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# Inventive Problem Solving OERs: from Students to Students

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**Abstract**

This interactive session presented findings of research completed by three student research assistants and feedback from MBA students on their learning experience with Open Educational Resources (OERs). Session attendees were offered the opportunity to practice inventive problem solving tool TRIZ with selected from MBA course OER.

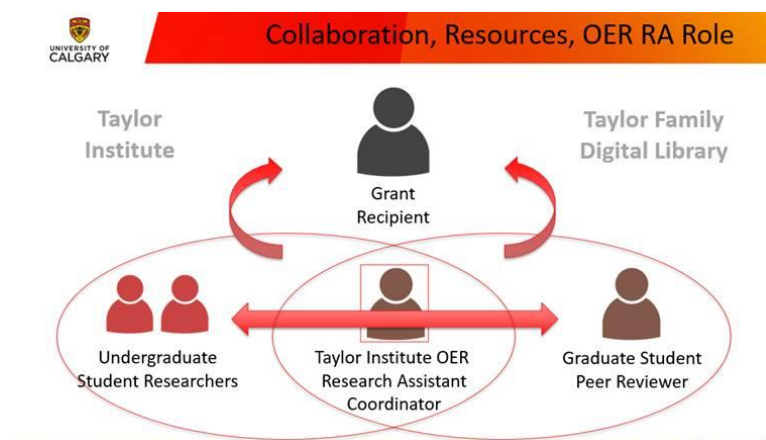
**Project Background**

Course textbook for MGST 741 Business Process Improvement and Creative Problem Solving (<https://www.amazon.ca/Hands-Systematic-Innovation-Business-Management/dp/1898546738>) is out of print, and only limited quantity of copies is available on the market now. This creates risk that students will not get the book via related Internet sites. Although the textbook was published in 2004, its price ranges between about \$100 (used copy) to \$1,500 (new copy), depending on demand, and averages about \$200.

As compared to the textbook, OERs provide more financially accessible, widespread and up-to-date content for MGST 741 students. OERs include examples, case studies, and solutions for business process improvement relevant to multiple organizations. Creative problem solving had been demonstrated in OERs across various areas, such as: business development, inventory, quality and supply chain management. MGST 741 MBA students have diverse previous work experiences and backgrounds, so each of the students can find in the OERs some information of particular interest to them.

Two Undergraduate students (Research Assistants) and a Graduate student (Reviewer) investigated and got experience in a new for them research area (see Figure 1).

Figure 1: Grant Model



Source: adopted from #1 OER – Advocacy Group Workshop 1

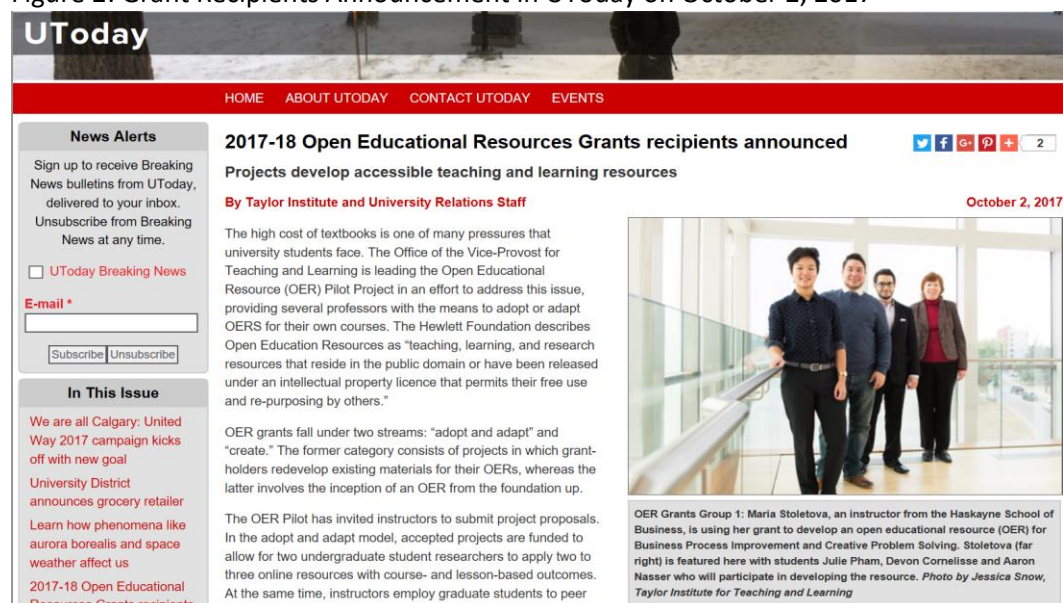
## 2018 University of Calgary Conference on Postsecondary Learning and Teaching

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OER research project was supported by a grant from Taylor Institute for Teaching and Learning at the University of Calgary, won in August 2017. While significant portion of research was completed between September and December 2017, research was ongoing with implementation of its findings in MGST 741 course during Winter 2018 semester and planned completion by September 2018. To obtain student feedback on OERs, Primary Investigator developed a student survey and obtained IRISS ethics approval early 2018. Project team was featured in UToday October 2<sup>nd</sup>, 2017 issue (see Figure 2).

Figure 2: Grant Recipients Announcement in UToday on October 2, 2017



Source: [http://www.ucalgary.ca/utoday/issue/2017-10-02/2017-18-open-educational-resources-grants-recipients-announced?utm\\_source=UToday&utm\\_medium=Email&utm\\_campaign=October-2-2017&utm\\_term=2017-18%20Open%20Educational%20Resources%20Grants%20recipients%20announced](http://www.ucalgary.ca/utoday/issue/2017-10-02/2017-18-open-educational-resources-grants-recipients-announced?utm_source=UToday&utm_medium=Email&utm_campaign=October-2-2017&utm_term=2017-18%20Open%20Educational%20Resources%20Grants%20recipients%20announced)

### OER Findings

Project research findings may be accessed at OER website of the Taylor Institute for Teaching and Learning (see Figure 3). During Fall 2017, research team investigated 57 OERs on 16 course subjects, including articles, case studies, videos and blogs. Current list of OERs consists of 62 items.

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Figure 3: OER Project Findings



Source: <https://ucalgary.ca/open/node/27>

## Student Survey

MGST 741 student survey included 28 questions around Performance, Engagement, and Satisfaction. Specifically for OERs, the following questions were offered:

- "I believe that by using OERs my effectiveness of learning about business process improvement and creative problem solving increased"
- "Examples used in OERs well-illustrated course material"
- "I liked the use of different instructional tools in my course"

Responses with "Strongly / Somewhat Agree" averaged to 86%, which is a positive outcome. Response rate was 88% of the class.

At this point, conference attendees were offered to participate in the first interactive module of this presentation. The following items were asked:

- Please reflect for one minute on textbook that you use in your course, its pros and cons, as well as applicability of OERs in your course

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- Please discuss with the team at your desk for three minutes
- Please share with this audience

Overall, participants supported idea of using OERs in their courses and one of them shared their current resource for textbooks at [//open.bccampus.ca](http://open.bccampus.ca).

**Inventive Problem Solving TRIZ**

TRIZ is a Russian acronym for the Theory of Inventive Problem Solving. In the Russian language, it is referred to as Teoriya Resheniya Izobretatelskikh Zadatch. Genrikh Altshuller (1926 - 1998) developed TRIZ methodology to overcome psychological inertia. His approach was to create a method that will be “accessible to anyone, important to learn, and very exciting to work through. We can teach everybody to invent.”

TRIZ offers methods that enhance the solution development stage. The benefits of TRIZ methodology are:

- a systematic and structured approach to concept development that offers advantage of productivity, robustness and repeatability of the innovation process;
- low-cost improvement solutions based on ideality principle that uses resources available inside the system;
- a breakthrough improvement.

In TRIZ, all problems occur as a result of conflicts or contradictions among the system attributes. The following contradiction was formulated for MGST 741 course materials:

Planned course textbook for MGST 741 was expensive, out of print, only limited quantity of used copies is available on the market now. This creates risk that students will not get the book via related Internet sites.

Under further problem investigation, it was noticed:

Course materials may be in a single source (e.g. book) because of convenience to use (but does not provide customization of course subjects, contains obsolete business examples), and

Course materials may be in multiple sources (e.g. articles, videos, cases) to assure variety of up-to-date perspectives on customizable list of course topics.

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One of key TRIZ tools is Separation Principles. Separation Principles are used to achieve a win/win resolution of conflict when it is desirable for an aspect (an object, process, parameter, function, or working condition) of a system to operate in different and opposing ways. For example, an automobile engine should be tuned (computer set up of fuel ejection timing, etc.) to provide good power and pick-up and should also be tuned to reduce exhaust emissions and provide good fuel economy.

Alternatively, when an aspect of a system should both exist and not exist. For example, aircraft landing gear must exist to hold and to transport the airplane on the ground, and the landing gear should not exist to reduce drag and allow better flight characteristics (speed, maneuver).

The purpose is to resolve the inherent conflict by separating opposing requirements:

- in space,
- in time,
- between the parts and the whole,
- based upon a condition.

*Separation in Space*

To determine the application of the Separation in Space principle, the following questions should be answered:

- I. Where does the conflict or contradiction occur?
- II. Where do I want this aspect of the system to have property X and where do I want this aspect to have a different or even opposite property Y?

Alternatively:

- III. Where do I want this aspect to be present in the system and where do I want it to be absent?

Many people enjoy the refreshing and invigorating taste and aroma of hot coffee. However, a paper cup filled with fresh hot coffee is so hot it may be uncomfortable to hold the cup. This problem may be resolved using the principle of Separation in Space. Apply the question: "Where does the coffee cup need to be hot and where does the coffee cup need to be cold?" The coffee cup needs to be hot on the inside so that the consumer can enjoy hot coffee, and the coffee cup needs to be cold on the outside so the consumer can hold and carry the cup comfortably.

One solution is to separate these requirements in space utilizing an additional insulating paper ring (usually made of corrugated cardboard) as a barrier between the hot cup and hand. The outside surface temperature of the corrugated cardboard is cool compared to the surface temperature of the cup due to the added insulation of the ring. In many instances, it is more economical to change the system locally (add corrugated cardboard), rather than to make changes to the whole system (utilize a more expensive cup design).

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Another example is a household refrigerator that is built to address the following system conflict: I want to have freezing temperature to preserve food for long time and I do not want to have freezing temperature for products of immediate use or products that cannot be subjected to very cold temperatures (fruits, vegetables, etc.). Refrigerator design is based on the Separation in Space principle of two compartments: one for freezing temperature and another for cool temperature. Separation in Space principle was applied over the evolution of this consumer product. At first, the freezer was located inside the whole refrigerator, and in following designs the freezer compartment was horizontally or vertically separated from the cool temperature compartment to assure easier access and efficiency.

*Separation in Time:*

- I. When does the conflict or contradiction occur?
- II. When do I want this aspect of the system to have property X and when do I want this aspect to have a different or even opposite property, Y?

Alternatively:

- III. When do I want this aspect to be present in the system and when do I want it to be absent?

For example, a pocket knife should be sharp to cut materials and should not be sharp so it can be safely handled during transportation or storage. The pocket knife allows a user to extract the blade for a cutting job. During transportation, storage or idle time, the blade is safely stored inside the handle. The use of the handle utilizes resources already available in the system increasing design ideality.

A sofa-bed resolves the following contradiction: I want to have a spare bed for occasional guests, but I want to have a sofa when I don't need a spare bed. The separation in time principle resolves this contradiction by transitioning the sofa into the sleeping bed or a couch depending on the need. That is, different properties of this consumer product occur at different times.

*Separation between the Parts and the Whole:*

- I. Can an aspect of the system have property X at the system level and a different or even opposite property, Y, at the component level?

Alternatively:

- II. Can a system aspect exist at the system level and not exist at the component level (or vice versa)?

Consider the properties of a mechanical chain. A bicycle or jewelry chain consists of individual links that are rigid and strong. Each link is not flexible, however, the chain itself, which is a system of connected links, is flexible.

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Internet technology utilizes hyperlink text. It was introduced to address the following contradiction: a computer screen should contain all the explicit information needed for the user, and the computer screen should contain only essential information presented in easy-to-read, user-friendly and organized way. A hyperlink separates the parts from the whole by allowing the system to be user-friendly, while the sub-systems contain explicit, detailed information.

*Separation Based upon a Condition*

I. Is there a condition where an aspect of the system has property X when the condition exists and has a different or even opposite property, Y, when this condition does not exist (but another condition might be present)?

Alternatively:

II. Is there a condition where an aspect of the system is present when the condition exists, and absent when this condition does not exist (but another condition might be present)?

For example, it is desirable for text on a computer screen to have a small font, so more information can be shown on the screen. It is also desirable for the text on the computer screen to have a larger font to make it easy to read. This contradiction is resolved by implementing a zoom-in and zoom-out feature based upon the circumstances or condition of the user. If the user desires to have an enlarged view, the zoom-out feature is used. If the user needs to closely examine details, the zoom-in feature is applied.

MGST 741 course material contradiction was resolved based on separation in space and in time principles. Course materials were found in OERs (e.g. articles, videos, case studies, blogs) which delivered variety of up-to-date perspectives on course topics.

The second and final interactive module of this presentation was an activity offered to the attendees. Specifically, attendees were shown OER source (video) found for MGST 741 course:

<https://ark-invest.com/research/amazon-drone-delivery>

Attendees were asked to formulate TRIZ contradiction based on the problem presented in the video and identify separation principle used to resolve it.

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