STEM education in non-formal learning institutions in ethnic minority and mountainous areas: a look from Ha Giang city’s community learning centre

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Abstract. Community Learning Centre (CLC) is an non-formal learning institution working at grassroots level of the society. It derives from the initiative of UNESCO (the United Nations Educational, Scientific and Cultural Organization) launched in 1988, as part of the Education for All Target Program in the Asia-Pacific region. The idea of building a lifelong learning society to promote the economy and appeal to participation of all social groups through education and the role of the CLC as a special autonomous community is the spirit and reason of CLCs’ existence [7]. In Vietnam, As of 2015 there have been more than 11,900 CLCs established in 10,600 communes and wards nationwide [4], working as informal and non-formal educational institutions in the commune level. STEM education has been a new trending method of teaching and learning in the last decades originated from US under the demands of educating and training new labour generations with expertise in practical knowledge and skills. STEM education can be in forms of formal and informal learning, in schools and in lifelong learning institutions. STEM education has been imported to Southeast Asian countries including Vietnam in the last recent years and become a trending word in educational discourse. In Vietnam, STEM education has been piloted in a few public schools of big cities of designed in international schools and private institutions of the nation. Yet it is a luxury educational product and strange in remote areas of Vietnam where most people are poor and live under disadvantaged conditions. While, CLCs as part of continuing educational institutions of the country have exited in all provinces, but struggling with the crisis of operation. In this context, there has been a model of CLC choosing STEM education as its main operating component and working with mostly children in informal ways such as supporting STEM clubs in local schools, running mobile STEM in villages and connecting STEM experts with local teachers. This is a groundbreaking pilot model in the ethnic and mountainous context, with close link between science - education - research and private sector participation with local government budget and government-led activities: Ha Giang City’s Community Learning Centre (HCLC) in Vietnam. It can probably be considered as a good example for other places to learn. The STEM education program of the HCLC is designed with the purpose of promoting formal and informal STEM education for ethnic minority students within the city. The three main aspects for changes after operating this STEM element are (1) improvement of...
learning environments and accessing to hands-on learning materials for children through a formal and informal science-integrated education system; (2) teachers’ and education managers’ professional development, and the enhancement of their provision of teaching learning material and through capacity building programs; And (3) opportunity of accessing better quality education for community, especially poor and ethnic minority children within remote suburbs of the city through free of charge enrollment for the community STEM program. In line with the content of the workshop, the following analysis focuses on the third aspect the STEM program that has been contributing to the improvement of better quality education for poor ethnic minority children in the 3 rural communes of Ha Giang city. This presentation will also provide some suggestions to the operation of STEM integrated education in CLCs or other community-based learning institutions in ethnic minority areas.

1. Introduction

1.1. The functions of CLCs
Community learning centre as defined by UNESCO is a local educational institution. It is theoretically established and operated by the local communities with the support of different sectors such as local government, private and Non-Profit/Government Organisation to deliver non-formal learning programs. The programs normally are designed and operated based on needs of communities and the conditions of locality.

Since CLCs aims at promoting lifelong education for all people in the community, they benefit mostly vulnerable groups who have less chances to access formal education like poor children, preschool children, dropouts, women and similar others.

In Vietnam, the CLC model has been supported by the Vietnamese government with strong commitments and resources for development. Vietnamese Government has issued specific resolutions to guide the implementation and operation of this model, with the responsible agencies including the Ministry of Education and Training – MOET (Continuing Education Department - CED which is similar to Non-Formal Education Departments in other countries), Vietnam Association for Promoting Education (VAPE) and Viet Nam Institute of Educational Sciences (VNIES). At the local level (communes, wards and towns), the CLCs are approved by the People's Committee (districts, counties, towns and cities in the province), and are managed and professionally directed by the commune People's Committee and the Department of Education and Training.

As of 2015, Ha Giang province established 195 CLCs at 195 communes/wards/towns in over the province. Ha Giang city has 8 CLCs, being respective to 8 wards/villages. However, according to the report on results of CLSs’ activity implementation in Ha Giang (509/BC-SGDDT on 20th July 2016) in the academic year 2015-2016 Ha Giang city is one of the districts that have the lowest number of classes being held in CLCs of the 11 districts of the provinces (142 classes/25,820 times of participation). Even, in the fields of strength as development tendency of urban areas, such as technical sciences, there was only 1 class a year . Or no classes was held and no particular activities were implemented in the fields that are considered as features of disadvantaged areas, such as illiteracy eradication and primary education univerlisation.

STEM education or STEM integrated education.

STEM education stems from science education as it stands for four disciplines of sciences studies Sciences, Technology, Engineering and Math. Therefore, since last two decades, STEM education has been considered to be the main target of developed nations where there was a prediction of lacking well-educated human resources in economic and technological areas. Along with this, notion of STEM integrated-education also occurs based on the division of STEM branches such as STEM career, STEM robotics, STEM professional, ....
STEM integrated education is defined as approaches focusing on integration or combination of two or more areas of STEM subjects or a STEM subject and other subjects in order to design a lesson or curriculum showing connections between the subject areas and the real world issues. [5, 8]. Thus, all knowledge and skills of the teaching programs will concern the connections between the real life problems and seeking to find the ways to solve them.

However, on the other side, it is also defined as an approach of teaching STEM disciplines bounded up with learning practices within contexts to enhance student learning [9]. Therefore, it seeks to locate connections between STEM subjects and provide a relevant context for learning the content. Educators should remain true to the nature in which science, technology, engineering, and mathematics are applied to real-world situations. Hence, the more students practice, the more they reach authentic knowledge and skills. Regarding to this point of view, the authors create a conceptual framework for STEM integrated education that put the community of practice into the assisting position to support the learning process. It helps the students to observe, discuss and participate into sharing and learning (p.4).

According to [2], in recent years, there has been a disconnection between schools and students communities, especially in urban environments where there are diversity of culture and linguistic. This disconnection leads to the situation that the school knowledge can not be used to solve the real-world problems. The authors also found out a form of connection called “connected science” using community-based knowledge and school–based knowledge to bridge the students to the community and provide them opportunities for meaningful and effective science learning programs.

There is also a rethinking of science education role in lifelong learning in our society. [8] state that, science education for community-participatory approach can not only prepare the life outside the school but also allows children “to participate in legitimate ways in community life and therefore provides a starting point for uninterrupted lifelong learning across the presently existing boundary separating formal schooling from everyday life outside schools”. The relation between science learning and cultural practices are also cited in studies in both rural and urban areas. Particularly, states the efficacy of community-based science education programs conducted in Native American Communities [1].

Given that, science education particularly STEM integrated education is a flexible approach in which the teachers and learners can apply not only Western science knowledge but also local cultural knowledge. It cannot solely be taught in school curriculums but in informal programs too. Its contents are more than the four disciplines as its name and can be added by multi-subjects.

Ha Giang City’s Learning Centre and Its STEM education

As in 2008 UNESCO Assessment Report [3], and the secondary data source survey in Vietnam, there are three groups of issues that a CLC model is facing, including: (i) management and operation (including infrastructure, specialized human resources and leadership); (ii) coordination mechanisms and engagement with relevant stakeholders (citizens, agencies join function); and (iii) strategies of CLCs (to solve specific problems locally, or linked with more macro issues).

Data analysis from professional reports and web-based surveys also indicates the importance and impact of CLCs on the implementation of socio-economic development goals at the grassroots level (illiteracy elimination, anti-illiteracy, knowledge and technology transfer, community engagement, livelihood support and health care). However, the performance of CLCs is uneven, and in many localities this model exists only in nominal terms but not in actual activity, leading to a situation where people do not approach and abandon this model.

In order to continue to exist and to maximize the effectiveness of lifelong learning promotion, and to help economic model transformation and socio-economic development in both rural and urban areas through learning activities, the model of CLC needs to change. In that circumstance, the HCLC is designed and advocate to pilot in Ha Giang City, a mountainous city grade 3 in the North part of Vietnam.
The Setting:
HCLC is first community-based non-formal education initiative in Vietnam, under the direct governance by Ha Giang City’s People’s Committee. It is entitled to own stamp and financial account to implement assigned tasks in compliance with the Law. It is the first model of CLC in the city level that cooperating between local government and a non-profit organisation working in sciences-technology fields named Ha Giang Centre for Community Assistance (HCA).

**Diagram 1. Organisation chart of HCLC**

According to Ha Giang City’s People's Committee’s decision, HCLC’s functions and missions include:

Playing a role as a master Centre to support the activities of the district-level community learning centres within the city; Counsels and orientates community learning centres plans; Support the important events of the district-level community learning centres regarding assistants.

Promoting and attracts the participation of the community in non-formal activities through STEM education programs, English language learning, Community library, special and inclusive education, mental health care. The place for community activities are modern and friendly where individuals and the community are beneficial and have access to opportunities of continuing and lifelong education and comprehensive care.

Promoting the attraction of social resources through public and private cooperation, gratis assistance, non-interest loans, fund raising...in order to reinforce and extend the Centre’s activities and improve its workforce quality (soft skills, foreign languages, knowledge of multi cultures…) in fields of economy, culture and society within the city.

Based on that, HCLC is responsible to:
Assist the activities of district - level community learning centres regarding techniques and human resource in within Ha Giang city and Vi Xuyen district in implementing annual tasks

Implement such education services as: STEM education courses, special education, foreign language teaching, art education…..

Organises events, counselling activities; Assists psychological counselling and mental health care for children, parents and other groups within the community.

Organise the courses that enhances foreign language levels for the community tourism within the city and the province’s districts.

Implement free social benefit programs as part of such modules as: library, STEM education, special education, local knowledge education and community mental health care

Cooperate, connects different resources within and beyond the community so as to practise and develop update, modern teaching and learning methods in compliance with the Law.

Hence, HCLC has demonstrated at the same time the parallel functions of (1) a model CLC which is able to deliver programmes and activities in response to the learning needs of the community and formal schools and (2) a resource center which is capable to provide technical assistance for other communes and formal schools in organizing practical classes.

HCLC’s STEM education Programs

The STEM education Module is one of the 4 main modules of the Centre, being responsible for receiving the transfer of STEM education models from other countries thus serving different local children groups. It plays a role as a bridge and assists local schools in general education curriculum innovation. Also, it contributes to create opportunities of accessing the information about education and creates creative learning spaces for children within Ha Giang city through high quality outdoor education activities. This is the first STEM education model implemented in Ha Giang and is the first model in Vietnam implementing education programs through a community-based and non-profit centre.

The vision of HCLC in implementing this Module is, till 2020, the centre will actively cooperate with high quality secondary schools to improve the province’s education, creating opportunities for developing high quality education in the province, serving local people over the province. This means the HCLC plays as a coordinating and monitoring role in building STEM education ecosystem of the city and the province as well.

Given that, community-based approaches is considered as the main strategy of developing STEM Education of the centre. Since, all part of planning, designing and conducting activities of STEM Education program focus on the integration and harmony between sciences knowledge and local cultural elements and local traditional knowledge.

Community STEM Education

1. Infrastructure, teaching facilities and human resources of HCLC:

Ha Giang is a mountainous and one of the poorest provinces in Vietnam with nearly 90% of the population are ethnic minorities. Ha Giang city is the province’s centre of economy, culture and politics with 45% of ethnic minorities and 8 administration units at ward/village level. 3 villages lie in the especially - disadvantaged group. Therefore, the implementation of STEM education can not be as robotic and technical as in developed cities and private STEM education centres in Vietnam. Due to characteristic features of the teaching materials and the orientation of teaching method towards the nature, agriculture, and local knowledge application, the centre just spent a little part of the budget on teaching facilities (about 5000 USD), but take advantage of material from the locality and nature.
The centre has 5 STEM education teachers. Most of them are teachers of science subjects, and have been trained by domestic experts under the coordination of the US experts. After being trained, the teachers are in person conduct STEM programs at HCLC and work with villages/wards in order to implement STEM activities to the community’s children.

2. STEM integrated programs

2.1. After school programs for children in 5 inner-city wards
The students have participated in programs of support STEM literacy. These programs include hand-on activities that involve active learning, such as making ice cream without refrigerator, creating a model of wooden stilts house, designing a bridge, planting in hydroponic systems, and putting together a science fair. All after-school components integrate asset building activities that promote learning, positive values, social competencies, and positive identities, cooperation around areas of STEM education. These programs have been held at the elementary and middle schools on Friday after 10 am and at the HCLC on Saturdays (Fantastic Saturdays). The programs have complemented initially with demonstration in class, hands-on experiment, field trips, with the number expanding in the following years to include more rural areas in Ha Giang province. Lots of parents came to the center to observe the positive activities in which their children have been involved, and witness their child receiving an award for participating.

Since December 2017 to present, the HCLC has organised 32 events like STEM fairs, STEM after-school sessions in the centre. There were approximately from 20 to 30 children joined in every single activity, of which 55% is girls.

2.2. STEM Club Network

In collaboration with communities and schools, STEM clubs have been promoted and engaged in a STEM Clubs network in vision of development up to 2010. This network supposes to provide the forum where students and teachers will share experiences focusing on STEM learning and teaching during their regular meetings. Activities will include STEM showcases, science fairs, science contests, and career exploration activities. These activities have been facilitated by trained teachers who will act as change agents and partners to HCLC. Up to July of 2018, 3 STEM clubs in 3 villages (Tien Thang, Tha, Thai Hai) of 3 moutainous communes of Ha Giang City have been set up and running effectively. Regarding to this activity, the HCLC’s STEM teachers have gone to the villages to conduct educational programs for the clubs weekly. The clubs’ programs are various from teaching STEM experiments to reading science books, watching science movies and learning life-skills. Recently, there have been about 700 children benefited from this network. 400 of those are girls.
2.3. Community-Free of Charge Programs:

- **STEM Fair:**
  
  STEM fair held on November 2017 was a playstation for knowledge sharing and learning among teachers and students. The fair was given at 2 places, Ha Giang city and Bac Quang district, with the participation of 120 teachers from Ha Giang and 95 teachers and education administrators from Ha Noi and from nearby provinces. The 16 stalls in the fair already attracted more than 3600 students to participate in experience activities. The show contents and experience classes included Robotics, Reaction engines, Motorcycles….
• **STEM on the Move**

This is a free program periodically serving the community, being held on every Sunday. The teachers will establish an integrated programs consisting of Animation movie shows, book reading, science games and STEM based experiment practice at CLSs in suburban villages to ethnic minority children. More than 1000 ethnic minority children in 8 villages benefit from the project. This is an ongoing-mobile program and working with children at various ages, different background and social status. Therefore making curriculum in for this program based on the traditional local knowledge and real-life knowledge rather than formal education programs. The project is funded by US Embassy to Vietnam and will be finished in Jun 2018.

![Figure 6. STEM on the Move](image)

3. **Conclusion**

**Lessons from HCLC:**

STEM education in CLCs contributes to lifelong learning and in the community and develops learning society.

STEM education in CLCs contributes to close the gap between the city and the country, mountainous areas in high quality education access.

STEM education is not an costly teaching method (despite the requirement of teaching facilities).

“No one fits all”. Effective STEM education programs should be flexible and characterised with local features, being well-matched with the perceptions and culture of local students and being suitable with local culture-economy conditions.

**References**

[1] Bang M and Medin D 2010 Cultural processes in science education: Supporting the navigation of multiple epistemologies *Sci. Ed.* 94 pp 1008–1026

[2] Bouillion L M and Gomez L M 2001 Connecting school and community with science learning: Real world problems and school–community partnerships as contextual scaffolds *J. Res. Sci. Teach.* 38 878–898

[3] Haddad C 2008 Community Learning Centres: Country Report from Asia (Bangkok)

[4] Hossain Z 2016 Towards a lifelong learning society through reading promotion: Opportunities and challenges for libraries and community learning centres in Viet Nam *International Review of Education* 62 pp 205–219
[5] Moore T, Stohlmann M, Wang H, Tank K, Glancy A and Roehrig G 2014 Implementation and integration of engineering in K-12 STEM education. In S. Purzer, J. Strobel, & M. Cardella (Eds.), Engineering in Pre-College Settings: Synthesizing Research, Policy, and Practices pp 35–60 (West Lafayette: Purdue University Press)

[6] National Research Council 2011 Successful K-12 STEM education: Identifying effective approaches in science, technology, engineering, and mathematics. National Academies Press.

[7] PHAM D 2010 Community Learning Center

[8] Roth W and Lee S 2004 Science education as/for participation in the community Sci. Ed. 88 pp 263–291

[8] Sanders M 2009 STEM, STEM education, STEMmania The Technology Teacher, 68 pp 20–26

[9] Todd R K and Knowles J G 2016 A conceptual framework for integrated STEM education International Journal of STEM Education pp 3–11