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ONLINE TRIZ TRAINING: EXPERIENCE WITH DEVELOPMENT AND DELIVERY

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Abstract

The paper presents an overview of distant online TRIZ training introduced by the author in 2012, and summarizes experience and results based on training of 314 students with different backgrounds who represent various customer segments: from university students to top managers of large industrial companies. The paper presents some statistical data related to the courses taken, geography of students, and students occupations. Finally, the advantages and disadvantages of online TRIZ training based on the author's experience are discussed.

Keywords: TRIZ training, online training, distant training.

1. Introduction

The first ever TRIZ course was delivered by the founder of TRIZ, G. Altshuller in 1958 [1] in Baku, Azerbaijan, a part of the USSR at that time. The distinctive feature of the TRIZ training courses which followed in the ex-USSR was a strong focus on presenting theoretical TRIZ foundations in high detail and explaining cases by a trainer or a group of trainers rather than on performing practical work by the participants in a classroom. TRIZ training courses used to take 120-160 hours of classroom time spent for lecturing excluding individual or group practice. The students used to perform practical exercises during homework which took 1-3 hours after each training day. Thus in total such courses resulted in about 200 hours of training.

The first attempts to transfer such a format to Western audience resulted in mixed positive and negative experiences, both within academy and industry. Major contradiction was created by the demand for balancing the time interval for lectures and presentations and the time interval for instructor-led practice on cases in a classroom which was not possible provided that neither universities nor companies within industry were willing to introduce 160-200 hours courses. In most cases, the demand was to fit a course program to 40-60 hours.

Modern professional education demands a person to learn and master skills with a training subject or a tool in as short a time as possible. It is why, in modern professional education and training, the ratio between theory and practice gradually moves towards practice, and nowadays it is approximately 20% to 80% to increase retention rate by students according to the "Learning

Pyramid" theory [2]. In academic education, one can observe the same trend: today approximately 60-70% of a course is given to practice while a considerable part of theoretical material a student has to learn outside a classroom.

The problems with traditional TRIZ training are discussed in [3]. From the practical side, modern TRIZ is well developed and provides a set of methods, tools and techniques, with about 30 TRIZ tools and techniques used more or less on a broad scale worldwide. One the other hand, TRIZ is a system of thinking, which is hard to master without understanding its theoretical basis which has strong fundamental background based on a scientific approach. Successful TRIZ competence can only emerge from combining decent knowledge of theoretical TRIZ foundations and well-developed skills of working with different TRIZ methods and techniques. But taking into account the abovementioned disbalance of learning time towards practice does not give an opportunity to learn theory to the level which would be necessary to use TRIZ tools as effectively as possible.

Such contradiction can be eliminated, for example, by separating conflicting demands in time: for example, a student can learn theory on his/her own, using books or video-lectures before the workshop, and only then come to a practical training. However, the experience shows that in such case sub-tasks emerge: more often than not students come to a workshop and say honestly that they did not have enough time to prepare for it. They say: "Let me practice now, and I will read about it later". Usually, it happens so at professional training. The problem is that by far not everyone actually reads after the training workshop. This contradiction must be eliminated.

2. Online Training Process

2.1. Basis for Online Training

Before engaging to online training activities in 2012, the author had considerable experience with delivering both public and in-house TRIZ training courses and workshops in industry and academia worldwide. By 2012, over 200 professional training courses and workshops in the traditional format were delivered by the author with an average time of 8-120 hours per course, and the courses took place in 28 countries. In 2007, a 80-hour TRIZ course (with extension to 132 hours) was introduced for B.Sc. and M.Sc. students at Twente University in the Netherlands [4]. These activities resulted in the refining the author's approach to TRIZ training and the availability of training materials including practical cases which could be used for organizing distant training online.

2.2. Online Training Format

There are a number of different formats of e-learning, among which two dominate: *on-demand training* which does not involve instructor and *instructor-led training*. Surveys show that today 58 percent of organizations prefer to use on-demand learning for compliance training, compared to 12 percent who prefer classroom instructor-led training [5]. With respect to TRIZ, fully instructor-independent on-demand training format can only be used for learning theoretical background of TRIZ. However learning TRIZ tools and techniques requires intensive assistance of instructor, preferably on the individual basis. Even if knowledge of the theory and the tools can be learned without instructor and evaluated by automated knowledge tests, mastering practical skills with inventive problem solving requires coaching and trainer's assistance, especially in the situations when training is based on solving actual, not educational problems which is the

most effective way of learn the valid use of the TRIZ tools as confirmed by traditional training formats.

As a conclusion, online TRIZ training has to blend both approaches. A typical flowchart of the distant TRIZ training process is shown in Fig. 1. After subscribing to a course, a student receives a courseware set which includes videos of lectures, texts of assignments to perform, samples of previously solved cases, workbooks, reference materials.

To learn a specific subject, a student watches pre-recorded video materials of a training module, in which the trainer demonstrates slides with presentations, cases, images and other relevant information. The video materials are available for watching any time off-line.

After watching the video lectures on a certain module, a student prepares questions which will be answered by the trainer during interactive sessions ("e-sessions"). During e-sessions, the student can view the desktop of a PC of a trainer together with a webcam window of a trainer at the screens of their PCs. Voice communication is provided through audio chat. Students can also broadcast their own video from their webcams if they wish.

Assignments are performed by students in the offline mode between e-sessions. Each student has to perform s number of individual assignments to complete a course. Usually there are 7-12 assignments per specific course which correspond to training modules included to the course. Each completed assignment is made as a separate document and is sent to the trainer prior to the next e-session to enable enough time to the trainer to study the results of the assignment. E-sessions are used to evaluate the assignments and provide feedback to the student and last from 30 to 90 minutes.

There are two types of assignments: educational and real-life. In the educational assignments, all tasks including a problem to analyze or solve are defined by the trainer. However, it is highly preferred that a student performs a real-life assignment on the actual problem or a system related to his own professional area. To ensure confidentiality, the trainer signs non-disclosure documents if required.

If the student has a question arising while working offline, he can contact the trainer to request extra e-session. Extra communication time between the student and the trainer during the training course is not charged as long as it is necessary to reach the goals of training.

Date and time of each next e-session are flexible and are agreed depending on availability of the trainer and the student.

Total time for taking courses vary. On average, time to complete a course is from two weeks to two months for the courses of MATRIZ Level 1 and from 1 to 3 months for the courses of MATRIZ Level 2. Level 3 usually requires from 3 to 6 months. Since training is individual, time frames of taking the courses are defined by a student and a trainer.
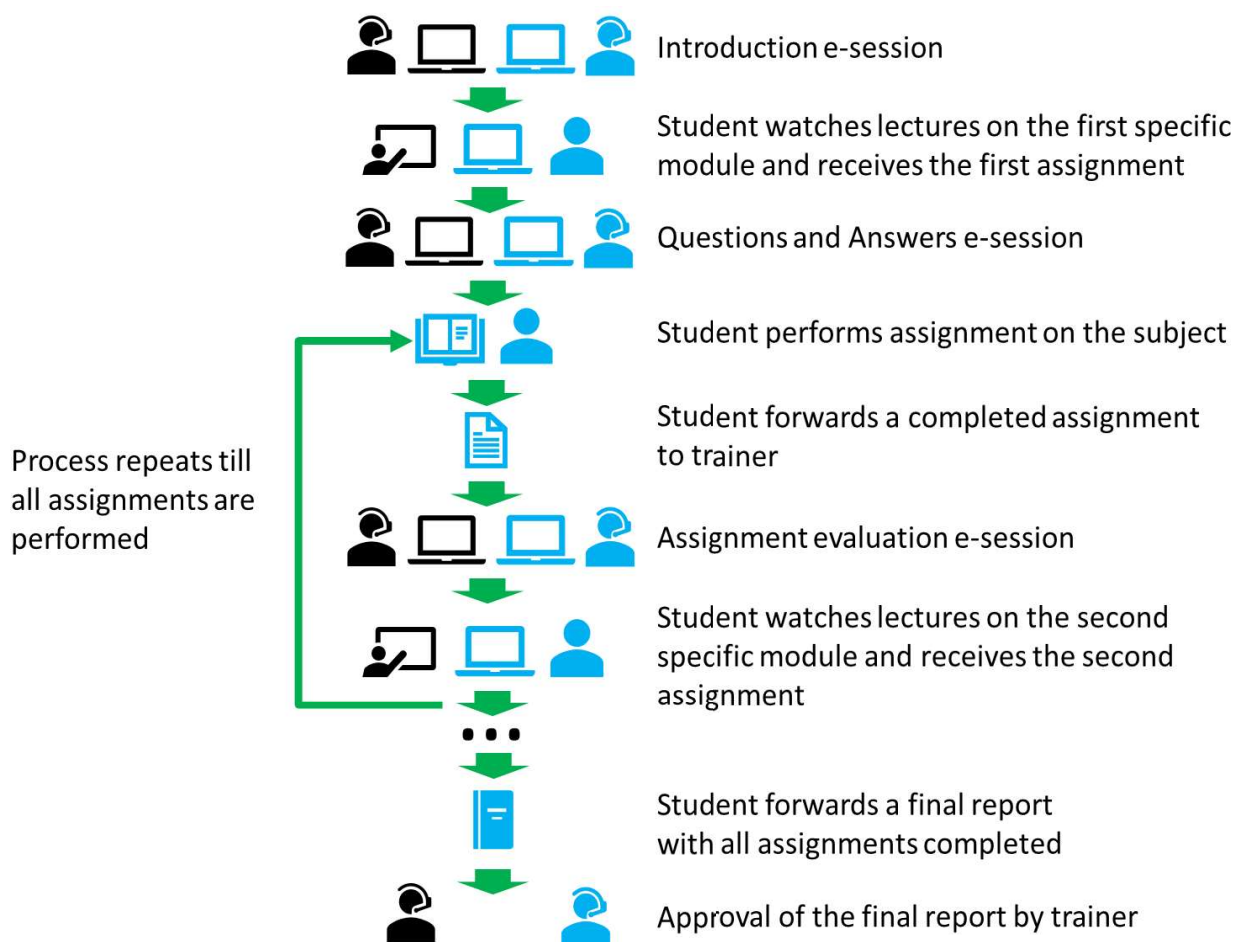
	Introduction e-session
	Student watches lectures on the first specific module and receives the first assignment
	Questions and Answers e-session
	Student performs assignment on the subject
	Student forwards a completed assignment to trainer
Process repeats till all assignments are performed	Assignment evaluation e-session
	Student watches lectures on the second specific module and receives the second assignment
	Student forwards a final report with all assignments completed
	Approval of the final report by trainer

Fig. 1. Flowchart presenting distant TRIZ training process.

3. Results

3.1. Course Subjects

Since 2012, the following two categories of online courses have been offered [6]:

- MATRIZ Certification courses which meet certification demands established by MATRIZ (Levels 1-3) [7]. Successful completion of such courses is currently awarded by a MATRIZ certificate of a corresponding level. Granting MATRIZ certificates was introduced in 2014.

- Specific courses on separate subjects. These courses help students to better understand and practice with specific subjects, such as a System of Standard Inventive Solutions, or Function Analysis, or ARIZ, and so forth. Usually these courses are taken by those who already learned TRIZ from some other vendors or tried to learn TRIZ without engaging to training courses. Students who successfully complete such courses receive certificates of the TRIZ Training International Centre.

Fig. 2 shows how many courses in each category were acquired by May 1, 2017. As seen, most of the courses acquired were TRIZ for Technology and Engineering, Level 1 (126) and courses on specific subjects (90).
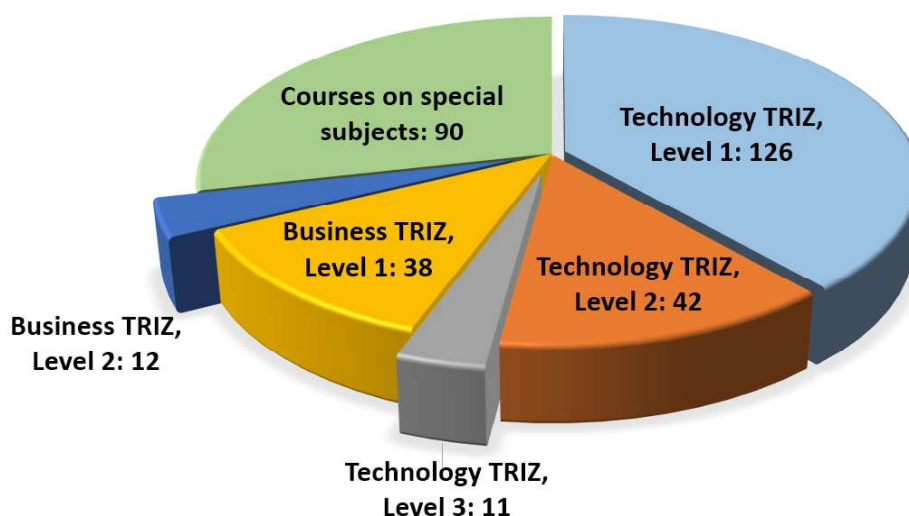
Fig. 2. Numbers of persons who took different courses delivered by distance learning at ICG T&C, 2012-2016 (Technology TRIZ Level 3 course was introduced in 2016). Levels 1-3 correspond to the classification by MATRIZ.

3.2. Customers Segmentation

The online TRIZ courses require students to possess some basic background in the field of business or engineering but it is enough for the first-grade university students or other individuals to engage. Fig. 3 shows current segmentation of the student occupations who took online courses in 2012 - 2016.

Fig. 3. Segmentation of online students occupations.

3.3. Training Geography

It is quite interesting that most of online students come from the Netherlands where the main offices of ICG Training & Consulting are located and from Germany which shares the border with the Netherlands. Provided that information on the online training is disseminated worldwide without focusing on any specific region and there is no difference for the online audience where to take the course since only availability of the Internet is needed, it can be explained by psychological factors where the most important is probably our psychological inertia. Figure 8

shows a chart with a number of students per country who participated in the online training in 2012-2016.
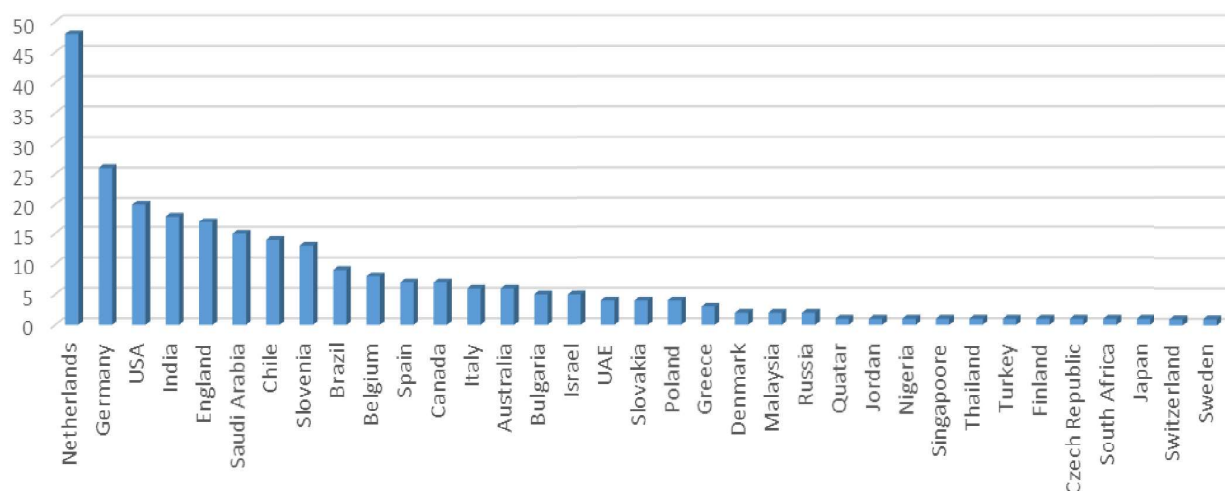

Fig. 8. Number of online students from different countries who took distance training from ICG T&C, 2012-2016

3.4. Tests and Evaluations

In addition to learning and understanding theoretical foundations, the primary goal of TRIZ training courses is, first of all, learning how to successfully apply TRIZ processes and TRIZ tools in practice. Which means that tests and evaluations of student's accomplishments must be done on the basis of assessment how well a student can apply TRIZ analysis, modeling and solving tools to deal with actual problems and challenges. As clear, to do it, knowledge tests only are not enough. There is only one way to evaluate the acquired knowledge and skills: to check how the student applies TRIZ on practical cases. Traditional training format of public or in-company courses does not leave much time neither to a student nor a trainer to thoroughly work with each tool and test the results due to time constraints. However, this problem is solved in the online distant training: each assignment performed and delivered by a student demonstrates his or her level of practical skills with a high degree of relevance.

For example, one of the students from UK who works in construction industry, solved 5 actual problems during online training. Each solution was a result on completing an assignment on certain module during taking the course on MATRIZ Level 3. All 5 solutions were implemented in his company and used in new patent applications before the course was completed. A similar result was shown by a student from Germany (automotive industry) who successfully solved three problems during his study of MATRIZ Level 2 course, and these solutions were approved patentable as well.

3.5. Students Retention

One of the main concerns which is often mentioned about online education is high attrition rate. It is estimated that totally, 40% to 80% online students drop out of online classes [8]. In our case, each student who delivered the final course assignment completed the course successfully. 42 students from total 314 have not completed their courses by their predefined deadline which means 13%, relatively low number compared with general statistics. Some of the students disappeared during the training process, but some of them returned after a while and continued training.

4. Advantages and Disadvantages of Online TRIZ Training

Based on the author's experience, the advantages of online distant TRIZ learning are as follows:

1. There is no time restrictions for a student to watch, listen and read all lecture and presentation materials as well as perform and deliver all practical assignments.

2. There is no time pressure to absorb the material by a student. It is well known that people have different rates of absorbing and processing information which creates a problem for some of them if the pace of training in a traditional classroom is fast. All the video lectures and other course materials are in full possession by a student so the video lectures or their parts can be watched several times if necessary.

3. Video lectures and presentations are edited before being included to the course materials. It helps to reduce time for watching and listening, and provides completeness of material since sometimes a trainer forgets or skips something in a real-life class.

4. The training materials are continuously updated by a trainer which provides an ability to supply new materials to a student during the course.

5. Quality and completeness of off-site assignments performed by students is considerably higher than during traditional classroom work due to the lack of time constraints. A recent presentation of one of the students from India who completed MATRIZ Level 3 program included 339 illustrated and well-structured slides.

6. Individual approach and coaching during e-sessions help a student to better achieve his/her training goals.

7. A student can safely work on his own cases or cases of his organizations to perform assignments due to confidentiality and non-disclosure agreements signed by a trainer. It often results in generating new patentable solution ideas during the courses.

8. Both student and trainer can flexibly manage their e-sessions which are conducted at dates and times convenient for both.

9. Online training provides considerable reduction of costs, specifically for a student since there is no need to travel and stay at the course location.

At the same time, there are certain disadvantages compared to traditional class-room training:

1. Lack of social interaction with other students. Such interaction is important to deeper understand the material learned, and, specifically, certain small details which can be critical. Such interaction occurs during breaks, discussions of presentation, outdoor meetings, and, most importantly, during working on actual cases in groups.

2. Time flexibility creates a contradiction: for well self-disciplined students it works fine, but less self-disciplined students tend to considerably extend the duration of taking a course which leads to forgetting previously learned material. Introducing harsh time limits does not help much because it creates unneeded pressure and eliminates the advantage of time flexibility.

3. Increased time of a trainer per student. Comparing to traditional classroom training, it is increased at least, twice which rises the trainer's workload and reduces his capacity.

4. Conclusions

As the summary of experience with online TRIZ training shown above demonstrates, the key advantages of the online training format compared to classical classroom training are flexible time management, more time spent by a trainer for individual assistance and coaching of each student during training, and a higher quality of assignments delivered by the students.

Another key advantage is a possibility of a student to safely work on real life actual problems during the courses.

However, the costs of online training still remain a bit too high for certain customer segments, specifically for college and university students. It is explained by the necessity of dedicating trainer's time for an individual approach to assist and coach students.

Another challenge is how to reinforce training with social interaction. It can be done by introducing a blended mode of training which is a sort of a bi-system combining both distant and classroom training. Such solution could allow students to travel to a course location only for a short period of time provided the student took a considerable part of the course online and to get experience with working on practical cases with other students.

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