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Generation of ideas for technologic research.  
Planning of the research topic.

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# The concept of research

Results of scientific activity are reached by scientists' cognitive activity called scientific research.

# Result of scientific research

The result of research – knowledge about tested objects, an innovative engineering technologies. In other words, based on scientific research we get to know something that has never been known before or find such ways to improve reality in the way that no one has even thought before.

# Main stages of scientific research process

- The process of scientific research is very complex. The main stages could be planning the research, creating the problem and hypothesis, choosing the research procedure, empirical research, processing statistic and theoretical material, practical result application.

# Idea generation in environmental engineering

Idea generation starts from scientific literature analysis.

- Literature source analysis – it's an inseparable part of scientific work that continues throughout whole scientific work process. The goals of literature analysis are different in each research
- Literature source analysis helps with **choosing the topic**, scientific methods, familiarizing with earlier scientific works , planning the work

# Recommended literature sources

- Scientific articles;
- Patents;
- Monographs;
- Doctoral thesis;
- Scientific studies.

# Literature analysis allows

- a) to know about newest scientific works in engineering;
- b) To adjust the course of scientific research;
- c) To find material that confirms or disproves the facts of your personal research
- d) To find the justification if the literature data doesn't match research results.

# Stages of literature source analysis

- 1. The name, contents, annotation, introduction , bibliography is read through. It helps to choose the best way to read the information: to read thoroughly or just to familiarize with the main idea



# Stages of literature source analysis

- 2. Reading the source the first time, you must to get to know the contents in order to understand main ideas of the author. This is why you have to underline most important ideas, write down the definitions of concepts and terms.

# Stages of literature source analysis

- 3. Reading the material the second time, you must evaluate the factual data, choose the most important facts and compare them with the already known information. You need to insight in the author's reasoning process, their logic, not to be afraid to discuss "with the book or the author (it does not matter that he is recognized authority), find the weak links in his ideas, inconclusive findings and others.

# Ways to generate ideas

- **Brainstorming**

Author – Alex Osbourne.

- The idea of the method is purposeful separation of idea generation and idea evaluation stages, changing the way of thinking. In the beginning the creative thinking is being applied to get most ideas. After the first step, the analytical thinking is being applied in order to justify the best ideas and methods. Brainstorming stimulates the free flow of ideas which can kickstart other ideas.

# Idėjų generavimo būdai

- **2. Thought map**

Author– Tony Buzan.

- According to author, creativity is connected with memory and by strengthening the memory we strengthen the quality of creative processes. Buzan offers to write the main idea in the center of page and to write associations as branches from the center of the page. Drawing the map usually provokes new associations and the graphic view helps to memorize better.

# Idėjų generavimo būdai

- **3. Synectics**

Author– William Gordon.

- W. Gordon thinks that the main source of creativity hides in the search of analogs. Firstly you have to find an objects and to draw the table of its analogs. In the first column you have to write direct analogs, in the second – indirect (example: denying all the features in column 1). Then you have to write accordingly the goal, object and indirect analogs.

# Idėjų generavimo būdai

- **4. Focal object method**

Author– Charles Merlange

- Idea of method – connecting the features of different objects in one thing. 1. generating the project or prototype that needs to be improved, specifying main goal. 2. 3-4 random objects are being chosen and some specific features are being determined. 3- specific features are applied next to the prototype or project that needs to be improved in order to create a fusion of features. 4 – fusion generates new ideas. 5 – new ideas are evaluated and the most effective ideas are separated 6- new tasks are being created for the realization of the most effective idea.



## **Two „golden“ rules for all PhD students:**

1. Start writing early and write often. This rule works because the more you write, the easier it gets and it turns into a habit. Eventually small parts of text turns into pages and pages turns into huge amounts of information. Also, procrastinating makes the task even harder.



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2. Don't try to write perfectly the first time, just write. This rule works because the comments can be submitted only for draft. Writing helps to shape your thoughts and better than everything else shows where the argument is not thought through and where it needs to be improved.



# What you need to know before choosing the topic

- Before choosing the topic, you need to know the parameters for the scientific research
  1. Scientific level;
  2. The innovativeness and originality of results;
  3. Reliability and validity of conclusions

Before choosing the topic you need to evaluate material base that you possess (laboratory stands, methods, materials, reagents, etc.)

# Cooperation with work manager

- Work with the manager should start from the mutual agreement about the work procedure. Don't be afraid to tell your expectations, find out the manager's expectations and how he imagines your cooperative work. Clear realization of your own and your manager's expectations is an important condition towards successful work.
- It may turn out that the expectations are too high and inadequate and the PhD student needs to lower them in order not to get dissatisfied. It also may be that the expectations are too low so the student doesn't understand the amount of experience he can get from the work manager

# Choosing the topic

- This is the first stage of scientific research because the value of the work depends on the topic. The topic can be offered by the work manager but the student needs to be independent and to use the advices from the work manager accordingly. Also, during the course of the project the topic is usually altered so at the beginning it can be formed preliminarily.

# Reccomendations for choosing the topic

1. The topic must be relevant: it needs to be important for the theory and practice of the environmental engineering branch.
2. Topic must be connected to the theory and practice of the scientific branch: two elements that retain a close relationship

# Recommendations for choosing the topic

3. It is important to choose topic that interests the researcher not any topic that has been offered.
4. Need to take into account the topic's realization opportunities: will you be able to use correct methods, will possessed material conditions let you solve the tasks of the research, will you be able to find suitable literature for the justification and preaparation of the research.

# Recommendations for choosing the topic

5. The chosen topic needs to be formulated correctly while estimating strict boundaries of the research work.
6. The topic needs to be fairly narrow (By choosing the wide topic, research usually turns out to be very superficial)
7. In the environmental engineering field, research should be related to the development and improvement of laboratory stands, models, software

# Accent of innovation and originality

- In order to justify the innovation and originality of your research you need to find the answers to the questions or problems important for the whole academic community, not just yourself.

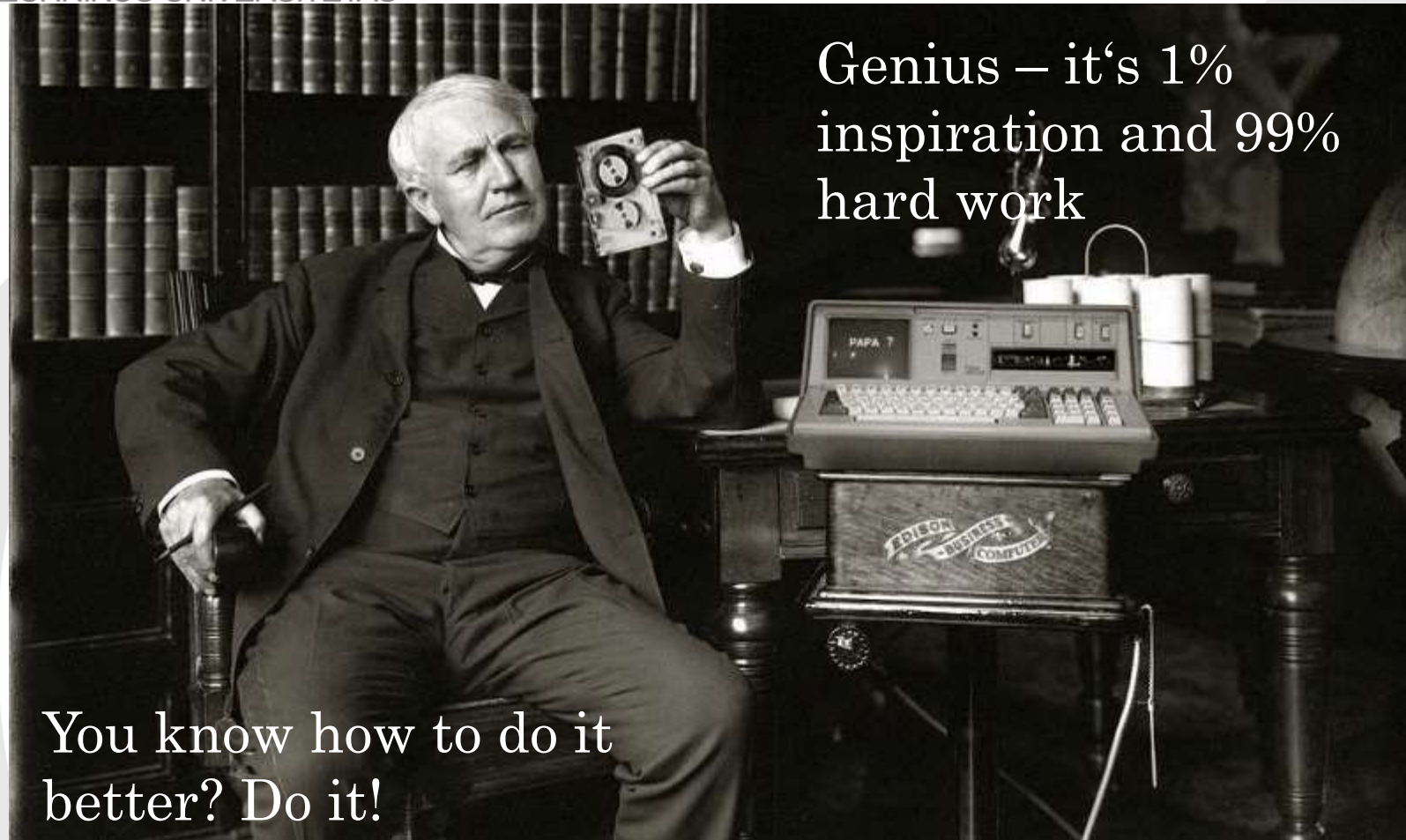
# Recomendations for formulation of the topic

- Topic must intrigue;
- Topic must sound untraditionally;
- Topic must contain intelligent terms.
- Specificness;
- In the technological sciences it is recommended to include terms as „research“ and „development“





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Genius – it's 1%  
inspiration and 99%  
hard work

You know how to do it  
better? Do it!

Source: <http://www.slideshare.net/DariusLomsargis/krybikumas-kaip-pritraukti-idjas>



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***THANK YOU FOR  
YOUR ATTENTION!***