor market. Instead, other 3 adopted the project-based-learning to address this problem with a direct interaction with local factories and partners. In the meantime, the reinforcement of study methods is also a specific core of 3 submissions in which students are guided to reach autonomy in learning a technical subject. Only 2 ideas instead include the involvement in the theoretical lessons of partners from the world of work with study case explanation and discussion.

The activities are usually organized in small groups (5 out of 14) or require first-of-all a class explanation followed by discussion on groups (3). Instead, the remaining submissions require either individual works and involvements (4) or the entire class (2) (Figure 4).

Moreover, 2 proponents asked to start with a partial implementation of the course remodulation on a portion of students in order to feel more confident with the new structures and methodologies as well as to understand the students' reactions.



**Figure 4.** Distribution of what type of involvement is required in the proposals

After this overall analysis, a commission designed by PoliTo Rector had judged all the proposals in light of the Kolb's learning cycle. 12 of them were accepted with some suggestions mostly about the concrete start of the project, whilst the other 2 required a review. This rethinking could be necessary because of environmental constraints, like labs capacity, or of technical problem, as a weak external network. These 2 projects will receive a support during this year in order to be implemented in the future.

### **Partial conclusions (ongoing project)**

The mental exercise that each professor made for rethink about his/her course and teaching methodology is the first positive effect of the GYM. In particular, this effort impacts directly the TTPU campus and, in the meantime, is indirectly changing the way professors teach at the Italian one. While the gym exercise become more practical by the start of each redesigned course, professors will transfer their learning in the PoliTo courses as well.

The project is just started and even if we are far from ultimate conclusions, its preliminary outcome from the ongoing implementation of the GYM idea in the first three courses is extremely positive. In two cases, a boost in the attendance and participation of students is registered. In another, the evaluation of students based on distributed assessments during the teaching period allowed most of the students passing the exam at the end of the course, well in advance before the coming exam session.

Then, the connection, already in place between a historical European University and a young Asian Institution, has now a different perspective: from "give to bring" to "win-win". Italian professors, in fact, can experience a new way of teaching and improve their teaching methodologies; whereas the Uzbekistan ones continue to grow their teaching and research skills.

Considering the mismatch between higher education expectation and working skill requirements, the proposals mainly suggested a more experimental approach through labs, interactive exercise sections and external visits.

The strengthening of factories' network in each study course is another attempt to create a stronger connection between bachelor education and working skills.

## Recommendations/Implications/Future research plans

The GYM project is actually ongoing, and a complete analysis of impact will be available in March 2020, when the experimental stage will end. In the meantime, also the impact that this would have been generating in the Italian campus will be further studied.

The replicability of this project requires a high degree of understanding of the local reality and needs; such as typical students' behavior, way of teaching of lectures, request of the labour market. Once the context information is available the experience can be easily repeated.

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