PENREACH STEAM COMMUNITY OF PRACTICE MEETING: OVERVIEW

23 June 2021

1. PRESENTATIONS

1	Title	(i) *Where are we on our STEAM journey: an update* & (ii) *STEAM in ECD: applying STEAM skills through design thinking*
	Presenter	Cheryl Williams
	Organisation	Penreach
	Key Themes	(i) Update on the Penreach STEAM Shalamuka Centre & (ii) Integrating design thinking processes of questioning, creating and prototyping in STEAM
2	Title	*STEAM Education Experiences from the Field: An NGO Perspective*
	Presenter	Henre Benson
	Organisation	CASME
	Key Theme	Approaches, challenges and opportunities for using STEAM to unlock curiosity
3	Title	*Where do you teach STEAM?*
	Presenter	Karen Walstra
	Organisation	Karen Walstra Consulting
	Key Theme	Planning, setting up and using spaces for STEAM education

Presentations can be accessed through the links in these Meeting Highlights.

2. MAIN DISCUSSION POINTS FROM PARTICIPANTS

Number of participants: 93

Presentations:

- How the mobile lab /science centre/ STEAM centre model might be broadened or replicated to reach more teachers and learners across greater areas of the country.
- Challenges and opportunities for collaboration in assessing STEAM projects.
- ECD already builds in STEAM principles, although the terminology does not foreground this.
- The value to be gained from have both older and younger learners work together in STEAM.

Issues/Concerns:

- The need for balance – by integrating communication as well as an awareness of human science thinking in STEAM, for e.g., ethics.

CoP Activities/ Reflections

- Comments, questions and discussions arising from the presentations, as well as the selection of a takeaway nugget to be implemented in participants' own contexts.

Useful Resources shared:
- Become an ecoschool: https://www.ecoschools.
- UN SDG ideas & resources for schools: https://sdgacademy.org/
- Dave Starke, ideas for STEAM activities: https://www.instagram.com/heartroomhcs/

3. ANNOUNCEMENTS/ EVENTS
- https://www.terrapinn.com/exhibition/edutech-africa/agenda.stm

PURPOSE AND WELCOME

The second meeting of the Penreach STEAM CoP explored a range of approaches to implementing STEAM education. To welcome participants and bring all the voices into the room, facilitator Hassiena Marriott invited everyone to join in an improv game of "Yes, and…". This involved imagining the process of creating a STEAM centre, and (in small breakout groups) building on each other's ideas in a fun, positive way. Participants found the game energising (although challenging) and suggested that it would be beneficial to play it with children, to encourage creative thinking.

PRESENTATION: UPDATE ON PENREACH'S STEAM JOURNEY – CHERYL WILLIAMS, PENREACH

Where are we on our STEAM journey?

Cheryl (who is the STEAM-based learning and makerspace manager at Penreach), shared a short video celebrating the launch of the Penreach Shalamuka STEAM Centre and giving a sense of the variety of activity areas and resources available. "This is an exciting space in which children learn how to be creative, to communicate, to collaborate, and to think critically, while they make and do projects," she said.

The Centre will continue to provide a space for teacher training and building teacher capacity – and to advance Penreach's vision of STEAM in education, which includes integrating the arts, creativity and design principles. Future developments will include an exhibition centre, as well as an upgrade of the science laboratory.

Link to the presentation: https://prezi.com/view/KkSEMpKvEqHex10ufgwJ/

STEAM in ECD: applying STEAM skills through design thinking

With this presentation Cheryl encouraged participants to explore design thinking and to apply this approach in STEAM education. The example shared – of a project-based activity involving the building of a boat to rescue the gingerbread man – plays on children's intuitive creativity while developing science, technology and design concepts.

Cheryl also encouraged teachers to "take the risk of breaking the boundaries of the norm that we know education to be, and to look at different ways of thinking and of bringing learning across to children", which the design-thinking approach offers.

Design Thinking challenges for preschoolers introduce processes such as questioning, creating and prototyping. This approach has captured the imagination of educators and kids alike with its emphasis on the **intuitive creativity** we all remember from childhood.

**Resource:** https:// knowwithoutborders.org/design-thinking-stem-preschool/

PRESENTATION: STEAM EDUCATION EXPERIENCES FROM THE FIELD: AN NGO PERSPECTIVE – HENRE BENSON, CASME (*Centre for the*

Click here to view the presentation.

Advancement of Science and Mathematics Education, based in KwaZulu-Natal)

STEAM – as WE know it (CASME's perspective on STEAM)

Henre used Bloom's Revised Taxonomy to frame CASME's perspective on STEAM education.
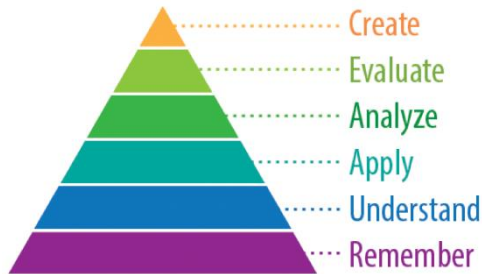
He noted that the taxonomy is typically represented as a hierarchy, which suggests movement through the elements towards a pinnacle. In this view, children move towards being able to apply all their knowledge and thinking across the various layers of the taxonomy to ultimately get to the point of creating something new.

CASME's view is "both more complex and more positive", where the elements of the taxonomy are seen as working together organically. Rather than acting as a set of steppingstones to be followed towards a pinnacle, there is ongoing interaction between all the elements. This forms the basis for CASME's engagement with its programme design, and STEAM in general. Henre described this as being about "bringing all the elements of the taxonomy together so they talk to each other, move together, and drive each other, in a process to unlock curiosity".

> **"For CASME, the essence of STEAM is about unlocking children's curiosity about the things in their environment and, more broadly, about the world. This is becoming really important as we look at some of the challenges we face as a planet and as a people, going forward."**

Some Examples of CASME's programmes

Henre discussed two initiatives: *Science2Go* (which "is still a long way from STEAM") and the *MAHLE F1 in Schools Challenge* (a good example of a STEAM project-based learning programme).

Science2Go

To provide context, Henre noted that "85% of public schools, including quintile 5 schools, do not have a functional laboratory", and that as a result teachers resort to trying to engage learners in practical science work by using chalk drawings of apparatus.

This programme "takes the resource centre concept and puts it on the road". Currently, three vehicles provide portable laboratory kits (covering curriculum-prescribed science activities) to a mix of primary and high schools in urban and peri-urban areas of KZN. Each vehicle supports 30 schools, which it visits twice a term. The programme allows learners to move beyond theoretical engagement, and aims to spark their curiosity by providing opportunities to engage in a hands-on way.

MAHLE F1 Schools Challenge

CASME partners with an engineering firm to present this interdisciplinary programme, which extends children's experience well beyond the curriculum. Learners work in small groups to create a (model-sized) car. In addition to designing and building the car, the programme exposes them to

business-related concepts such as developing a business idea, budgeting, marketing, communication, fundraising and project management.

Historically, the F1 Challenge has been seen as an elite project – but CASME aims to balance participation by broadening it to 50/50% suburban schools vs peri-urban and rural schools (which, Henre notes, has "presented its own challenges".)

Challenges

"The tyranny of the curriculum" – Implementing any initiative that steps outside of the curriculum is really challenging in the South African school

> "But the biggest obstacle, she said, was a curriculum that was hopelessly complex, and too punishing for the teachers to focus on anything else but getting through it."
>
> **Esther Duflo**

context. It is difficult to get teacher buy-in, so typically this kind of initiative has to happen outside of school hours; this creates further challenges in the context of rural or township schools, where additional socio-economic constraints stand in the way of implementation.

Assessment – How do we assess project-based/ problem-based learning initiatives? This can be challenging as it requires an open-minded attitude and recognition of the broader learning that can happen through an inter-disciplinary approach.

Opportunities

Henre reflected on some emerging opportunity areas for STEAM:

Climate education/action – this is an important growth area with opportunities for STEAM education. A good example is the *Keep It Cool – Climate Change Education (KIC-CCE) Project,* which draws out the climate education strands from the natural sciences and the geography curriculum.

Media and Information Literacy – this includes digital citizenship and literacy, and is particularly relevant in this time of Covid-19, with its proliferation of fake news and need for credible information.

Entrepreneurship – this can be built into STEAM programmes, for example the *MAHLE F1 Schools Challenge*, where it forms a key component.

Resources

Henre drew attention to various resources relating to STEAM education:

Networks/PLCs/CoPs – These (including the *Penreach STEAM CoP*) are important for connecting people and creating opportunities to share ideas and resources.

Skype A Scientist – A great opportunity to bring experts into the classroom / your STEAM centre.

VR and VFTs – Virtual reality and virtual field trips are good ways to expand / move beyond our environment.

SAASTA / DSI / SAASTEC / ASTEMI – These and other South African and international networks / associations provide good ideas, learning experiences and opportunities to connect.

MoMaths – Maths is sometimes overlooked when designing activities; the Museum of Mathematics has some great examples to draw on.

CSUnplugged – Access to devices should not present a barrier to teaching computational thinking. There are many resources which can be used to use expose young people to computational thinking, that require simply pen and paper (or chalk on the floor) activities.

QUESTIONS AND COMMENTS

- Could science / STEAM centres be situated in communities and shared? There are numerous unused or under-used teacher centres that could be used for this purpose.
  - CASME's experience mobile labs has been much more positive. Some barriers teachers may experience with standalone resource centres are (i) difficulties in transporting a lab kit back to their school, and (ii) capacity / confidence issues around using the lab kit. In contrast, mobile labs (which go out with a facilitator and a lab assistant) build teacher capacity and avoid exposing them to anxiety or fear of failure when things don't go according to plan.

- Does each child's experience of the *Science2Go* programme allow them to really experience the activities / hands-on tasks?
  - In terms of a STEAM approach, the twice-a-term engagement would not nearly be enough – but it has been sufficient in terms of CASME's current focus on covering the prescribed minimum practical activities in the curriculum. In negotiations with funders around adding new vehicles, CASME is looking at fewer schools but more visits. Schools are also encouraged to establish clubs to increase the frequency and amount of science engagement.

- How has the pandemic affected CASME's activities, in terms of access to schools and its own business as an NGO?
  - It has been challenging, but CASME was able to adopt a number of measures that enabled it to continue reaching schools. These included:
    - splitting classes and doubling up on staffing
    - using technology (data projector, laptop and internet connection) to allow one facilitator to facilitate semi-remotely across two venues in a school
    - increasing the amount of equipment to enable small groups of learners to form a 'touch bubble' (to only work with that equipment).

- CASME is focussed on schools in their area, but the problems they are addressing affect the whole country. Could they broaden their reach by focussing more on developing science teachers, who could then roll out to learners? This way they would reach more teachers and therefore more learners within a shorter time.

- There is an element of this. Through a phased exit approach – over a 3-year cycle– CASME moves responsibility to teachers (with support and training).

PRESENTATION: WHERE DO YOU TEACH STEAM? – KAREN WALSTRA, KAREN WALSTRA CONSULTING

Karen described the thinking, planning and actions that go into creating a STEAM makerspace – whether it takes the form of a dedicated venue, the corner of a classroom, or a movable unit.

To make STEAM succeed in your space, what do you need to do?

The presentation gives detailed information. This summary highlights some key ideas shared.

Click here to view the presentation.

Inform and get everybody on board – This includes school leadership and management, educators, support staff, parents, the community – and of course, the children. Parents can be a valuable resource within the STEAM space.

Explore what you already have and complete a detailed audit – Look at your existing spaces, facilities, and equipment. Is there someone on your staff with appropriate skills to drive STEAM, who really wants to do it, and who will be happy to have learners being creative and solving problems themselves?

Ask yourself what is needed – This will depend on what you want to do, where you are now and where you want to go in the future. What is your vision?

- **What will learners do and learn?** How will they use the makerspace? What content will they explore? Can they do it using just your available resources? How will you include both unplugged and online activities?
- **What facilities will be needed?** – Consider clean and dirty areas for design, research, robotics, technology devices, building and creating. How will the different activity areas be integrated?

Plan carefully – Decisions about what to teach will inform decisions about tools, equipment, resources, etc. This might evolve over time, e.g., as funding and venues change.

Budget carefully to avoid wasting money – What will your once-off items be? Your operating expenses? What ongoing budget will be needed to maintain equipment and replenish consumables? Also consider that technology keeps changing and will need to be updated.

Provide secure but accessible storage – for tools, materials, devices, consumables, workbooks, work-in-progress etc. Will this include space to display the learners' creations?

Emphasise safety – What kinds of safety hazards could arise, and how will you mitigate them? Consider handling of tools and machinery, exposure to toxic substances, and ways of monitoring internet use. Plan for safe and accessible placement of plugs to avoid electrical hazards.

Think flexibly – While all these elements are important, STEAM doesn't only have to happen in the classroom or in a dedicated STEAM space. It can also happen outdoors, and Karen urged participants to think of their entire school as becoming a STEAM space.

Encourage problem-solving and creativity

Karen went on to highlight the importance of encouraging problem solving and creativity, and for learners to engage with different types of scenarios, with and without technology.

Relate activities and learning to real-world problems – Make learning authentic and meaningful by relating content to real world needs and problems that impact communities. The UN Sustainable Development Goals (SDGs) are an excellent source of ideas, resources and case studies that can help teachers and learners think and build within this space.

> **"While we want children to be creative, learning must be authentic – so tie lessons and activities back to what is meaningful for your learners and their communities."**

Promote thinking that is cyclical, not linear

Design thinking leads learners through a process of designing, evaluating what works and what needs to change, adjusting/fixing their design, making a model, testing it, and adjusting/fixing again. This process also helps children to 'resist' the idea of failure. The continuing cycle of making, testing and fixing helps them realise that their first attempt (at anything) is only a starting point and that they can improve on it through further thinking and doing.
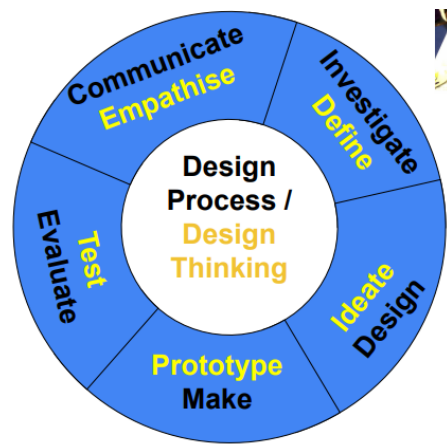
> **"STEAM is all about the thinking. It is about beginning with the question that you want your learners to think about."**

Ideas for STEAM activities

Karen shared some innovative and implementable ideas for STEAM projects, such as:

- If learners were to design and make bird feeders, and these were placed about the school grounds, they (the learners) could do science in terms of studying the birds and the insects … which could lead to planting plants that attract birds, and then to establishing vegetable gardens … and more opportunities for real-world thinking and learning.

Resources

Become an ecoschool: https://www.ecoschools.
global/ UN Sustainable Development Goals https://sdgs.un.org/goals
UN SDG - Schools https://sdgacademy.org/
Electronic Equipment & Supplies - Electronics 123 https://electronics123.co.za/
Building engineering skills https://seeblocks.education/

QUESTIONS AND COMMENTS

Participants appreciated the information shared, and raised several related issues.

- Children learn so much more from each other. It helps build confidence in both children to have an older child work through something with a younger child. Even children who struggle can gain an extra boost of confidence from helping a younger child.

    o Karen noted that makerspaces are ideal for this kind of interaction. STEAM lends itself to forming interest groups across ages/ grades and having older and younger learners do collaborative grade work or projects.

- On the issue of extending the acronym STEAM, we should think about adding two 'p's – for *people* and *planet*, which are inextricably intertwined in one living system. Science and technology should be taught with this awareness, because technology can quite easily cross a line, for e.g., in human health care. We need a balanced approach that brings in the human sciences and develops ethical awareness.

- Communication skills are also enormously important, particularly when considering the role of STEAM in creating entrepreneurs. This should include developing visual communication (e.g., for advertising) and spoken communication (e.g., for presenting ideas, interacting with others, creating new information) as well as teaching negotiating skills and how to sell an idea or product.

DISCUSSION

The floor was opened to participants and for closing comments from the speakers.

Assessment

There was a wide-ranging discussion on assessment:

- The Covid pandemic has created an opportunity for a conversation with policy makers around the role of assessment, and for reflecting on how useful assessment really is. High stakes summative assessments put a stamp on the system at the end of the day, but they also create anxiety and don't necessarily teach us much.

- STEAM presents its own challenges to policy makers and the system. We are all advocating for a revolution in education (in terms of coding, robotics, 4IR), but in some ways there is a paradox, as old ways are still in place.

> **"You can't teach in a new way and assess in the old way – we need to find new ways to do assessment."**

- When looking at assessment of STEAM in a school space, it works well to involve all the teachers of the different subject areas in designing a project, so that it ties into what they are teaching. This means that one project can be assessed from a range of different subject perspectives, and learners are not required to complete several different projects. This approach has the added benefit that it begins to break down the barriers between subjects.

It also requires careful planning of the various elements (language, maths, science, technology, etc) and how they tie into the assessment. The learning becomes meaningful, is relevant, and is curriculum based, showing that all these aspects can be addressed in the STEAM space.

- What are some alternatives for measuring impact and outcomes? Not only from the perspective of children's learning in terms of the school system, but also from that of meeting funders' expectations for measuring whether what they fund is reaping a benefit.

  - In terms of learner assessment, CASME requires learners to complete curriculum-aligned worksheets when they do the activities, which teachers then assess according to the assessment guideline. In terms of measuring on a project level, one initiative that provides CASME with data is a year-end competition based on practical activities in the curriculum. This is an open event, so it allows tracking of project school performance against that of non-project schools.

  - NGOs could bring Eskom's established way of evaluating projects to bear as well.

Collaborating in STEAM

- How can teachers of different subjects approach working together in STEAM? Especially when trying to include other areas such as communication and the social sciences?

  - Collaboration between staff members would be vital. In essence it would start with having the discussions – meeting regularly, and finding the common themes and where and how the different subject areas fit in. Collaboration could start in a grade, then expand to the phase. Planning would be crucial. Buy-in would depend on thinking about saving teachers time, and not adding to their load. School leadership would also need to include the collaboration in their planning. This approach would not be a quick fix, but would slowly evolve over time as more teachers came on board.

Events and resources

Cheryl drew attention to an up-coming event: https://www.terrapinn.com/exhibition/edutech-africa/agenda.stm

Dave Starke shared details of his STEAM Instagram page, which has ideas for mostly free activities: https://www.instagram.com/heartroomhcs/

Close

The meeting closed with participants sharing their takeaway nuggets. Some illustrative examples have been captured on the chat summary, below.

The CoP is reminded of BRIDGE's knowledge management role. All meetings, presentations and discussions are captured and shared on BRIDGE's Knowledge Hub. To view, follow this link.

Chat comments and questions

The chat function gives CoP participants opportunities to share their questions, comments and views. We have tried to group the conversational threads and have shown illustrative examples of comments on these issues. Chat comments and questions are taken verbatim and should be read alongside the Meeting Highlights.

Many participants expressed appreciation and enthusiasm for the ideas shared.

- This has become a wonderful platform and community to build our knowledge!
- Thanks for showing us what is possible!
- Very vital inputs from the presenters. Thanks.

Unplugged learning

- For schools without technology, accessing TANKS and BOATS are a brilliant alternative. Fun coding without computers.
- My daughter is at a school with computers, but because of COVID she and her classmates are not allowed to use them. They are being taught basic CAT (Gr 3 level) using paper templates of a keyboard, etc.
- Yes! Computational thinking, design thinking etc, are not dependent on devices.

Broadening access

- Could social media help in sharing those 'science to go' experiences – if nothing else, to just raise interest in kids?
- Totally agree, there are ways of doing collaborative learning while being safe and socially distanced.
- There are a lot of resources that we can expose kids to get them excited about Science and Maths.

Takeaway nuggets

- Link projects to the Sustainable Development Goals.

- The importance of creativity and lessons relating to our real-world problems or experiences.
- The importance of proper planning.
- STEAM does not have to be fancy – we can start with whatever we have in hand.
- Moving from where we are to a multipurpose STEAM space.
- When making resources, get children to do what they want to create, so not everyone has the same solution.

- The involvement of everyone – how setting up a STEAM centre requires though planning as well as participation from the entire community, teachers and learners.
- The simplicity of implementing STEAM.
- Integration of STEAM activities into all the subjects at school.
- Our multi-faceted ECD programmes already do STEAM; we just don't call it that.
- How simple STEAM based learning can be. It's about smart planning, making it intuitively creative.
- The importance of promoting collaboration, creativity, and communication.