

## Does STEAM Approach help in closing the gap between the books and the real world when used in classrooms?

### Action Research

A growing interest in action research, as it provides the opportunity to improve and study teacher's practice, and it provides them with a chance to work together on common issues or everyday concerns in their classrooms. Good action research integrates theory, practice, and meaningful applications of the research results. Encourages changes in school, empowers individual's through collaboration with one another, encourages teacher reflection, and examines new methods and ideas. Action research is typically focused on a particular issue or concern that is examined in a class or school. The results tend to be localized to a given school, department, or classroom. *Table 1 compares action research with traditional educational research.*

What	Traditional research	Action research
Who?	Conducted by university professors, scholars and graduate students on experimental and control groups.	Conducted by teachers and principals on children under their care.
Where?	In environments where variables can be controlled.	In schools and classrooms.
How?	Using quantitative methods to show, to some pre-determined degree of statistical significance, a cause-effect relationship between variables	Qualitative methods are used to describe what is happening and to understand the effects of some educational intervention.
Why?	To publish and report generalised conclusions to large populations.	To take action and effect positive educational reform in the specific school environment that was studied.

*Table 1: A Comparison of Traditional and Action Research*

Throughout each stage, the researcher's learning is articulated and reinvested into the process. In the process, learning occurs for practice, about the practice and through practice. Action research is a kind of inquiry that is **practical** as it involves making the change to practice and **theoretical** as it is informed by theory and can generate new insights.

Action research follows a cycle, which always involves planning, then making a change and then reviewing the situation to generate learning. There are several models of action research that break these key phases down into smaller steps. The similarity between action research models and models of reflection can be noticed, as both are part of the same family of approaches in developing practice. Action research is more thoroughly planned in comparison to reflective practice, more formal, is likely to have an audience and is possibly undertaken less frequently. Unlike reflection, it involves data collection. Action research is undertaken through practice. It should have benefit individual, colleagues or other key stakeholders. Any action research project relating to teaching and learning should complement your existing activities, interests and priorities.

Action research is characterised by clear stages, which includes:

**Consideration of action in a focused area (reflection and reconnaissance):** The initial step is to identify and define the focus of the investigation. Developing questions in focus areas, determining a plan to effectively studying the question emerged. Considering aspects of these areas needed to study as part of the research. Specifically examine student outcomes, curriculum, instruction, school climate, parental involvement.

**Execution of the plan to individual practice and data collection on the action:** conducting action research includes collecting data to use in answering research questions. Gathering information to address questions, this data may consist of teacher-made surveys or standardized test data, interviews, student portfolio, observations and other sources of information. Keeping the data organised makes analysis easy and clear. It's vital to Identify when we have collected enough data

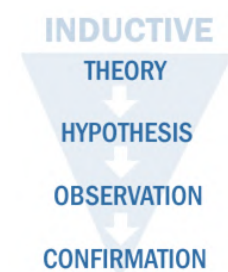


Figure 1: Inductive Analysis

**Analysing and understanding data:** analysing and making interpretations from the collected material. Describing or summarising the data clearly and finally, using the data to answer the research question and/or proving the hypotheses. There are multiple strategies and techniques can be used to analyse, lay out all the data and identify themes and patterns, making notes and utilising to determine how to discover. In this research, inductive analysis of the data is used. Moving from the theory, using the hypothesis and the data to confirm the findings.

**The identification of further action for improving intervention:** Making the decision and identifying the next possible action about the research. Uncover the root cause of the focus and know exactly how to fix the problem. A multitude of factors and continuous will determine actions, observe, act, reflect as the classroom is planned and operated.

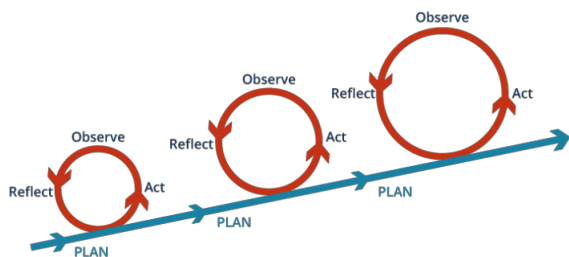


Figure 2: Multi-stage Action Research Cycle

**Continuing the action research cycle:** Action research is a systematic **multi-staged cyclical** process, which seeks to improve practice through the application of informed and incremental change. It is not conducted in isolation but seeks out opportunities for collaboration and the participation of other agents.

Parts of action research, which were considered very difficult for teachers, is probably the focus of training and development for teachers. Likewise, the number of teaching load and teacher tasks require too much time that they cannot devote to research. Thus, For teachers to conduct researches, there should be a lesser teaching load to provide extra time for institutional researches and support more teacher-researchers.

## Rationale for this study

STEAM is an educational framework that combines reality into the classroom, learning approach that connects the different subjects in a way that would relate to the business world and each other as an access point for directing student inquiry, problem-solving, dialogue, and critical thinking. An integrated methodology to learning that encourages students to think more broadly about real-world problems. Using STEAM education results in students who take thoughtful risks, engage in experimental learning, persist in embrace collaboration, problem-solving, and work through the creative process. These are the leaders, innovators, educators, and learners of the next generation!

We are at a point where it is not only possible, but imperative that we facilitate learning environments that are fluid, dynamic, and relevant. It is what happens when we open the doors to the real-world and places those same practices in our cycles of teaching. So, we can finally remove the walls and classroom doors to get at the core of learning. Students learn to: ask questions, connect the dots, problem solve, think creatively, and be innovative

Not only can STEAM can save the world, but it can also save our kids too by making their future bright. Statistics says STEAM jobs are estimated to grow by 16% between 2014 and 2024 compared to only 11% for other sectors. And at the moment, science & engineering occupations earn more than double the income of the median job. Despite this, math performance is faltering and STEAM graduates are dropping out of their fields.

So, what's the solution? It is recommended that starting young can make a difference. By adding STEAM education into elementary schools. Because without improving STEAM education in our schools, we are going to fall behind and with that goes the potential for our children's futures.

The STEAM approach is one of the this is one of the emerging approach that's being initiated with the student and in this research aim is to find out how successful is this approach is as it claims to be, I am one of those who are using this approach as part of teaching. If the STEAM approach is successful in closing the gap between the books and the real-world, I aim to recommend this approach to other subject teachers for broader use of this approach as this will help us prepare future generation better for real-time jobs and career.

## Plan

My objective of this research is to test the hypothesis "Does STEAM Approach help in closing the gap between the books and the real world when used in classrooms?" action research is used to test the hypothesis, as this methodology provides continuous reflecting findings and plan for next cycle implementation focusing on specific number of students on ground. The research is going to be based on STEAM career sessions from age 7 to 11. The initial plan is to run two cycles of study and observe students over 10 days, and sessions were conducted on Day 1, Day 3, Day 8 and Day 10. Students will be divided into groups of 2 to 3 for collaboration. Observations are specifically designed to

capture these variables: focus, detail, discovery, application, presentation, link, problem-solving, critical thinking and innovative. First two sessions are Space science subject major (science, math, art and engineering). Last two sessions were based on robotics (Technology, Science, engineering).

The idea is to make sure the hypothesis is going to run two cycles on the same set of students for consistent data and noting developments. Consent was received from relevant higher authorities with supervisor's approval Student's names and data is kept confidential throughout the research including other details I had on students through school.

## Methods

There are also several types of action research in the field of education. For instance, Individual Action research, Collaborative action research, School-wide action research. This research is based on individual action research which involves working independently on a project, such as an elementary school conducting her own, in-class research project with her students.

Research can be conducted through different methods, either they are quantitative or qualitative methods of research or mixed methods in some cases. Quantitative methods are listed as Survey, questionnaire, document review, interviews, probability sampling and under some circumstances observations as well whereas Qualitative methods of data collection such as text analysis, focus groups, observations, case study and one-to-one interview (open-ended questions).

There are several methods known to conduct action research; more than one of the ways can be used to assist in collecting rich and meaningful data. Some of the ways include:

- Observing individuals or groups
- Using audio and videotape recording
- Using structured or semi-structured interviews
- Taking field notes
- Using analytic memoing
- Using or taking photography
- Distributing surveys or questionnaires

Observations and survey are methods are the main source of data collection in this research. There are nine variables we aim to measure and analyse which are not numerical, as I am experimenting with student of young age it is difficult to come to interview them as students may not realise that happens or exist but as a teacher, I may be able to identify the presence of variable and analyse the intensity present during an ongoing observation. The benchmark for observation scale is set based on the expected ability of the student group in general for each marking 1 as lowest and 10 as highest setting expectations on 6 as average with a group of 10 students.

Data analysis is perhaps one the essential component of research. The weak analysis produces inaccurate results that not only hamper the authenticity of the research but also make the findings unusable. It's imperative to choose your data analysis methods carefully to ensure that your conclusions are insightful and actionable.

Qualitative process of data analysis is applied to Analyse and understand data for finding results. Following are the steps below:

**Getting familiar with the data:** Most qualitative data is just words, reading the data several times and start to look for observations and patterns; this also includes transcribing the data.

**Revisiting research objectives:** revisiting the research objective and identifies the questions that can be answered through the data that's collected.

**Developing a framework:** identifying broad ideas, concept, behaviours or phrases and assigns codes to them (age, gender, response to the question, positive or negative). This helps in structuring and labelling the data.

**Identifying patterns and connections:** Identifying themes, looking for the most common response to the question, identifying data or patterns that can answer research questions and finding that can be explored further.

Further resources used are robotics Kits, activity print outs, laptops, Presentation/video, STEAM career lesson plan, other craft supplies for making space elevator supplies, and classroom.

## Results

One of the aims of the research is to experiment the link with the real world and research looks into this direction with two sets of data with two subjects, same students. The initial response for one subject was more excited whereas the other one was a bit dull. There are few reasons for such a happening; one was the subject matter concentration different and second that we have come to conclusion is the approach I used to introduce both the topic to students. Science was introduce with a broad introduction of "hired by NASA" on the other hand, robotics was not. The difference in teaching approach was noted and made a massive difference in the setting of the class.

My observation was to test a few variables that play a significant role in the STEAM approach. They are Focus, Detail, Discovery, Application, Presentation, Link, Problem-solving, critical Thinking and Innovative. Case 1 is data that is interpreted from the first two observations and second 2 observations are referred to as Case 2. Case 1 did show lower energy in various aspects in comparison with case 2 observation of all student. Based on scale and benchmark set, case 1 students were able to connect almost up to the expected level as collective data, as individual nearly 50% of student's performance was marked as expected or higher.

Moreover, case 2, based on scale and benchmark set, 60% student's performance was marked as expected or higher. Collective comparison based on average was that students performed better in case 2. Such a difference may also be noted because of learning

from Case 1, getting familiar with STEAM-based sessions. An exciting outcome from the research was focus, concentration, and active participation was enhanced in students who were practising ongoing course of brain development through a holistic approach.

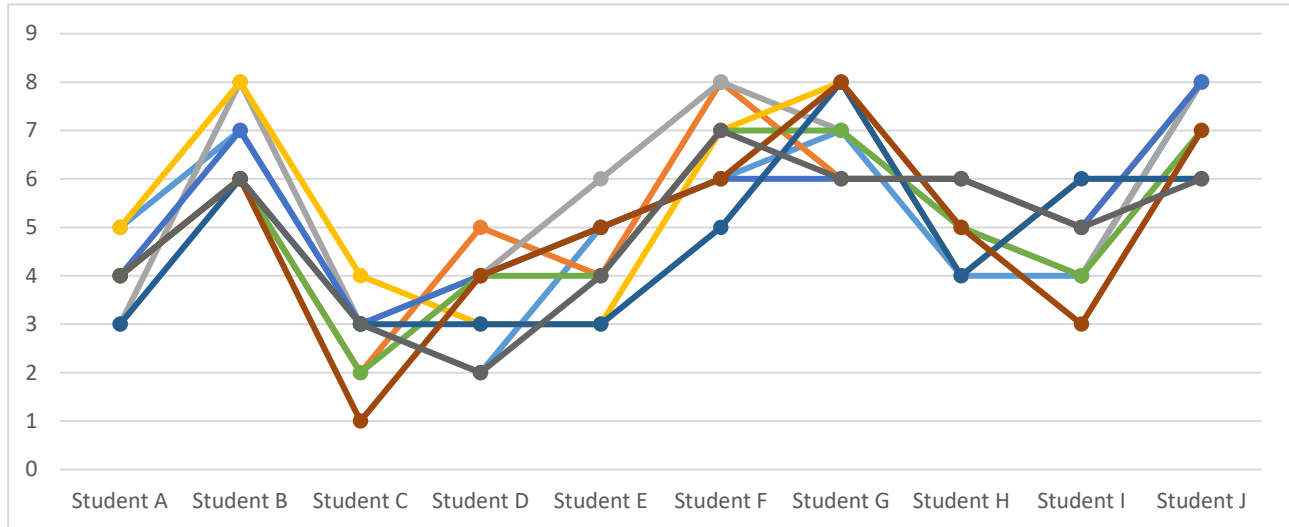


Figure 4: Case 1 | Robotics Observation Data

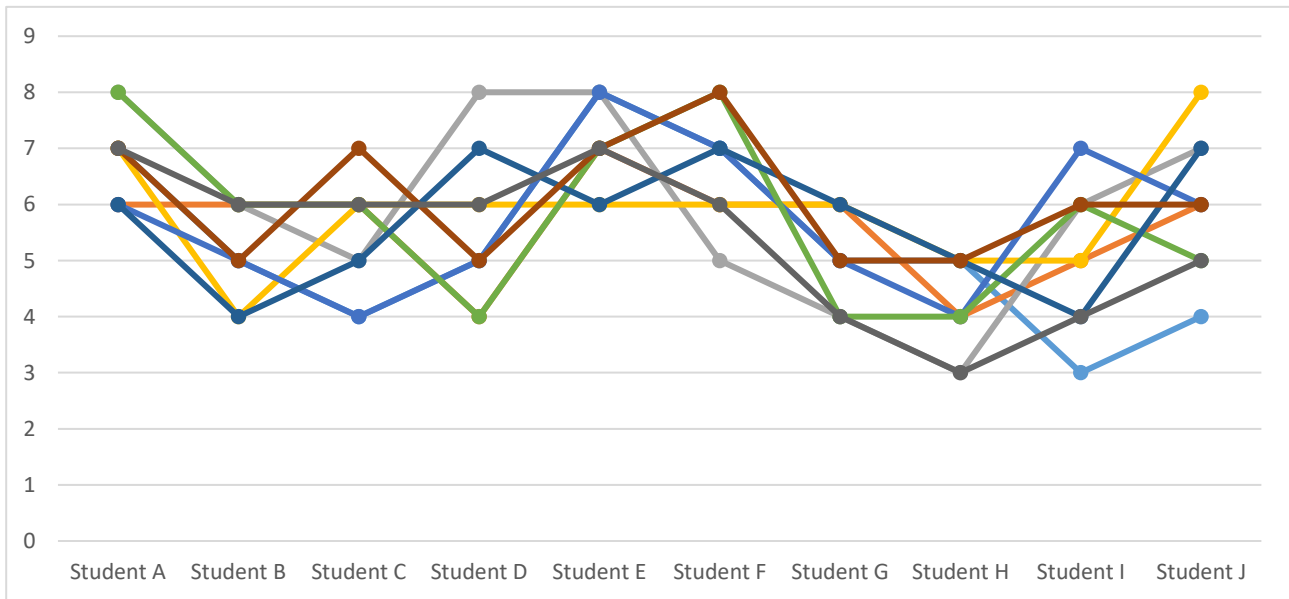


Figure 3: Case 1 | Science Observation Data



Figure 5 Key for Graphs Fig 3 and Fig 4

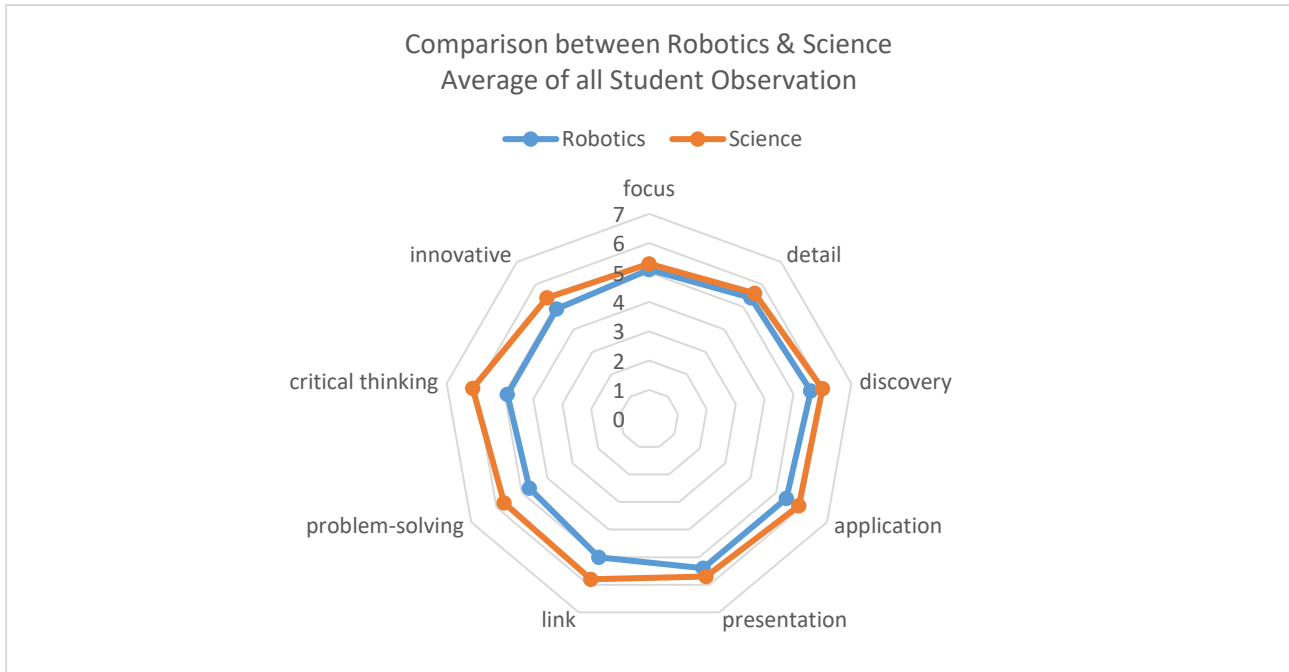


Figure 6: Comparison between Robotics & Science | Average of all Student

## Recommendations

So now the question is “does STEAM approach closes the gap between the books and real-world, from this research?” It would be safe to say that students did show development in observed variables over time, and was able to capture a new approach with appreciation and interest. Many new words were introduced to subjects, they have responded well towards them all though students with slower pace took their time to gain knowledge. Development in discovery and linking with real-world was surely noted overtime in figure 5. I did experience a positive response from students when connecting with real-world. Prior knowledge may differ from the results. It can be concluded that STEAM minimises the gap to some extent but does not close as the complex level of structure and flow cannot be brought in classrooms for students or to be able to give complex problems even in the real-time scenario. What STEAM can do is give them experience outside the school and give them a taste of what happens in the real world and ignite critical thinking, problem-solving and innovative personality in different aspects of specialisation. This also gives them the perspective of future, specialisation, the kind of jobs and work, team collaboration is applied as we grow older.

This research is to continued or taken as a base for next research by the following recommendations: experimenting with older students for a more extended period with interviews where we can hear what they feel, know, see and learn. This would be interesting to see as they can capture a bigger capacity of knowledge and come up with a higher level of innovation and research. Another interesting fact that was noted and I would recommend tests another hypothesis on student’s performance when they have gone through brain development training for around one year already looking for areas of development in focus, concentration, actively participation.

## Reflection

The research was conducted at its best looking at the resource, time and experience I had until now in action research. I am new to this, and I did explore a wide range of new knowledge and process it. I spend time to plan out more than analysing the data, which could be better if I know my plans better and able to deliver as per my plans. Better organisation is recommended for next time. The positive part is the research was helpful to a good extent, in other words on a scale of 1 to 10, 1 as not effective and ten as highly effective, I would say the process was at 6.

Few strengths and areas of improvement were noted, the ability to collect data and run subjects that are not my majors like Science and space matters. Designing observations, research on what would be the right variables to observe and measure. My literature needs improvement, and I would suggest more reading on the topic and making notes. Work needed to improve conclusions and findings. There is always room for improvement and this was my first attempt at action research. However, this is the best way of researching in the classroom to improve and develop my practice as well as make my lessons more beneficial and exciting for students. This would help me in continuing study and be able to present findings with better confidence to others so they can benefit from my work.



## Reference list

Aguilar-de Borja, J.M. (2018). TEACHER ACTION RESEARCH: ITS DIFFICULTIES AND IMPLICATIONS.

*Humanities & Social Sciences Reviews*, [online] 6(1), pp.29–35. Available at:

<https://giapjournals.com/index.php/hssr/article/view/hssr.2018.616> [Accessed 4 Jan. 2020].

Arnold, L. (2007). *Action Research – characteristics*. [online] lydiaarnold.net. Available at:

<https://lydiaarnold.wordpress.com/2007/11/27/action-research-characteristics/> [Accessed 4 Jan. 2020].

Bhat, A. (2018). *Qualitative Research: Definition, Types, Methods and Examples*. [online] QuestionPro.

Available at: <https://www.questionpro.com/blog/qualitative-research-methods/>.

Bhat, A. (2019). *Five methods used for quantitative data collection* | QuestionPro. [online] QuestionPro.

Available at: <https://www.questionpro.com/blog/quantitative-data-collection-methods/>.

Gay, L.R. and Airasian, P.W. (2002). *Educational Research: Competencies for Analysis and Applications*.

7th edition ed. /ch9.pdf. Prentice-Hall.

<http://facebook.com/educationcloset> (2016). *What is STEAM Education?* | *The Institute for Arts Integration and STEAM*. [online] The Institute for Arts Integration and STEAM. Available at:

<https://educationcloset.com/what-is-steam-education-in-k-12-schools/> [Accessed 22 Dec. 2019].

leftbraincraftbrain (2019). *What is STEAM and Why is it Important?* [online] Left Brain Craft Brain.

Available at: <https://leftbraincraftbrain.com/what-is-steam-and-why-is-steam-important/> [Accessed 22 Dec. 2019].

Manu Bhatia (2019). *Your Guide to Qualitative and Quantitative Data Analysis Methods - Atlan* | *Humans of Data*.

[online] Atlan | Humans of Data. Available at: <https://humansofdata.atlan.com/2018/09/qualitative-quantitative-data-analysis-methods/>.

O'Byrne, W.I. (2016). *Four steps to conducting action research in the classroom*. [online] W. Ian O'Byrne.

Available at: <https://wiobyrne.com/action-research/>.

Study.com (2016). *Action Research in Education: Methods & Examples - Video & Lesson Transcript* |

*Study.com*. [online] Study.com. Available at: <https://study.com/academy/lesson/action-research-in-education-examples-methods-quiz.html> [Accessed 20 Jul. 2019].