Steam Education for School Teachers in Nepal

Indra Mani Shrestha, Bal Chandra Luitel, Binod Parsad Pant,
Niroj Dahal and Netra Kumar Manadhar

February 16, 2022

STEAM EDUCATION FOR SCHOOL TEACHERS IN NEPAL

Since the integrated curricula were implemented in grades 1-3 in Nepali schools two years back, there is still a chaotic situation among school stakeholders (headteachers, teachers, students, and parents). Being graduated with discipline-based education and teaching a particular subject for years, teachers are still not able to grasp integrated teaching and learning. In this context, we felt that we as responsible citizens decided to promote STEAM education throughout the nation so that maximum schoolteachers, especially in remote areas, would be empowered. After recapitulating and reconceptualizing our learning and experiences, we encountered a common issue of teaching and learning having been raised by teachers and students for a long time - Can we teach and learn all subjects, especially science and mathematics, using the arts-based pedagogy – storytelling, poetry, singing, and dancing? Subscribing to this pertinent issue, we conducted STEAM workshops for school teachers across the nation in Nepal. Using collaborative autoethnography as a research methodology, we analyzed and interpreted that STEAM education approaches engage teachers and students in creative teaching-learning activities. Further, arts-based pedagogy is an empowering pedagogy for teaching and learning all subjects in an integrated way. More specifically, arts-based pedagogy helps both teachers and students in self-motivation, creativity, imagination, and critical thinking.

TEACHING AND LEARNING IN THE NEPALI CONTEXT

Elsewhere, Nepali educators, Luitel (2003, 2009, 2013, 2019, 2022/in press), Pant (2015, 2019, 2022/in press), Shrestha (2011, 2018, 2019, 2022/in press), Dahal (2017), Manandhar (2018, 2021) have constantly been raising an issue of disengaged, disintegrated and discipline-based teaching and learning practices in the Nepali context due to culturally decontextualized science and mathematics education. With the collaborative efforts of our university and the Ministry of Education, Science and Technology (MoEST), the curricula from grades 1-3 were reformed into integrated curricula and implemented since 2020 in all schools.

Since the implementation of integrated curricula, there has been a chaotic situation among school stakeholders (headteachers, teachers, students, and parents) for not grasping the intent of integrated approaches to teaching and learning. The unpreparedness of both stakeholders and MoEST and the COVID-19 pandemic played crucial roles in boosting the chaotic situation further across the nation. When the whole nation was fighting to implement the integrated curricula, our university was running the virtual classes of Master, MPhil, and PhD in STEAM education efficiently and effectively. Since we had been teaching, educating and researching integrated curriculum since 2019 via the university programmes, workshops, training, seminars, conferences, and paper writing via both physical and virtual modes, whichever possible, we collected feedback from our students (pre-service and in-service schoolteachers) and other students, teachers, educators, researchers, parents, and ordinary people across the nation about the intent of integrated curriculum via survey, formal and informal discourses, and informal interviews. The survey report showed the urgent need for Teacher Professional Development (TPD) on integrated approaches to curriculum, pedagogy, and assessment.

In this context, our university took initiation from our side. It began to educate teachers and headteachers from across the nation on integrated approaches to curriculum, pedagogy, and assessment through STEAM Education programmes both physically and virtually. We have been conducting free webinars on STEAM Education every Saturday from 5:30 PM – 7:30 PM (visit https://www.youtube.com/channel/UCy6R6fFPlfVEl8Qvo4UHwgw). This platform is

especially created for our university graduates who present their activities, research papers, discourses on STEAM Education to educate all the interested people worldwide. Apart from this, we have been conducting on-demand workshops and Training of Teachers (ToT) programmes nationwide.

Given the above contexts, we have been conducting STEAM Education workshops and ToT for schoolteachers from Basic Level (grades 1-8) and Secondary Level (grades 9-12). Therefore, in this paper, we have presented the narratives on our experiences of conducting STEAM Education and workshops and the outcomes of the study using collaborative autoethnography as research methodology.

STEAM EDUCATION IN SCHOOL EDUCATION OF NEPAL

For our future generations to be prepared to address global challenges, they must be able to think creatively and innovatively (Huser et al., 2020). STEAM Education plays a vital role through multidisciplinary, interdisciplinary, and transdisciplinary integrations of Science (S), Technology (T), Engineering (E), the Arts (A), and Mathematics (M) in curriculum, pedagogy, and assessment, where Science is for inquiry, Technology for skills, Engineering for design thinking, the Arts for creativity and imagination, and Mathematics for computational, logical thinking and problem-solving skills. Referring to Susan Riley, an Arts Integration Specialist, STEAM is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking (elearning.tki.org.nz).

Many educators in Nepal (e.g., Luitel, 2009, 2019, 2022/in press; Pant, 2015, 2019, 2022/in press; Shrestha, 2011, 2018, 2019, 2022/in press; Dahal, 2017; Manandhar, 2018, 2021) and across the world (Taylor, 2018; Taylor & Taylor, 2019; Goldberg, 2016; Dietiker, 2015; Eisner, 2002; Sinclair, 2001, etc.) have been raising an issue that the roles of arts – liberal arts (narrative, storying), visual arts (images, paintings, sculpture), performing arts (role play, drama) – in teaching and learning all subjects, especially science and mathematics, are not well acknowledged, and hence they are advocating the integration of the arts in school education. Moreover, the integration of the Arts into STEM education places learning into a context, creating opportunities for innovation, teaching flexibility using the Arts to teach students how to solve real-world problems by combining Science, Technology, Engineering, the Arts and Mathematics (Hayman, 2017). The fundamental reason behind the integration of arts is to create "aesthetically-rich learning environments as those that enable children to wonder, to notice, to imagine alternatives, to appreciate contingencies and to experience pleasure and pride" (Sinclair, 2001, p. 26). As Eisner (2008), a leading arts educator, explains: the Arts are concerned with expressiveness, evoking emotion, generating empathic understanding, stimulating imagination that disrupts habits of mind and creates open-mindedness, and eliciting emotional awareness.

Since arts-based pedagogies draw upon holistic experiential learning and constructivist approaches where learners mine their personal experiences to produce situated understandings, these pedagogies open up spaces for exploration, dialogue, and questioning (Carroll, 2018). Arts-based pedagogy, or arts integration, is a pedagogical approach that uses one or more art forms (e.g., visual arts, music, drama, or dance) to deepen understanding and support non-arts and arts curricular learning objectives in the classroom (Lee, 2015).

In this context, the main of the paper is to explore the contributions of STEAM Education programmes that we have conducted for schoolteachers and related people across the nation.

THEORETICAL REFERENTS

As teacher educators, we realized that there is no "royal road" to pedagogy, and grand theories of teaching and researching may not be appropriate in developing ourselves (and teachers) as change agents (Pant et al., 2020). Therefore, we employed Transformative Learning Theory (Mezirow, 1991) and Living Educational Theory (Whitehead, 2008) which are much helpful as our home-grown theories.

Transformative Learning Theory provided us with the new ontological, epistemological and axiological grounds in research that advocates research as a means for transformative learning (Pant, 2019). Ontologically, it helped us shape our 'being' by integrating different worldviews into our worldviews to transform our 'being' into our 'becoming' through critical self-reflection. Epistemologically, our 'instrumental knowing as being' was transformed into 'communicative knowing as becoming' through transformative learning theory so that axiologically we could widen our horizon of knowing as a synergy of instrumental knowing and communicative knowing for promoting transformative pedagogy.

Living Educational Theory guided us in researching and answering a question of the kind 'How do I improve what I am doing?" with the implications that include the generation and sharing of a valid explanation of our educational influences in our own learning throughout the study. Whitehead (2008) explained that a living theory is an explanation produced by individuals for their educational influence in their own learning, in the learning of others, and in the learning of the social formation in which they live and work.

RESEARCH METHODOLOGY

We used collaborative autoethnography as a research methodology. Autoethnography is an approach to research and writing that seeks to describe and systematically analyze personal experience to understand cultural experience (Ellis et al., 2011). Moreover, as collaborative autoethnographers, we challenged our personal biases, positioned our research to make sense to a wider audience and had a greater impact on them. We recapitulated and reconceptualized our experiences of promoting STEAM Education programmes and analyzed and interpreted them to make meaning out them.

ENGAGEMENT IN THE FIELD

For about four years, our engagement in the field brought many transformations in us, our university education, teachers, headteachers, and students across the nation. The most interesting story was that the majority were interested in arts-based pedagogy.

Remarkably, 2020 and 2021 were engaging for us because the Curriculum Development Centre had implemented the integrated curricula in grades 1-3 nationwide, and we were on-demand for educating school teachers nationwide. We would make plans and move towards the destinations for conducting workshops and ToTs for school teachers. We present some exciting narratives we experienced during 2020 and 2021 regarding integrated curriculum and STEAM Education.

"Sir, this integrated curriculum is merely a new book with old ideas. Yes, one thing is easier for teachers as the integrated themes are collected in the textbooks of grades 1, 2 and 3, and we don't need to create themes ourselves."

This was a common understanding of integrated curriculum for many teachers across the nation, especially in the remote areas when a pre-test was taken before the workshops. Moreover, many

teachers (and even some headteachers) were found to have a misconception about the integrated curriculum implemented by the government across the nation. They have been teaching integrated themes using disciplinary approaches as they had been doing for a long time. This suggested that many teachers and headteachers still have in their hearts and minds the disciplinary egocentrism – a state of thinking and performing certain tasks where a person is hegemonized with the particular disciplinary knowledge system and ways of developing such knowledge (Connor et al., 2015).

"Oh, my goodness! I was wrong! It's not a textbook … it's an integrated way of teaching and learning using multidisciplinary, interdisciplinary, and transdisciplinary approaches … We should encourage students to create themes and learn through project-based learning … Oh! We should engage students collaboratively for inquiry learning … Students themselves construct knowledge through social interaction, and we should not impose our methods on them … I promise I will teach accordingly …"

This was the post-test feedback given by the teachers and headteachers after the workshops. We would engage teachers and headteachers in developing various teaching-learning activities based on project-based learning, collaborative learning, constructivist learning, inquiry-based learning using multidisciplinary, interdisciplinary, and transdisciplinary approaches to curriculum integration (Drake, & Burns, 2004). Moreover, curriculum integration centres the curriculum on life itself rather than on the mastery of fragmented information within the boundaries of subject areas. Curriculum integration, in theory & practice, transcends subject-area and disciplinary identifications (Bean, 1995).

"In the STEAM Education, S stands for Science, T for Technology, E for Engineering, A for Arts, and M for Mathematics. So, we should teach our students these five subjects in school ... But how can we teach students to become an engineer from an early grade?"

This was the pre-test understanding of many teachers before the workshops. They would think STEAM education is about teaching these five subjects in school but didn't know that STEAM education is an integrated approach to curriculum, pedagogy, and assessment. However, after the workshop, they realized that all subject teachers could use Science as/for inquiry, Technology as/for skills, Engineering as/for design thinking, the Arts as/for creativity, critical thinking, and imagination, and Mathematics as/for computation, logical thinking and problem-solving.

"Oh, my goodness! Being a mathematics teacher, I can teach mathematics using arts-based pedagogy. I will use storytelling, poetry, singing, dancing, and drams in teaching mathematics."

"I now realized why students hate mathematics and science the most! It's because there is no arts in them, no stories, no poems, no songs, no drama."

Moreover, we have been engaging schoolteachers in developing arts-based teaching-learning activities of all subjects using their local stories, poems, songs, dance, drama, (visit https://www.youtube.com/channel/UCwwY5wIzgvDMCPI-RtKmpHA).

CONCLUDING REMARKS

Our efforts of educating schoolteachers and headteachers via workshops, seminars, webinars, ToTs, conferences, and university programmes have been empowering many accessible and inaccessible people across the nation in STEAM Education. In the latter part of our experience, the growth in the enrolled students in our university programmes (Master, MPhil, and PhD in STEAM Education) has also showed that there is a growing demand of STEAM Education

approaches to curriculum, pedagogy, and assessment throughout the nation. Not only that, though there is still a fear of post-COVID-19 across the nation, many community and institutional schools have constantly been demanding us for STEAM workshops. Therefore, our experience of promoting integrated STEAM Education programmes across the country is exemplary in the context of Nepal in terms of educating many schoolteachers, headteachers, students, parents, education committee members and community people. Our survey report showed that STEAM Education approaches have been helping teachers and students to connect school education with real-world contexts.

Finally, we experienced that STEAM education approaches engage teachers and students in creative teaching-learning activities. Our analysis and interpretation showed that arts-based pedagogy is an empowering pedagogy for teaching and learning all subjects in an integrated way. More specifically, arts-based pedagogy helps both teachers and students in self-motivation, creativity, imagination, and critical thinking.

References

Beane, J. (1995). Curriculum integration and disciplines of knowledge. *The Phi Delta Kappan*, *76*(8), 616-622. https://www.jstor.org/stable/20405413

Carroll, S. (2018). Arts-Based Pedagogy. *Teacher Training and Professional Development*. https://doi.org/10.1002/9781118784235.eelt0266

Connor, A., Karmokar, S., & Whittington, C. (2015). From STEM to STEAM: Strategies for enhancing engineering & technology education. *International Journal of Engineering Pedagogy*, *5*(2), 37-47.

Dahal, N. (2017). *Understanding and usage of questioning by mathematics teachers: A narrative inquiry* [Unpublished MEd dissertation]. Kathmandu University.

Dietiker, L. (2015). What mathematics education can learn from art: The assumptions, values, and vision of mathematics education? *Journal of Education, 195*(1), 1-10.

Drake, S. M., & Burns, R. C. (2004). *Meeting standards through integrated curriculum.* Association for Supervision and Curriculum Development (ACSD).

Eisner, E. W. (2002). What can education learn from the arts about the practice of education? *Journal of Curriculum and Supervision, 18*(1), 4-16.

Eisner, E. W. (2008). Art and knowledge. In J. G. Knowles, & A. L. Cole (eds.), *Handbook of the arts in qualitative research* (pp. 3-12). Sage.

Ellis, C., Adams, T. E., & Bochner, A. P. (2011). Autoethnography: An overview. *Forum* Qualitative Research, 12(1). https://doi.org/10.17169/fqs-12.1.1589

Goldberg, M. (2016). *Arts integration: Teaching subject matter through the arts in multicultural settings.* Routledge.

Hayman, S. L. (0. Investigating STEAM: Integrating Art and STEM to Spark Innovation. *Curriculum and Instruction Undergraduate Honors Theses*. 16. http://scholarworks.uark.edu/cieduht/16

Huser, Joyce et al. (2020). STEAM and the Role of the Arts in STEM. New York: State Education Agency Directors of Arts Education.

Lee, B. N. (2015). What predicts pre-service teacher use of arts-based pedagogies in the

classroom? An analysis of the beliefs, values, and attitudes of pre-service teachers. *Journal for Learning through the Arts, 11*(1), 1-15.

Lindeman, K. W., Jabot, M., & Berkley, M. T. (2014). The role of STEM (or STEAM) in the early childhood setting. In *Learning across the early childhood curriculum*. Emerald Group Publishing Limited.

Luitel, B. C. (2003). *Narrative explorations of Nepali mathematics curriculum landscapes: An epic journey* [Unpublished Master's Project]. Curtin University of Technology, Perth.

Luitel, B. C. (2009). *Culture, worldview, and transformative philosophy of mathematics education in Nepal: A cultural-philosophical inquiry* [Unpublished doctoral thesis]. Curtin University, Perth, Australia.

Luitel, B. C. (2013). Mathematics as an im/pure knowledge system: Symbiosis, (w)holism and synergy in mathematics education. *International Journal of Science and Mathematics Education*, *11*(1), 65-87.

Luitel, B. C. (2019). Introduction: Research as Transformative Learning for Sustainable Futures. In P. C. Taylor & B. C. Luitel (Eds.), *Research as transformative learning for sustainable futures* (pp. 1-16). Brill Sense.

Luitel, B. C. (2022/in press). Why are we teaching factorization at a time when the planet is getting hotter every year? Conceiving STEAM education through an East-West symbiosis. In P. C. Taylor, & E. (Lily) Taylor (Eds.), *Transformative STEAM Education for Sustainable Futures*, 00–00. Netherlands: Brill-Sense.

Manandhar, N. K. (2018). *Conceptual and procedural knowledge of students in mathematics: A mixed method study* [Unpublished master's dissertation]. Kathmandu University.

Manandhar, N. K. (2021). *Connecting academic and non-academic lifeworlds for envisioning a transformative STEAM education in Nepal: An evocative autoethnographic inquiry* [Unpublished MPhil dissertation]. Kathmandu University.

Mezirow, J. (1991). Transformative dimensions of adult learning. San Francisco, CA: Jossey-Bass.

Pant, B. P. (2015). *Pondering on my beliefs and practices on mathematics, pedagogy, curriculum and assessment* [Unpublished MPhil dissertation]. Kathmandu University.

Pant, B. P. (2019). An integral perspective on research: Methodological and theoretical journey of a teacher educator. In P. C. Taylor & B. C. Luitel (Eds.), *Research as transformative learning for sustainable futures: Global voices and visions* (pp.75-87). Brill Sense.

Pant, B. P., Luitel, B. C. & Shrestha, I. M. (2020). Incorporating STEAM pedagogy in mathematics education. *Proceedings of episteme 8 International Conference to review research in Science, Technology and Mathematics Education*, January 3-6, 2020, pp. 319-326. Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, Mumbai, India.

Pant, B. P. (2022/in press). A journey from mathematics educator towards STEAM educator: A lived experience. In P. C. Taylor, & E. (Lily) Taylor (Eds.), *Transformative STEAM Education for Sustainable Futures, 00–00.* Netherlands: Brill-Sense.

Shrestha, I. M. (2011). *My journey of learning and teaching: A trans/formation from culturally decontextualized to contextualized mathematics education* [Unpublished master's dissertation]. Kathmandu University.

Shrestha, I. M. (2018). *My pedagogical sensitization towards holistic mathematics education: A practitioner's inquiry* [Unpublished MPhil dissertation]. Kathmandu University School of Education, Nepal.

Shrestha, I. M. (2019). Facilitating Culturally De/Contextualised Mathematics Education: An Arts-Based Ethnodrama. In P. C. Taylor & B. C. Luitel (Eds.), *Research as transformative learning for sustainable futures: Global voices and visions* (pp.75-87). Brill Sense.

Shrestha, I. M. (2022/in press). Transforming my teaching self as a loving gardener and dancer: Autoethnographic reflections. In P. C. Taylor, & E. (Lily) Taylor (Eds.), *Transformative STEAM education for sustainable futures* (pp. 00–00). Brill-Sense.

Shrestha, I. M., Luitel, B. C., & Pant, B. P. (2020). Exploring Transformative Pedagogy in Teaching Mathematics. *Mathematics Education Forum Chitwan*, 5 (5), 9-16. https://www.nepjol.info/index.php/mefc

Sinclair, N. (2001). The aesthetic is relevant. For the Learning of Mathematics, 22(1), 25-32.

Taylor P. C., & Taylor E. (2019). Transformative STEAM education for sustainable development. In Y. Rahmawati & P. C. Taylor (Eds.), *Empowering science and mathematics for global competitiveness* (pp. 125-131). Taylor and Francis.

Taylor, P. C. (2018). Enriching STEM with the arts to better prepare 21st century citizens. In *Proceedings of the 5th International Conference for Science Educators and Teachers (ISET) 2017* Thailand (pp. 89-93). AIP Publishing. https://aip.scitation.org/doi/10.1063/1.5019491

Whitehead, J. (2008). Using a living theory methodology in improving practice and generating educational knowledge in living theories. *Educational Journal of Living Theories (EJOLTS), 1*(1), 103-126. https://ejolts.net/node/80