systematic approach for implementation of STEAM education in schools

STEAM IMPLEMENTATION GUIDELINES

STEAM education should not be seen as an end in itself or as a Holy Grail that will solve all educational problems inside your institution. Before implementing STEAM education in school, it is important to identify main problems, that needs solving immediately and then decide, whether implementing STEAM education will help you solve that. For that purpose, it may be useful to consider the following eight steps[1] as you reflect upon improving the inquiry and problem-solving skills of your STEAM implementation team.

The problem-solving approach to designing and implementing a strategy includes these eight steps:

0. Before starting
1. Self-check analysis
2. Identify and analyse the problem
3. Develop a theory of action
4. Set your goal
5. Plan for implementation
6. Monitoring of implementation
7. Assess progress
8. Adapt and modify for continuous improvement

Here you can find Plan template, which you will need to fill throughout whole process. We recommend printing template on A3 paper and after you will fill it hang somewhere in visible place at school, so it could always be used in implementation process.

This document contains links to useful resources, which should complement Plan template. In some steps you will have hint, when that step result should be transferred into Plan template. If steps do not contain such hint, these means it is up to you whether you take and how any notes. We always suggest for you to take most important notes, thus is usually useful in process of implementation and evaluation.

This document is intended to be step-by-step guide for appointed team lead. Whether you should require all project team to read is up to you.

Abbreviations used within document:

TL – team lead;
PT – plan template.

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[1] These steps were outlined by Stacey Childress and Geoff Marietta in their resource "A Problem-Solving Approach to Designing and Implementing a Strategy to Improve Performance" and modified according to project "sySTEAM - systematic approach for implementation of STEAM education in schools" material.

0. Before starting

There are some questions to answer before planning STEAM implementation in your school, that would help to make this process smoother:

0.1.   Who will be responsible for leading whole process (from planning to implementing) of STEAM implementation in your school? Appoint the team lead (TL) who will lead planning process and monitor implementation of the project. Write down the name in **Plan template (PT), section 0A.**

0.2.   Who will be developing STEAM implementation in your school? Gather the project team that will develop and implement STEAM project. Write down the names in **PT, section 0B.**

0.3.   Before starting for inspiration you can read [State of the Art of STEM Technologies with Applications in the Classroom](#).

1. Self-check analysis

To start with STEAM implementation, it is essential to first analyse your school's current situation and needs in relation to STEAM implementation.
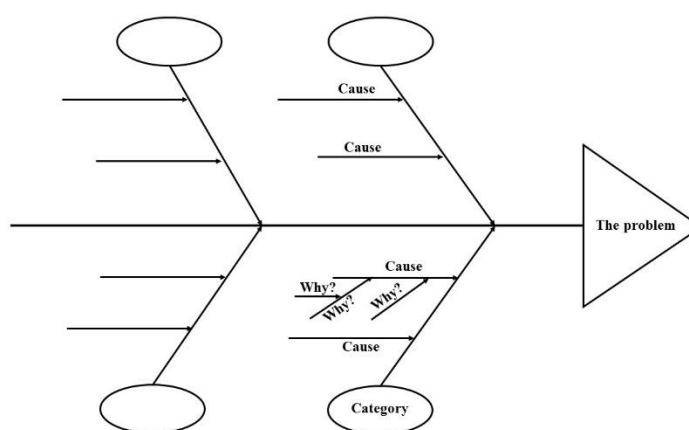
1.1.   **Read** [STEAM Readiness Level Framework](#), which offers a base for this kind of analysis. This is not a tool for assessment but rather a helpful way to map your current state and based on that plan the best strategy for a systematic STEAM implementation process.

1.2.   **Use** [self-check tool](#) in order to better understand your current situation in relation to STEAM implementation.

1.3.   **Place** dots and **connect** them in **PT, section 1**.

2. Identify and analyze the problem

To identify problem, it is important to answer these questions together with project team:

2.1.   What is the problem we are trying to solve? Describe it in simple terms with no jargon (no more than a sentence or two). Be sure that it is linked to activities and outcomes related to the instructional core (students, teachers, educational content). **Write down** the problem in the **PT, section 2**.

2.2.   What concrete evidence do we have to back up the short description we developed? Will this evidence enable us to communicate the nature and importance of the problem to staff and stakeholders? How will we test our assumptions with them and learn from their feedback?

2.3.   What are three observable symptoms of the problem identified? What are the root causes of each symptom? For root cause analysis **use** [Fishbone (Ishikawa) Diagram](#) (also called *5 Why's*).

Picture 1. Fishbone (Ishikawa) Diagram Example

2.4.   Is it possible to prioritise the root causes that emerge from our analysis? Often it is not possible to do everything at once, and your team should develop a common point of view about where to start. One way to make your team to prioritise is by asking, "If we only had time or money to tackle one or two root causes, which ones do we believe would have the most impact?"

2.5.   What are the consequences of not solving the problem? Be specific. How will a failure to act affect students over the long-term? How will it impact district-wide performance in the medium term?

3.   Develop a theory of action

Questions that will help you to develop a theory of action:

3.1.   What specific actions do we think will reduce or eliminate the effects of one or more of the root causes we identified in the previous step? Answer this question for as many root causes as you can.

3.2.   Why do we think these actions will lead to the results we desire? In other words, what assumptions are we making about how kids learn? How adults learn? How our team operates? About our context or environment? About our students and their families? Another way to think about this step is, "What do we have to believe for our theory to have merit?"

3.3.   From the above analysis, construct a series of "if…then…" statements that communicate the theory of action (e.g. if we integrate different subjects not only our students will get a grasp of the difficult concepts easier, our staff members will also learn to collaborate better) and **write down** it in **PT, section 3.**

4. Set your goal

Questions that will help you to set the goal:

4.1.   What do I want to accomplish? How will I know when it is accomplished? Formulate the goal that would be specific (well-defined and clear to everyone involved), realistic (within the availability of resources and knowledge) and time bound (with concrete dealine). You can use SMART principles to formulate goal as well. **Write** your goal in **PT, section 4**.

4.2.   What are the indicators, that would allow to measure the progress of achieving the goal? State indicators in **PT**, **section 4.**

5. Plan for implementation

In this step, project team should decide on concrete actions which needs to be taken and identify the resources needed to successfully execute the project. These might include financial resources, people, and/or technology.

5.1.   What steps will we take to implement our project? Who will do what by when? **Write** everything in **PT**, **section 5.**

5.2.   If your plan involves adopting new technologies, we suggest for you to read Guidelines for Adopting Technologies in School. Is there anything you could benefit from? **Write down** those ideas in **PT, section 5a**. If it is not relevant in your project – leave it blank.

5.3.   If your plan involves integration of different subjects, we suggest for you to read Guidelines for Integrating Different Subjects. Is there anything you could benefit from? **Write down** those ideas in **PT, section 5b**. If it is not relevant in your project – leave it blank.

5.4.   Additionally, we suggest for you to consider what possible cooperation could bring added value for your project. Read School-Business-NGOs Cooperation Guidelines. Is there anything you could benefit from? **Write down** those ideas in **PT, section 5c**. If it is not relevant in your project – leave it blank.

5.5.   You should not underestimate importance of investing in your people who will be participating in implementation of project. Is new training needed to ensure that the people asked to implement pieces of the strategy have the skills they need to do their best work? **Write down** answer and actions in **PT, section 5d**.

Additional questions for increasing likelihood of successful implementation:

5.6.   What material resources are required to implement project? (curricular materials, technology, physical space, etc.)

5.7.   How much will the implementation cost? How will we pay for it? Will there be savings in other areas related to the new strategy?

5.8.   What are the implications for pupils, teachers, parents and management if change occurs? This question helps uncover groups who might feel threatened by the changes you propose.

5.9.   How will we build support for the project, especially among stakeholder groups who think that they may lose as a result of the change?

5.10.   What roadblocks (both internal and external) are we likely to encounter? What can we do to prevent or quickly address them? Who will be accountable for managing the response to roadblocks?

5.11.   What are some specific benchmarks we will measure throughout the process to assess whether the implementation is on track?

5.12.   Are there systems in place to collect the data needed for the indicators? If not, how will we collect data? Who will be responsible for analyzing the data that is gathered?

6. Monitoring of implementation

During this step, roadblocks will surely arise, and the owner(s) of the implementation phase must address them immediately. Usually these barriers can be overcome, but occasionally a bump in the road is an opportunity to learn important information that will help improve the action plan. Feedback loops that enable the organization to learn and continuously improve are critical to successful implementation over time.

6.1.   **Decide** how often PT will review the plan? Team should agree on the frequency for revising the plan (recommended unit – weeks) and **write down** the number in **PT, section 6**.

Guiding questions for the monitoring of implementation and plan review (this is not exhaustive list of questions and there is no need to answer them all in each meeting. This list serves as inspiration and TL should use it in most appropriated fashion):

- Do people understand how their day-to-day actions are related to the achieving the goal? Is the goal meaningful to them?

- Are we providing the supports people need to enable them to successfully perform the work required of them during the implementation phase?

- Are people actually implementing the actions as it was designed? If not, why not? Are there consequences for failing to implement the actions?

- What is the process for making sure that all participants provide regular feedback that will allow us to continuously improve performance?

- Is the data we are gathering the best data for assessing our progress? Are we asking the relevant stakeholders to give us input about the implementation?

- Are we achieving all of the milestones we set during the implementation planning step? Are we on track in terms of timelines? Budget projections? Staff allocations?

- If we are missing milestones, why is that happening? Was the initial schedule unrealistically ambitious? Did we underestimate the time certain activities would take to accomplish? Did our forecasts fail to account for important factors? Have barriers come up that were unexpected? Should we adjust our expectations or accelerate our efforts in order to meet our original targets?

- Are individuals and/or teams engaging productively in the activities that the action plan requires? If not, why? Is it a problem of skill, which would call for us to provide more training and development? Or, is it a problem of will? Are some people opting out of the whole approach, believing that "this too shall pass"? If so, what steps will we take to help people change their behavior? If this is ineffective, what will we do?
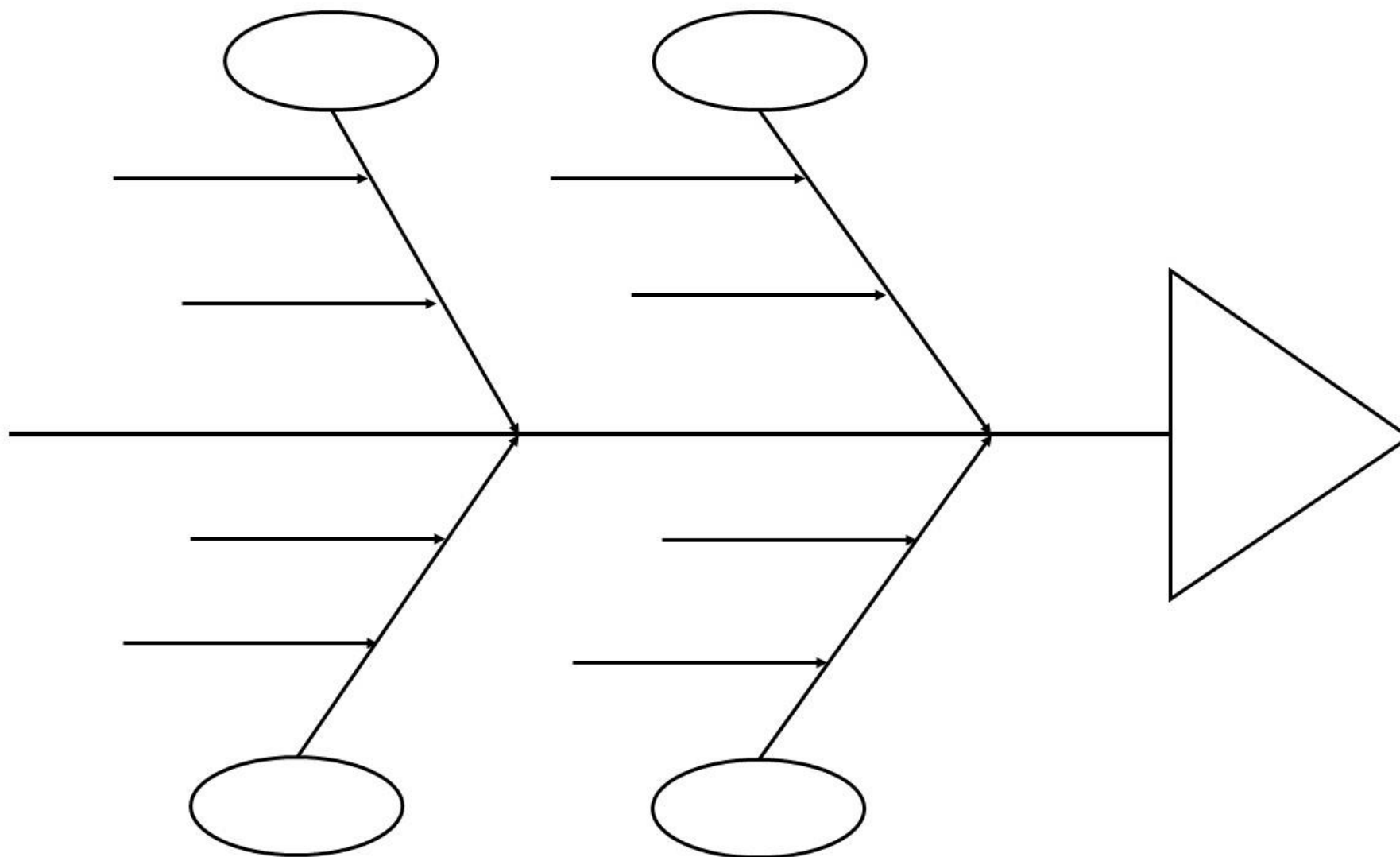
7. Assess Progress

7.1. Have you achieved the goal? Evaluate the indicators, have they reached expected value? What had biggest impact for (not) reaching them?

7.2. Has your problem been resolved after reaching the goal? Have you diagnosed the right root causes of the problem? What have changed after implementation of the project in school, class, among pupils, teachers, etc.? Write down in **PT, section 7**.

7.3. If not, what can we learn from our feedback loops that might help us revise the goal and action plan to make it more effective? Are there alternative activities that might be more efficient?

7.4. What have you learned during implementation of your action plan? How you can make this process more effective? **Use** Implementation reflection ([printable](#) / [computer](#)) template to reflect the whole process.

8. Adapt and modify for continuous improvement

8.1. Chose the status (see details below) and mark it in **PT, section 8.**

A. If we are making progress in solving the initial problem, but the goal has not been achieved yet: **REPLAN**. What adjustments do we need to make to our approach now that one or more of the root causes might be diminishing in importance? Start re-planning your strategy from step 0.

B. If the goal was achieved: **CONTINUE**. Use assessment and reflection information to plan how to sustain achieved effect.

C. Our actions had no impact on problem or problem is no more relevant: **TERMINATE**.

Annex 1. Fishbone (Ishikawa) Diagram