STEM Discipline and Tribal indigenous knowledge for self -Reliant India

Priyanka Karunamay
Research Scholar (Ph.D.)Regional Institute of Education, Bhubaneswar.

Abstract: *Now we live in knowledge era, knowledge power is essential for the achieving the developmental goals specially 2030 Agenda. Through this review-based work researcher explored and unique pedagogy based on STEAM with the convergent of Indigenous pedagogy. Through the searching the literature review it was explored the STEAM Learning and Tribal Indigenous knowledge helpful for the Self-Reliant India.*
Key words: *STEAM, Discipline, Tribal, Tribal Indigenous Knowledge, Self-Reliant*

STEM is a teaching approach that integrates the four disciplines, such as science, technology, engineering, and mathematics from single subject development to a crossdisciplinary program. This is also known as STEAM with the addition of art elements. STEM education is expected to enhance students' learning ability, and improve their critical thinking skills which become more creative, logical, and innovative related to real situations.

Most people are in the dark and moreover, most educators and students are as well. When one hears the acronym "STEM" within an educational setting, they may think along the lines of stem cell research or something dealing with flowers (Angier, 2010).

Indigenous ways of knowing are often perceived to be contrary to STEM learning, but they are in fact powerful resources for learning. STEM instruction should be made inclusive for Indigenous students by building connections between Indigenous and Western STEM. There are a set of strategies teachers can use to intentionally incorporate indigenous ways of knowing into STEM learning environments—both in and out of school and in relation to family and community.

Centre Indigenous Ways of Knowing:

Make Indigenous ways of knowing central in instruction. One strategy is to draw upon the practice of observation of the natural world that is valued in many Indigenous communities, such as observing animals, plants, and weather patterns over time. These observations are often communicated through oral stories that have been accumulated and built over time and generations. Drawing explicitly upon the culturally valued practices of observation and storytelling—and their analogous NGSS practices of data collection and explanation— provide powerful pedagogical leverage points for STEM learning.

Localize Knowledge & Learning:

STEM learning framed in local knowledge—in relation to local practices, and in land- and place-based ways—can enhance the relevance and meaning of STEM for Indigenous students and their communities. Many Indigenous students have responsibilities to their communities and territories (including human and non-human ancestors and future generations), so their learning and lives are often embedded in these responsibilities. Therefore, connecting STEM learning to Indigenous students' everyday lives, their territories, and sets of relations they have, can lead to more meaningful and engaging STEM experiences Facilitate Navigation Within & Across Multiple Epistemologies: When engaging Indigenous students in STEM learning, it is critical to explicitly recognize and encourage their border-crossing and navigation of Indigenous and Western ways of knowing as opposed to erasing one or the other or assimilating Indigenous students into Western ways of knowing. This approach frstcenters on and reinforces Indigenous students' ways of knowing, and secondly teaches them Western STEM. Bridging Indigenous and Western STEM—grounded in Indigenous students' everyday lives, communities, and territories—can lead to more productive STEM learning, expertise, and career trajectories for Indigenous students. Attending To Equity

STEM learning for Indigenous students should involve offering them learning and knowing that is land- and place-based, centres (not erases or undermines) their ways of knowing and builds connections between Indigenous and Western STEM. It also involves creating STEM learning that is relevant to their everyday lives

---

and their interdependent roles and responsibilities that they have to their families and communities, now and in the future. Such learning experiences are more meaningful, relevant, and culturally appropriate.

Many students who do choose to enrols in STEM subjects in secondary school make these decisions to aid entry into tertiary courses, as achieving highly in STEM subjects generally facilitates higher tertiary entrance scores (Bøe et al., 2011). particularly in mathematics, physics, technology, and engineering at the secondary and tertiary level; and computer science and engineering at the professional level (Sullivan & Bers, 2013). An integrated STEM approach uses real world contexts to investigate authentic problems using active learning and teaching approaches (Hernandez et al., 2014), leading to improved motivation, and enhanced achievement in science and mathematics (Furner & Kumar, 2007). "STEM literacy is the ability to identify, apply, and integrate concepts from science, technology, engineering, and mathematics to understand complex problems and to innovate to solve them" (Balka, 2011, p.

Tribal indigenous Knowledge

Quality education for all students, and in particular improving the educational outcomes for Indigenous students, has been a focus in many countries such as the United States, Australia, and Canada. Despite this, there continues to be disparities between Indigenous and non-Indigenous students, especially in STEM subject areas. Because science and STEM education focus mostly Western science knowledge to the exclusion of other ways of knowing, Indigenous worldviews are usually undermined in Indigenous students' science and STEM learning experiences, which has created tension between traditional Indigenous knowledge and school science. When Indigenous students are forced to compromise their cultural identity, their science learning and development of scientific literacy are impeded. One possible way to provide Indigenous students with access to science learning without comprising their cultural identity is making science programs aligned with their traditional knowledge and everyday experiences.

By interrelating with stories and traditional activities (e.g., festivals and ceremonies) in these programs, Indigenous youths strengthened connections to their communities, cultural inheritance, and Indigenous worldviews, and thus became prouder of their cultures and Indigenous personal identities. Informal science and STEM education which allows for flexibility and creativity that is not always possible in a formal classroom setting has the potential to provide educational experiences that lead to further interest and enjoyment of.

Instead of putting Indigenous knowledge and Western science knowledge in opposition to one another, these culturally relevant programs extend knowledge systems and find value and new perspectives for teaching and learning from both.In this way, students' cultures are respected and valued as resources for learning. In addition, Indigenous people had broad involvement in these programs, which also helped make these programs culturally relevant to Indigenous students. This is consistent with the recommendation from Gillan et al. that Indigenous people should be involved, especially in decision-making roles, to help shape and encourage support for initiatives to promote educational success for Indigenous learners. s study showed that inquiry-based science practice was widely used in these programs to engage Indigenous students, such as obtaining, evaluating, and communicating information or evidence, constructing scientific explanations and designing solutions, and developing and using models. Programs like these that focused on science inquiry reported positive outcomes. This is consistent with results from another review, in which Brown identified several areas of

Self-reliant India

In this era of globalization, all countries are interlinked. In this case, the definition of self-reliance has also changed. Self-reliance is different from self-centred. India believes strongly in the concept of Vasudha IvaKutumbakam.India is a part of the world, if India progresses, it also contributes to the progress of the world by doing so. Globalization will not be boycotted in building a self-reliant India but will be helped in the development of the world. Therefore, for us, a self-reliant India means improving the quality of life of people with economic development while remaining connected to the world. The objective of the self-reliant India campaign is not only to fight the covid-19 epidemic but also to rebuild future India. The idea of a self-reliant India campaign has been part of the ideological tradition of India. This idea matches Mahatma Gandhi's concept of village swaraj.Mahatma Gandhi believed that every village should be Self-Reliant in meeting He emphasized the promotion of cottage industries to promote the village, including the promotion of charkha and khadi.Now after the crisis arising from the coronavirus as a side effect of globalization, the intention is to develop a rural economy on the basis of Gram Swaraj itself. its needs, only then a true Gram Swaraj can be established there.

Self-reliant India's Strategy

Under the strategy of self-reliant India, the government has focused on 4L: land, labor, liquidity, and law. Land: No industry can be established without land. In such a situation, the land issue will be cleared for the establishment of industries. Labor: Even without labor, industry or trade cannot be imagined, but there are many complications regarding the labor law in India. For this, logical laws need to be made. Liquidity: Liquidity is

also very important to run the wheel of economic activities. Law: There are many such complicated laws in the country, due to which the development is hindered, so major changes will be made in the law to clear the way for Self-Reliant. May 2020, Prime Minister, Mr. Narendra Modi launched the Self-reliant India (Atmanirbhar Bharat Abhiyan) mission to promote Indian goods in the global supply chain markets and help the country achieve self-reliance. The mission was announced amid the pandemic when the government allocated funds worth Rs. 20 lakh crore (US$ 268.74 billion), which amounts to ~10% of India's GDP, as a stimulus package to help recover the economy by promoting incentives for domestic production. It encompasses themes such as 'Local for Global: Make in India for the World' and 'Vocal for Local'. The key objectives of the 'Self-reliant India' (Atmanirbhar Bharat Abhiyan) mission are as follows:

- Develop India into a global supply chain hub.
- Build the government's trust in the private sector capabilities and prospects.
- Establish 'good force multipliers' for Indian manufacturers.
- Enter the global markets to export goods including agriculture, textiles, clothing and jewellery.
- Determine adequacy of each sector (e.g., defence, agriculture, healthcare, infrastructure, etc.), with the help of FY22 budget, to achieve self-reliance.

Conclusion:

Traditional Indigenous knowledge can be defined as a network of knowledges, beliefs, and traditions intended to preserve, communicate, and contextualize Indigenous relationships with cultureand landscape over time.STEM stands forscience, technology, engineering and mathematics and refers to any subjects that fall under these four disciplines. Because these things are never straightforward, there are also dozens of alternative versions of STEM (including STEAM, STREAM and METALS) but STEM is by far the most widely used. According to NEP2020 Assessments of educational approaches in undergraduate education that integrate the humanities and arts with Science, Technology, Engineering and Mathematics (STEM) have consistently showed positive learning outcomes, including increased creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, teamwork, communication skills, more in depth learning and mastery of curricula across fields, increases in social and moral awareness, etc., besides general engagement and enjoyment of learning. Research is also improved and enhanced through a holistic and multidisciplinary education approach. If we Integrate both Tribal Indigenous knowledge and STEM definitely outcome will be more fruit full in this way we can achieve the goal of self-reliant India.

Reference

[1]. Aikenhead, G.S. Towards a cultural view on quality science teaching. In The Professional Knowledge Base of Science Teaching; Corrigan, D., Dillon, J., Gunstone, R., Eds.; Springer: New York, NY, USA, 2011; pp. 7–23.
[2]. Aikenhead, G.S. Students' ease in crossing cultural borders into school science. Sci. Educ. 2001, 85, 180–188.
[3]. Ainley, J., Kos, J., & Nicholas, M. (2008). Participation in Science, Mathematics and Technology in Australian Education (ACER Research Monograph 63). Camberwell: The Australian Council for Educational Research
[4]. Angier, N. (2010, October 04). Stem education has little to do with flowers. New York Times. Retrieved from http://www.nytimes.com/2010/10/05/science /05angier.html? pagewanted=all.
[5]. Anthony-Stevens, V.; Mahfouz, J.; Bisbee, Y. Indigenous teacher education is nation building: Reflections of capacity building and capacity strengthening in Idaho. J. Sch. Leadersh. 2020, 30, 541–564.
[6]. Balka, D. (2011). Standards of mathematical practice and STEM. Stillwater, OK: School Science and Mathematics Association.
[7]. Background of Ohio State. (2012). Retrieved January 21, 2012, from http://ucat.osu.edu/read/teaching/background_osu/background_print.html
[8]. Beals, J. (2012). Thomas edison.com. Retrieved April 30, 2012 from http://www.thomasedison.com/.
[9]. Brophy, S., Klein, S., Portsmore, M., & Rogers, C. (2008). Advancing engineering education in P-12 classrooms. Journal of Engineering Education, 97(3), 369-387.
[10]. Fielding-Wells, J., & Makar, K. (2012). Developing primary students' argumentation skills in inquiry-based mathematics classrooms. In International Conference of the Learning Sciences (Vol. 2, pp. 154- 156).
[11]. Furner, J. M., & Kumar, D. D. (2007). The mathematics and science integration argument: A stand for teacher education. Eurasia Journal of Mathematics, Science & Technology Education, 3(3), 185-189
[12]. Gee, J. P. (2010). Learning by design: Games as learning machines. Interactive Educational Multimedia, (8), 15-23
[13]. Gillan, K.; Mellor, S.; Krakouer, J. The Case for Urgency: Advocating for Indigenous Voice in Education; ACER Press: Melbourne, Australia, 2017.
[14]. González, N.; Moll, L.C.; Amanti, C. Funds of Knowledge: Theorizing Practices in Households, Communities and Classrooms; Routledge: New York, NY, USA, 2005. 47.
[15]. Ma Rhea, Z. Leading and Managing Indigenous Education in the Postcolonial World; Routledge: Abingdon, UK, 2015
[16]. Riegle-Crumb, C., King, B., Grodsky, E., & Muller, C. (2012). The more things change, the more they stay the same? Prior achievement fails to explain gender inequality in entry into STEM college majors over time. American Educational Research Journal, 49(6), 1048-1073. Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools,
[17]. Hernandez, P. R., Bodin, R., Elliott, J. W., Ibrahim, B., RamboHernandez, K. E., Chen, T. W., & de Miranda, M. A. (2014). Connecting the STEM dots: measuring the effect of an integrated engineering design intervention. International Journal of Technology and Design Education, 24(1), 107-120.
[18]. Hernandez, P. R., Bodin, R., Elliott, J. W., Ibrahim, B., RamboHernandez, K. E., Chen, T. W., & de Miranda, M. A. (2014). Connecting the STEM dots: measuring the effect of an integrated engineering design intervention. International Journal of Technology and Design Education, 24(1), 107-120.

[19]. Harrison, N.; Tennent, C.; Vass, G.; Guenther, J.; Lowe, K.; Moodie, N. Curriculum and learning in aboriginal and Torres Strait Islander education: A systematic review. Aust. Educ. Res. 2019, 46, 233–251. [CrossRef]

[20]. Judy, B. (2011). Five innovations from world war ii. Retrieved from http://bigdesignevents.com/2011/09/innovations-from-world-war-ii/

[21]. Kim, M. Indigenous knowledge in Canadian science curricula: Cases from western Canada. Cult. Stud. Sci. Educ. 2017, 12, 605–613.

[22]. Koszalka, T. A., Wu, Y., & Davidson, B. (2007, October). Instructional design issues in a cross-institutional collaboration within a distributed engineering educational environment. In World Conference on ELearning in Corporate, Government, Healthcare, and Higher Education (Vol. 2007, No. 1, pp. 1650-1657)

[23]. Kennedy, T. K., & Odell, M. R. L. (2014). Engaging students in STEM Education. Science Education International, 25(3), 246-258.

[24]. Mack, E.; Augare, H.; Different Cloud-Jones, L.; Davíd, D.; Quiver Gaddie, H.; Honey, R.E.; Kawagley, A.O.; Little PlumeWeatherwax, M.; Lone Fight, L.; Meier, G.; et al. Effective practices for creating transformative informal science education programs grounded in Native ways of knowing. Cult. Stud. Sci. Educ. 2012, 7, 49–70.

[25]. Meyer, X.; Crawford, B.A. Teaching science as a cultural way of knowing: Merging authentic inquiry, nature of science, and multicultural strategies. Cult. Stud. Sci. Educ. 2011, 6, 525–547

[26]. McNeill, K. L., Pimentel, D. S., & Strauss, E. G. (2013). The impact of high school science teachers' beliefs, curricular enactments and experience on student learning during an inquiry-based urban ecology curriculum. International Journal of Science Education, 35(15), 2608-2644

[27]. Mervis, J. (2010). Innovations in STEM Education: A Conversation With PCAST's Jim Gates. Retrieved June 7, 2011 from http://news.sciencemag.org/scienceinsider/ 2010/04/innovations-in-stem-education-a-.html

[28]. Miller, J.; Armour, D. Supporting successful outcomes in mathematics for Aboriginal and Torres Strait Islander students: A systematic review. Asia-Pac. J. Teach. Educ. 2021, 49, 61–77

[29]. Morgan, P. L., Farkas, G., & Wu, Q. (2009). Five-year growth trajectories of kindergarten children with learning difficulties in mathematics. Journal of Learning Disabilities

[30]. Moundridou, M., &Kaniglonou, A. (2008). Using LEGO MINDSTORMS as an instructional aid in technical and vocational secondary education: Experiences from an empirical case study. In P. Dillenbourg& M. Specht (Eds.), Times of Convergence.

[31]. National Aeronautics and Space Administration, (2012). Nasa fy 2012 budget estimates, education. Retrieved from website: http://www.nasa.gov/pdf/516643main_NASA_FY12_Budget_Estimates-Education.pdf.

[32]. National Aeronautics and Space Administration. (2008). Sputnik and the dawn of the space age. Retrieved November 5, 2011, from http://history.nasa.gov/sputnik.

[33]. National Research Council. A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas; National Academy Press: Washington, DC, USA, 2012.

[34]. Pugh, P.; McGinty, M.; Bang, M. Relational epistemologies in land-based learning environments: Reasoning about ecological systems and spatial indexing in motion. Cult. Stud. Sci. Educ. 2019, 14, 425–448.

[35]. Lee, O. Teacher change in beliefs and practices in science and literacy instruction with English language learners. J. Res. Sci. Teach. 2004, 41, 65–93

[36]. Lee, H.; Yen, C.-F.; Aikenhead, G.S. Indigenous elementary students' science instruction in Taiwan: Indigenous knowledge and Western science. Res. Sci. Educ. 2012, 42, 1183–1199

[37]. Ogawa, M. Science education in a multiscience perspective. Sci. Educ. 1995, 79, 583–593. [CrossRef] 43.

[38]. Lim, C. P., Zhao, Y., Tondeur, J., Chai, C. S., & Tsai, C. C. (2013). Bridging the gap: Technology trends and use of technology in schools. Journal of Educational Technology & Society, 16(2), 59-68

[39]. Rioux, J.; Ewing, B.; Cooper, T.J. Embedding Aboriginal perspectives and knowledge in the biology curriculum: The little porky. Aust. J. Indig. Educ. 2018, 47, 158–170

[40]. shttps://www.doi.org/10.53964/jmer.2022003

[41]. Sánchez Tapia, I.; Krajcik, J.; Reiser, B. "We do not know what is the real story anymore": Curricular contextualization principles that support indigenous students in understanding natural selection. J. Res. Sci. Teach. 2018, 55, 348–376

[42]. Sabzalian, L. Indigenous Children's Survivance in Public Schools; Routledge: New York, NY, USA, 2019.

[43]. Tzou, C.; Suárez, E.; Bell, P.; LaBonte, D.; Starks, E.; Bang, M. Storywork in STEM-art: Making, materiality and robotics within everyday acts of Indigenous presence and resurgence. Cogn. Instr. 2019, 37, 306–326.Wood, A.; Lewthwaite, B. Maori science education in Aotearoa New Zealand. ⁻ Cult. Stud. Sci. Educ. 2008, 3, 625–662.

[44]. Vass, G.; Lowe, K.; Burgess, C.; Harrison, N.; Moodie, N. The possibilities and practicalities of professional learning in support of Indigenous student experiences in schooling: A systematic review. Aust. Educ. Res. 2019, 46, 341–361.