Strategies for Teacher Utilizing Ethnography as a Way of Seeing for STEAM Education

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Abstract. This paper attempt to offer research digest of ethnography as a way of seeing which perceive having interrelated with Anthropology. Human being associated to culture, ethics and moral, aesthetic, value, and so on, these are considered as arts. As I perceive an outstanding feature of ethnography as a way of seeing spontaneously bond with arts, so I afford to provide an insight example of ethnography and provide an inspiring a way of employing ethnography to describe phenomena or circumstance in STEAM Education. I have offer the notion of implementing ethnography as a way of seeing for teacher on STEAM teaching in three stages, implementing ethnography during teaching process, implementing ethnography for assess students leaning.

Keywords: ethnographic research, way of seeing, STEAM Education

1. Introduction

The term ethnographic research was first introduced to me when I (Pairoh Sohsomboon) enter Ph.D. in Science Education Program at Khon Kaen University and attend Advanced Research Paradigm and Methodology in Science Education Class with Chokchai Yuenyong. The reading material offered for this topic is from Cohen et.al [1] which was such a remarkable book representing about research methodology in educational research. Another inspiring knowledge that I have gain from this class is called “a way of seeing” [2] which I believe is interconnect with ethnography in the sense of powerful informing the position of seeing and understanding the world of the researcher in different contexts. Apart from the newly notions, ethnographic research and way of seeing, I also was introduced, the particular interesting and indeed novice research paradigms for me, new paradigms in educational research such as interpretative, critical, and postmodern paradigm [3], [4], which is far from my notion of research in education that I have ever familiar with. I was really appreciate and enthusiastic learning in the topics and I am also passionate in implementing the novice knowledge in my educational research. I consider that Ethnographic research, a way of seeing, and new educational research paradigms were introduced into the class as intention to encourage us (me and my peers) to realize the appropriation and the exquisiteness of these topics in educational research, as it interrelated with human being so called Anthropology. Traditional paradigm, known as normative paradigm, of educational research usually illustrate research information in quantitative method or event qualitative approaches in the way of interpreting data addressing solely on fact and logic, attempting to measure materials, looking for truth. Whereas new paradigms in educational research such as interpretative, critical and postmodern paradigm acquire in depth of information and insight understanding related to meaningful of individual’s experiences. Correlated to that, normative paradigm or quantitative research methodology, which quite common in the circumstance where I was, might not be able to
elicit and display sensible and in depth such information. Furthermore, normative research paradigm have to indication a genuine validity and reliability, but it certainly does not make sense to set standard, control, and measure in social research, as human being has there own individual culture and value of belief. Whereas ethnographic research is believed more appropriate in social research as it is believed to be able to gain trustworthiness. I also consider that these topics were introduced to us with intention not only encourage us to perceive and appreciate to topics but may also be trusted that the appropriation and appreciation would lead us to follow this path implementing such methodology in the research with gratitude.

Currently, Arts is recognized as another aspect of creatively practicing to design solutions for human need. Arts, therefore, is a part of process of engineering and technology. There is Arts-based teaching and learning strategy called STEAM, motivating effective approach in classroom teaching and learning. STEAM education pointed up Arts (A) in STEM as an intention of inspiring humanistic vision of 21st century as it is believed to enrich and expand the scope of STEM education. STEAM is introduced as believed promoting not only academic and creative talent but also disclose sense of human being such as aesthetic, ethics and moral consciousness, value, goodness appreciation, beauty, social responsibility, and so on [5], [12], [13], [14].

I have noticed when I have read ethnographic research form Cohen et.al [1] that they suggest remarkably critical ethnography as for critical paradigm. From this point, it might be interesting what ethnography for postmodern paradigm could be. Considering this point, I recognize the connection of ethnography, a way of seeing and STEAM teaching, I percieved that ethnographic research or ethnographic way of writing may remarkably demonstrate STEAM education rather than other research method. Ethnography suggests a way of seeing that would be able to reveal value of indivual as believing that people are different. And ethnographic writing as a way of seeing could expose inside human sensation concerning all factors in that sense such as beauty, aesthetic, human being, culture or the position where the researcher or participant involve.

Therefore, for these reasons it is my effort to clarify the example of ethnographic research and offer a notion of teacher utilizing ethnography as a way of seeing for STEAM teaching as an intention to inspiring the alternative applicable and suitable strategy for teachers in the new era.

2. Ethnographic research

When I was introduce the term ethnographic research from Advanced Research Paradigm and Methodology in Science Education Class and as I have read about it from Cohen et.al [1]. I actually did not comprehend what really ethnographic research was, as this term did not familiar for me since being a teacher in science or science education concerning intensely on logic, empirical data, and truth. Chokchai realized that the astonishing of the new way of this kind of knowledge so he presented the works that implement ethnographic approach as an example for us to grasp some idea about these amazing knowledge. For example, Critical autoethnographic inquiry for culture-sensitive professional is a work of Afonso and Taylor [6]. This work is representing and interrogating the complexity of learning and teaching in Mozambique. They implement autoethnographic methodology as the aim to describe Afonso professional perspective with trainee teacher, science teacher in order to generate narrative intent to engage reader in pedagogical thoughtfulness. And they also emphasis how autoethnography support to reflect critically on the sensitivity of the professional practice to Mozambique culture.

Another example is from Maneelam, Yuenyong, and Taylor [7], developing the STEAM polymer learning unit: ethical dilemma plastic story. This research is prominent on implementing postmodern paradigm in the sense of concerning the ethical dilemma on plastic. The first author have taught topic of polymer in a sense that not only contented focus but concerning the ethics and value in using plastic, elicit students’ consciousness responsibility. Maneelam’s work noticeable using dialogical style to enable reader to interpret the author thinking. These works inspired me insight ideas about ethnographic research in multi paradigm. And I will reference these works later when I discuss strategy of implementing ethnographic research in STEAM education.
Before going through other aspects, I will try to identify my point in definition of Ethnographic research first. Cohen et.al [1] state that ethnographic research is a process involving method of inquiry which outcome of the research recorded from inquiry and the intention of the research is to pursue a reconstruction of the culture of the studies. Naidoo [8] also reveal that ethnography is a study of belief, social interactions and behavior with participation and observation over a long period of time among the groups under study and the detailed interpretations of the data collection. In view of Harris and Johnson [9] ethnography is a written description of a particular culture, customs, beliefs, and behavior based on information collected through fieldwork. Somehow Fetterman [10] believed that ethnography is the arts and science of describing a group or culture.

From scholar point of view, I notice that ethnography related to inquiry, social interaction, representing belief and culture. Therefore, ethnography in my perception, involve a process of inquiry where the researcher act as inquirer attempt to understand the interactions, behaviors, and perceptions that occur within a groups in order to understand how that group make sense of the world in their various context, so called social knowledge. And ethnographic writing has to explicit the ethnographic research which has to describe the aspects involve in the occurring social context of that situation for the reader. This perception may implicit characteristics of ethnographic research from key aspects that I mention earlier as a feature of guiding ethnographic research. In this section, it will be my effort to reflect understand and represent some of example that I find related to they feature of ethnography.

First, ethnographic research involve with human, who might referred as researcher in this sense, sometime named inquirer or knower actively construct their own meaning of situation. Inquirer in ethnographic research use various methods gathering data such as observing, interviewing, gathering documents so that the meaning of individual arise social phenomena. In this sense researchers are generally the instruments of the research. In order to be in-depth comprehend the phenomena the researcher have to be part of that community for example if you are researcher and you want to explore teaching strategies of the teacher in classroom, you may need to observe classroom teaching of that teacher for several times not just one lesson in order to perceive atmosphere, circumstantial, context, culture of that classroom. If you are a member of that community you will be able to describe in depth the scenes, the circumstance, the belief of that culture.

Researcher has to explain about s/he situation of being involve in that research. Refer to what Cohen et.al [1] mention, researcher is instrument in ethnographic research, this imply that the researcher get involved the research, therefore, we have to gain trustworthiness by describing how the researcher involve in that phenomena. Gaining trustworthiness, the researcher has to describe how they get into the research, the relationship between researcher, as believing research instrument, and research method. For example, there are two example of researchers who implementing ethnographic research in their work. The example represented here is to show that the researchers had tried to explain their background and link to how they involve with the research.

Reflecting on and writing about how I came to be a teacher was for me a helpful experience in learning about the self in me who was teaching these students ... [6]

Back to my life before studying PhD in KKU, I am chemistry teachers who graduated in B.ED in chemistry and M.Sc in chemistry. I am chemistry teacher who love in enhancing students to do science projects. ... [7]

Ethnographic writing has to set the scene or to show the culture for reader to make sense of phenomena and to get into the sense like when we read poem that the author attempt to put the reader into the scene in order to acquire the same lens which will encourage the similar feeing of participants (actor) or author. It is important for ethnography to show the research culture in the sense of gaining trustworthiness from the reader in order to identify research lens and position. As people does not have the same way of seeing, setting scene would be able to inform researcher’ lens of seeing. There are example from Afonso and Taylor [6] and Mancelam et.al. [7] respectively, they have attempt to indicate their research scene in order to engage reader image inspiring their research story.
It was during 1974 that I was sent to school in Mozambique. I was 7 years old. Although it was my first year at school, I did not attend Year One. ...

About 10 years ago, Chokchai conducted his qualitative research about enhancing students’ learning about energy through STS. ...

The word inquiry is stressed from Cohen et. al.[1] in ethnographic research. For me inquiry in this sense refers to process of conducting the research, the process influenced by research paradigm which guiding the investigation methodology and the practical theory guiding data collection and data analysis in the interpretation of finding [1]. From this sense, it is hinted that research methodology, data collection, and data analysis are consequence of lens of seeing research, so call research paradigm. Bear in mind, research in social science should be conducted in natural, real world setting with as little interfere as possible, this sense unlike laboratories or in controlled setting where variables are deliberately manipulated. We may familiar with reliability and validity measuring the quality of the research in positivist paradigm, however, these standards may not appropriate for new research paradigms rather trustworthiness is more conventional as research in social science requires to examine situations through the eyes of researchers and participants. Ethnographies be obliged to use observation techniques in order to extensively comprehend the point of view of the real world setting related to participants’ experience. A major part of ethnographic task is to stimulate sociocultural knowledge from participants, interpreting social behavior comprehension, to put it in a simple way is what is impact in what we see and how the researcher interpret what we see.

Cohen et.al [1] stress that ethnographic data are socially situated, context-related, context-dependent and context-rich. This might imply that methods gathering data such as observing, interviewing, gathering documents stimulate the meaning of individual arise social phenomena. The process of interpreting data, understanding the context affected behavior and other perspectives is necessary as people are deliberate, intentional and creative in their actions in individually.

Consequently, as the world view of participants is investigated and represented through interpretative process. Interpreting data in ethnographic approach normally embrace “thick descriptions” as data are analysed inductively with constructs arising from the data during the research. The research is generated the data rather than test hypothesis, meanings and understandings rather than proof. In Ethnographic approach, the researcher do not know or cannot predict what they will see of the result as human phenomena appear to require more conditional stipulations than do other categories as situations are unique. This mean that the ethnography go beyond fundamentally observing and describing the details of particular situation and focusing on material or fact. Rather it pursues to explain how these incidents represent culture which emphasis on immersing in the context and exploring the culture of study setting. With this intention, theory emerges from inductively analysis so called grounded theory. There is a move from description and data to inference, explanation, suggestion of causation and theory generation.

Ethnographic research requires researcher personal perspectives, along with those of research participants, are ‘given voice’ or reflective thinking. Writing narratively (1st person voice) about relating experiences allows researcher to offer deep insight into the inquiry process and outcomes, indicating how we have interpreted or constructed meaning and representing rich detail of the context within. Ethnographic writing could draw from the full range of pronouns (I, you, she, he, it, they), active and passive voice, and multiple tenses (past, present, future), depending on the purpose of their inquiries.

However, it is fascinating of Cohen et.al.[1] addressing that implanting narrative writing (using 1st person voice or pronouns) “the choice can be overwhelming for the novice researcher and quite confronting for ‘elders of the tribe’ still steeped in the positivist paradigm”. This could imply that these strategy might not be familiar for researcher in positivist paradigm but it could be appreciated and be an advantage for people who eyes open for lens of seeing in new paradigms. You will see researcher who employs new paradigms using 1st person voice or pronouns in their research representation. For example, Afonso [7] reveal his feeling first seeing this kind of research
methodology as culture shock, but he appreciate and see the beauty of this research strategy and implement in this work at the end.

Usually, ethnographic research employs three methods of data collection; interview, observation, and documents. These methods could produce such quotations, description, and excerpts of document. This could consequently lead to the way of representing research such as using personal narrative to a colonizing discourse. Writing personal narrative in a dialogical style intend the reader to engage with reflective thinking rather than guiding definitive answer. Research which employ ethnographic mean normally represent discourse in their writing in order to engage the reader to absorb and interpret the same situation related to arts and being document to tell the reader about the story of that situation. For example, Maneelam et.al. [7] provided discourse represent voice of authors (Peter and I as Maneelam) as reflective thinking.

Peter: Did you tell students the advantages of plastics when you teach chemistry about plastics?
I: Yes, I did ..... (I don't know how to reflect as the right answer of Peter’s question. I quite was worried about the right answer. In fact, it has no the objectivist right answer. It depends on human awareness).
Peter: You can answer anything you like. But, you need to provide your justification for that. And, you have to listen to others.
I: Ok, I will keep thinking.
Peter: The answer of dilemma story could be found if we have empathic conversation, collaborative decision-making and critical reflective thinking. If students have practiced these, they will gain their skills for problem solving in everyday life. [7]

Ethnographic writing has to be written to engage reader or gain emotional appreciation in the story, sometime it has to add dramatic, funny, odd story in the writing. And, have you ever read articles or books but you don’t understand event those materials are written in the language that you have been reading since you could have ability to read. Ethnographic writing does not require much formal language rather it require way of writing that is easy for reader to understand and appreciate the story.

Ethnographic writing could highlight on demonstrating the progressive development of the researcher’s professional practice. It requires alternative means of describing the reasons causing that phenomena such as metaphorical thinking, dialectical thinking, inductive thinking, reflective thinking and so on. These alternative mean of reasoning is making available many new forms of representation such as autobiographical writing, storying, poetry, ethno-drama, screenplay and fiction. For example, Afonso and Taylor [6] provided on their study as following.

I am sitting in research project class, an ordinary day in my first semester in the Master of Science Education course. Peter begins to read a paper co-written with a former student, Joe Timothy (1999) who has recently returned to his home in Vanuatu. ...
In a remote village on the island of Vano (Far-no), in Kantri, lived Tamanku and his eight sons and three daughters. Well, to be accurate, Tamanku now only has seven sons and one daughter. One son and one daughter were adopted away, and one daughter died as a child.... [6]

3. Ethnography as a Way of Seeing

Comprehending ethnography and a way of seeing, inspiring my thought that ethnography and a way of seeing cannot be separated. I have read about “a way of seeing” from Sue Saltmarsh Ethnographic workshop which mention that Wolcott [11] had state that ethnography is involve more than describing fact in that situation, ethnography is ‘a way of seeing’ which involve the study of culture and the position where researcher and participants interact with that phenomena. This notion is more or less share similar direction to the definition of ethnographic research from some scholars such as Harris and Johnson [9] and Fetterman [10]. The anthropologist believed that the position related to
field of inquiry plays huge impact on what the researcher see and how the researcher interpret research outcomes. The workshop of Sue Saltmarsh was talking about position of seeing thing influence from individual experience. For example, when people look at the same picture and asked to describe that picture, of course different people could spot, focus and explain in various ways and stories. The ways of telling and the stories may influence from different culture, experience, interested, belief value and so on, these are individually in each person. In order to understand why they describe the picture in that way or why they come up with that kind of story, we have to know their background, which could refer to their position, that lead them to perceive or look at the picture in that direction. The way of seeing inspire acceptance of different. In order to understand other people point of view we have to accept that people are different such as different in culture, experience, and belief.

From this point, I perceive that ethnography is regularly perceived as making rich and detailed descriptions but a way of seeing act as a lens through the observation of ethnographer to understand the phenomena. A way of seeing is also emphasis that individual person, who has different experience, will be making meaning in different sense, although they interpret the same phenomena. So that a way of seeing have attempt to set trustworthiness by pointing a scene and setting a position where the researcher look at and interpret that situation in order to be clear informing the reading looking at similar lens and not expressing that the interpretation is truth.

For example, when we attempt to explain beauty of woman, perception in beauty of woman the east and west countries are completely different. If the research is held in the east we need to take account of culture and believe of east people how they perceive the beauty in woman and this is different from the west. Hence, setting a scene the researcher may making sense for the reader to understand phenomena event they have different sense of beauty as the reader may perceive it as a way of seeing not truth.

4. Teacher Utilizing Ethnography as a Way of Seeing a Sense of Arts for STEAM Education

In recent years Arts-based educational research has been flourished, STEM Education has become a popular approach for sustainable development in order to support students to become critical, creative and ethically citizens, innovative designers, good communicators and collaborative decision makers [5]. Moreover, scholars suggest that Arts (A); should be added in STEM to be STEAM as arts concern with expressiveness, evolving emotion, generating empathic, stimulating imagination, elicit emotional awareness [7]. As these sense, the arts may enable us to ascertain our humanity. Furthermore, in my point of view, the arts is also encourage human being in a sense of aesthetic related culture, aesthetic may imply to pleasant which deniable different in individual. The aesthetic is related in the area of beauty, love, inclination and so on. In order to illustrate the abstractness of aesthetic for other people to understand we may need a strategies such as metaphor. Or sometime illustrating beauty we may need poem or song as a pathway to make sense for reader to appreciate our way of seeing as we aim to write in a way that seem to the reader to be realistic, plausible or believable. These could inspire interconnect of ethnography and arts.

Consequently, Arts-based educational research like STEAM education require manner which appear to reveal sense of arts such as beauty, culture, moral and ethics, aesthetic. Therefore, ethnography may be appropriate for exposing the sense and beauty of STEM education.

Ethnographic research may differ concern to nature of each paradigms. If I have to match STEAM education with research paradigm, I may say that STEAM education is pretty much appropriate for multi paradigm, interpretative, critical and postmodern paradigm, whereas postmodern paradigm might be a prominent one from of Arts in STEAM education should be conspicuously represented. According to Taylor et.al [5], the postmodern paradigm is a recent arrival form of the arts and has begun to bring an influence on science education researchers. When we're talking about postmodern paradigm is like we try to explain about what is the truth in terms of the beauty, what we believe about we see what we see about beautiful world, which is relatively subjective. A good example of that is, imagine that you are going out into nature where could be garden, the forest, the ocean, you learn to appreciate the beauty of nature, and if you have a strong appreciation of nature's beauty. Postmodern paradigm realise sense of arts which could be referred to many kind of arts not just painting. Yakman
[11] categorise arts into language arts, fine arts, physical arts, manual arts and liberal arts. Cohen et al. [1] suggest critical ethnography as for critical paradigm. So it is interesting what ethnography for postmodern paradigm could be. For me, ethnography for postmodern paradigm would not be much different but might be elicit sense of beauty in the arts more than others paradigm. From this point, I will try to suggest strategy for teacher utilizing ethnography as a way of seeing for STEAM education which outstanding of postmodern paradigm as they both share the sense of arts.

First of all, we need to define “sense of arts”, arts in postmodern paradigm or in STEAM education does not focus solely on beauty of painting, sense of arts here could refer to all kinds of arts that Yakman [11] have attempt to categorise arts such as language arts, fine arts, physical arts, manual arts and liberal arts. In the beginning of teaching STEAM, teacher has to think about teaching topic that has to include arts. Some teachers may focus solely on arts component combining in designing prototype which reflex STEM + Art = STEAM which nothing wrong with that idea, but I could be too narrow for arts definition which is directly on only fine arts. We could will more broadly in the lens of liberal arts for example. In Maneelam et.al. [7] represent arts in her teaching in STEAM approach as ethical dilemma story via topic of plastic awareness. Maneelam taught not only the knowledge of plastic but also the ethical, moral, and value issue of plastic. This plastic awareness bring meaning to students’ ethics and the awareness could bring beauty to society. Ethnography in this stage of STEAM could be inspiring the ethical consciousness using story which related to habit of using plastic in their society. So, at this point, teacher does not need to worry how to design integral of arts into STEAM activity as the arts is straightforward to the title already. The example of ethical dilemma in Maneelam et.al. [7] is about a 13 year old student called Nisha who live in northeastern region of Thailand, Khon kean province. This province reported number one of waste in this region. The conflict situation of plastic waste disposal was raised as there was toxic smog covering the city and some more problem believing causing from plastic dispose. Questions related using plastic and plastic conflict in daily life is raised such as using plastic bag for shopping or drinking water from plastic bottles. The purpose of creating story or character of ethical dilemma is believed to provide students the opportunity to experience in value interpretation, critical reflective thinking, empathetic compromise, and collaborative decision making. Furthermore, it is believed that the created activities through ethical dilemma story might offer chances to bring arts such as cultures, ethics and moral, values, aesthetic to integrate in practicing STEM awareness for problem solving. According to Maneelam et.al. [7], it seems that Thai science teachers did not aware of enhancing students’ awareness of science interaction to other aspects and habit of mind, ethics, morals, and values. Many teachers could not find appropriate teaching strategy for awaking students’ awareness of ethics and moral consciousness but STEAM is well inspired these issues for Maneelam and I totally agree.

In teaching process, employing STEAM strategy for teaching, the teacher has to implement ethnography in teaching in order to engage student’s emotional appreciation in the topic such as ethical dilemma, sometime it has to add dramatic, funny, odd story in the story. Metaphor is found helpful in teaching science as we perceive that science concepts sometime is abstract as we cannot imagine and it is perceived difficult to understand so using metaphor will be useful to help students catch the abstract ideas. Storytelling or songs are also found helpful to engage students’ feeling in the teaching topic. For example, Maneelam et.al. [7] represent Loi krathong song and storytelling about history of Loi krathong festival in her STEAM teaching. This believe to elicit insight of engaging in the story and led to comprehend inside students’ feeling. Being a teacher implementing STEAM education, that teacher have to implement ethnographic strategy in their work as well. The teacher would have to assess students’ learning, the assessment now a day tend to be in formative mean instead of summative assessment. So that teachers might have to employs ethnographic writing to reflect students’ learning progress through profile description.

Ethnographic writing in profile description, teacher has to, first, understand and describe student’ background and characteristic in order to bring reader to students’ position, and that reader or teacher would be able to understand the students’ process of improvement on s/he learning as a way of seeing. Teacher need to understand and accept the differences of individual’ experience, this might bring to understand differences in learning ability lead to difference in learning progress.
Second, in order to reflect progress, teacher has to follow closely on student’s learning process. In this point, ethnographic writing play a very essential role of describing such a progress. The reflection from teacher might express the beauty of student’s progress, encourage them to do better, guide them the way of improvement. For example, teacher might describe how that students develop their progress, how the students do better. Seeing students’ progress is seeing beauty of development teacher might implement ethnographic writing describe progress in a positive sense. Postmodern paradigm here is beauty of progression in individual’s mean. Ethnographic writing here is aspect which teacher represents reflection in using ethnographic way of explanation such as easy vocabulary.

5. Conclusion

I believe that not many teachers familiar with ethnographic methodology especially science teachers who may have normative paradigm believing in truth and empirical data. They may familiar with teaching STEM integrating science, technology, engineering, and mathematic in teaching and learning activities. But coming to arts-based teaching, STEAM approach, and arts is added to STEM, teachers in traditional paradigm might struggle to combine arts in the activities and may have difficulty in employing appropriate methodology in STEAM teaching and learning. However, learning new paradigm, ethnography may introduce light of the day for arts-based teaching. The research methodology in new paradigm, ethnographic strategy is perceived thoroughly related with human being and the human being interconnected to arts. Learning new paradigm, I personally notice the interrelated of ethnographic methodology, a way of seeing, and arts-based teaching so called STAEM. So I have an attempt to offer the notion of boundary ethnography with STEAM teaching for teachers. I could see the closely link and suggest an example of the strategy in three stages in STEAM teaching, first, in designing topic, teacher could use ethical dilemma as a liberal arts and ethnography in this stage is place position or elicit students’ feeling engaging in the ethical conflict. Second, during teaching process, ethnography quite prominent in engaging students’ emotional feeling, effective techniques that usually employ during teaching process such as story-telling, song, metaphor. And the final stage, assessing process, ethnography is engaging in formative assessment, teacher has to implement ethnography in describing and reflecting students’ learning progress.

References

[1] Cohen, L., Manion, L. and Morrison, K. Research Methods in Education. London, UK: Routledge Falmer. pp. 211-220 (2000)
[2] Wolcott, H. Ethnography: A way of seeing. Lanham, MD: AltaMira Press. (1999)
[3] Taylor, P.C., Taylor, E., and Luitel, B.C. Multi-paradigmatic transformative research as/for teacher education: An integral perspective. In K. G. Tobin, B. J. Fraser & C. McRobbie (Eds.), Second international handbook of science education. pp. 373-387 (2012). Dordrecht, The Netherlands: Springer.
[4] Taylor, P.C. and Medina, M.E. Educational research paradigms: From positivism to multiparadigmatic. Journal for Meaning-Centered Education,1. http://www.meaningcentered.org/journal/volume-01/educational-research-paradigms-from-positivism-tomultiparadigmatic/. (2013)
[5] Taylor, P.C. Why is a STEAM curriculum perspective crucial in the 21th century?
[6] Afonso, E.Z. de F., & Taylor, P.C. Critical autoethnographic inquiry for culture-sensitive professional development. Reflective Practice, 10(2). (2009)
[7] Maneelam P., Yuenyong, C., Taylor, P.C. Developing the STEAM polymer learning unit: ethical dilemma plastic story. Jurnal Pendidikan IPA Indonesia. (2020 in press)
[8] Naidoo, L. Ethnography: An introduction to definition and method. In an ethnography of global landscapes and corridors. Europe: In Tech. (2012)
[9] Harris, M. and Johnson, O. Cultural Anthropology, 5th ed. Needham Heights, MA: Allyn and Bacon. (2000)
[10] Fetterman. Ethnography, 2nd ed., Thousand Oaks, CA: Sage Publications. (1998)
[11] Yakman, G. STEAM Education: an overview of creating a model of integrative education. (2008)

[12] Suwono H, Fachrunnisa R, Yuenyong C, & Hapsari L  Indonesian Students’ Attitude and Interest in STEM: An Outlook on The Gender Stereotypes in The STEM Field. Journal of Physics: Conference Series, 1340 (1), 012079  (2019)

[13] Sutaphan, S. and Yuenyong, C. STEM Education Teaching approach: Inquiry from the Context Based. Journal of Physics: Conference Series, 1340 (1), 012003  (2019).

[14] Chomphuphra P, Chaipidech P, & Yuenyong C. Trends and Research Issues of STEM Education: A Review of Academic Publications from 2007 to 2017. Journal of Physics: Conference Series, 1340 (1), 012069  (2019)