



Undergraduate Female Mathematics Students Identities

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Abstract

The main purpose of this study was to explore the undergraduate level female mathematics student's identities construction in Nepal. The study adopted narrative inquiry methodology with four female participants from Tribhuvan and Kathmandu University, Nepal. There is an attempt to explore how females have been able to construct identity with the barriers they cope up with while making their career. Vygotsky's cultural- historical activity theory was the theoretical meniscus. The result revealed that female mathematics teachers struggled with societal bars, discrimination, transitional phase, setting up identity mark point during the process of constructing student's identity at undergraduate level. The result revealed that during this phase, every female student face challenge and take steps towards their career which in turn out to be a milestone for their empowerment as well as identity construction. This research encourages, motivates, inspires and empowers every female mathematics students who aims to shape up their identity in mathematics field.

Keywords: Undergraduate level, Identity construction, Narrative inquiry, Empowerment

Introduction

Identity is an essence that a person achieves through ongoing convictions aiming to establish her to be widely recognized in a society, country and world which is shaped up by a person's individual knowledge and experience (Paudel, 2018). Identity reveals the inner and outer nature of a person. It shows what kind of persons they are, where they belong to and their influence in a society. Identity can be made up by focusing on the person's past, visualizing their present and the realizing their future expectations (Stryker, & Burke, 2000). It is a continuous process of transformation and social interaction. Social interaction process of stands out to be quite similar male and female, however our social norms, values, cultural barriers and psychology makes the female's identity construction strenuous. Still society doesn't believe in female mathematics students. Thapa (2012) pointed out that women as someone who is engaged in doing household work, cooking food in the kitchen and working in the fields, how can they study such a complicated subject? So, people have the misconception that the females are not supposed to study difficult subjects like mathematics. Gudyanga, Mandizvidza, & Gudyanga, (2016) found out that female students perceived mathematics to be a difficult subject, masculine and irrelevant to their future aspirations which outlines their perceptions were rooted in the prevailing cultural belief. During times of my school education, after passing school level, it was difficult for females to enter university education. I didn't get any opportunity to study with a female mathematics teacher in my student life. Females were under many restrictions within family, community and society, where most of the girls were busy in household chores and agricultural activities with their parents. They were not allowed to go outside of the home alone, travel alone, and participate in public programs. They were not open to speaking restricted to interacting with boys studying in same school, college and elsewhere. These were very much deeply rooted social norms and values of our culture. These differences in

the opportunities of life found between men and women have forced women in many contexts to bear a subordinate position (Shrestha & Gartoulla, 2015). I grew up in this kind of society and had to overcome this situation. I struggled during my school life and university education. So, this type of socio-cultural restriction was the boundary of a female for further study. From this, experience I want to explore viewpoint of other females about how did they overcome this problem to uplift their career?

In the context of Nepal, undergraduate level is a major milestone for any female to proceed towards a professional life. Because there are societies, culture has deeply rooted discriminating values and norms that stand as a barrier in fulfilling their aim for a beautiful future. In this situation, women in the field of education are still a minority regarding the social status of men in the common workforce (Kim, 2013). Higher Education Plan, Nepal (2016, p. 5) has mentioned that the government has encouraged approach to higher level education to all the targeted groups of people including women as well as financially and economically backward people and to provide them with assistance programs. The Constitution of Nepal has declared in the article 38 sub-article 4 and 5 that women shall have the right to participate in all bodies of the state on the basis of the principle of proportional inclusion and right to obtain special opportunity in education (The Constitution of Nepal, 2015, p. 24). If female get opportunities to use their rights given by the constitution, it is hoped to certainly support women's empowerment and have helped the females to form their identity. Furthermore, Sustainable Development Goals, in goal 5 it is mentioned to maintain gender equality for women and girls everywhere in all levels in Nepal by 2030. If women get the education from which they are empowered, then the education helps them to think critically and to develop life skills (Poudel, 2017). They can also analyze the real value of mathematics. Those different plans, policies and education system help women to be empowered; they can come forward and construct their own identity in society. Keeping these scenarios in mind, I was very much curious to investigate how the other females are utilizing this assistance programmed to gain university education and how did they struggle to build learner identity in mathematics at undergraduate level experience.

From these experiences, the major motive of this research study is to traverse the female mathematics teachers' narratives from their experiences of identity construction relating to learning journey in undergraduate level. It covers the research question of how do female mathematics teachers narrate the process of constructing their mathematical identity in undergraduate level, then support explanation of the research question to clarify the objective.

Purpose of the Study

The purpose of my research is to explore the female mathematics teachers' narratives of their experiences of identity construction in relation to their learning journey to undergraduate education. Furthermore, the study also aims at exploring how their identities are being constructed.

Research Question

This study answers the following research question:

How do female mathematics teachers narrate the process of constructing their mathematical identity in undergraduate level?

Literature Review

Dickinson, (2012), on her dissertation presented a study about five pre-service teachers' identity construction from junior year to on-site senior year program. Her findings

depicted the importance of the On-Site Senior Year Program [OSSYP] to provide the context for teaching identities. From this research, the understanding level and the knowledge level of the process of identity construction during the time while involved in teaching can be understood through narrative inquiry. Similarly, Kaplan (2016) investigated a study to find out the factors that influenced the evolution of the young girls' mathematical identities through narrative inquiry. The findings from this study revealed that the mathematical scenario the students created were influenced and inspired by the messages they perceived through their primary caregivers and their mathematics teachers, and also by the way they act and present their high quality of personality. Sapkota (2016) in his research study has explored about the university level EFL (English for Foreign Language) teachers and their identity in Nepal. The identity construction of the EFL teacher is directly linked with the socio-cultural perspective, teachers' interactive nature. The findings showed that maximum of the EFL teachers' shaped their identity without the institutional support: they actually did it through self-reflection. Basnet (2017) carried out a research in the context of Nepal where the social process of active participation of the students can build identity in additional language learning was investigated. The study reveals the eye of the learners which see their possible future selves through English language skills and help them understand the complex factors that help them in building student's identity. Adhikari, (2019) in his phenomenological study of girl students' identity construction in Nepal showed difficulties and struggle of female students. This struggle arises on account of patriarchal society system, false beliefs regarding mathematics and mathematics learning, and traditional meritocratic system of teaching learning.

Different local as well as global authors have shown about the dimension of identity construction varies according to students as there is difference in cultural and socio-cultural belongings and environment of each student. But, I couldn't find out research interest about how the female mathematics students coming from different backgrounds have shaped their identity as mathematics learner in Nepal.

I referred to Vygotsky's Self in Cultural-Historical Activity Theory (SCHAT) to make it appropriate to study about the identity construction of female mathematics teacher during their undergraduate education. The most important insight is about Vygotsky's dynamics of consciousness about a person; it says that it is essentially subjective and shaped by the history of each individual, social and cultural experience. Vygotsky states that "psychology is what recognizes the essential relationship between an individual's mental processes and interaction with cultural, historical, and institutional settings" (Rogoff 1990; Wertsch 1991; Wertsch et al., 1995 as cited in Yamagata-Lynch, 2010). Self in cultural-historical activities theory is also a cross-disciplinary framework for studying how self purposefully transforms natural and social reality, including them, as an ongoing culturally and historically situated, materially and socially mediated process (Leinonen, Aucamp & Sari, 2006). It gives the importance of transforming ourselves to natural, social and cultural reality (Stetsenko & Arieivitch, 2004). With the help of SCHAT, I discovered different experiences of female mathematics teachers and their strategy to build social as well as learner identities from their study period.

Methodology

This study was carried out with paradigmatic considerations as interpretive paradigm. The purpose of this study was how female mathematics teachers have constructed their learner's identity in mathematics at undergraduate education. For this, interpretive research allowed me to provide a substantial description of the details that are imperative in

contextual understanding (Bryman, 2012). I carried out the research with a value of critiquing other and transforming others. Critique was done on the traditional culture of learner experiences. The participant's narratives experience me to look in an integral way. In order to do so, the guiding philosophy of the research was based on integralism supported by interpretivism and criticalism (Taylor et al., 2012). The ontological position of participant's interpretive and critical paradigm is relativism and historical realism. Relativism stands on the view that reality is subjective and it differs from person to person (Guba & Lincoln, 1994, p. 110). Historical realism mentions that reality has been shaped by social, political, cultural, economic, ethnic, and gender values clarifies reality which believes that deemed plastic has become crystallized (Scotland, 2012). Epistemology is to clarify what is the conception of knowledge, its application and its features (Rescher, 2012). Epistemology of this research is multiple realities, multiple interpretations and societal ideology. In this research, the participant's knowledge is generated through the context of their learning journey experience. The axiology of research is value-laden, context-oriented, and subjective portrayal of the educational phenomena (Luitel, 2009). So, to fulfill it I have provided non-partial value and equal participation opportunity to all research respondents to reveal their stories pertaining to set up the identity.

This study is based on narrative inquiry to explore the stories of female teachers when they were in undergraduate level. Narrative inquiry depicts the teachers' experience (Clandinin & Connelly, 2000). Stories attempt to explain, understand and account for experience, experience does not automatically assume narrative form, but rather we constructed stories throughout the process of reflection on experience (Boase, 2008). So, narratives are composed of memories, experiences, knowledge, and reflections. In this study, narrative as a mode of inquiry actually means to study the ways female teachers experience their journey of mathematics in undergraduate education and how they are making meaning out of their experience. In this way, narrative inquiry assists me to understand and explore the experience-based knowledge of female mathematics teachers. For this study, four female mathematics teachers who have between 15 and 25 years of mathematics teaching experience are purposely selected from Tribhuvan and Kathmandu Universities. During the process of narrative construction of participants, I tried to maintain trustworthiness and make the research relationship authentic. I used an in-depth interview having open questions with participants. Throughout the process of narrative inquiry, at first, I took informed consent from each the participants to participate in the study and proceeded with in-depth interviews with each participant regarding the different phases of story in their journey of mathematics learning at undergraduate level. Then after, I transcribed interview information into the raw story and get along with developing it into narrative. Furthermore, the research proceeded with the interpretation of narratives. Finally, the themes were generated, then from those themes, sub-themes were generated for meaning making and then research was concluded.

Analysis and Discussions

In the course of four participants' narratives, I asked different questions regarding their undergraduate education. How do they perceive the transition from school to university education? How did they build their identity? They explained narratives in shaping their identity during undergraduate education of mathematics journey. Here, from the narrative inquiry of participants, I identified the ideas of the transition stage in two levels. The first level of transition was from their home relating to socio-cultural boundaries for females to further their studies and the second level was from school to university adjusting and transforming to the university environment. I generated themes based on these two transition

periods to address the research question. I have analyzed each story and interpreted the narratives relating them to theoretical perspectives and practices for meaning-making. Likewise, I have articulated one main theme, and based on the theme, I developed three sub-themes which are presented below.

Transition Period: A Milestone to Construct Identity

Entering university education opens up and creates various career opportunities and challenges for the female students. Wangeri, Kimani and Mutweleli (2012) pointed out that comparing the home environment and setting, the physical and social environment of the university is new, overwhelming and intimidating to some students. During this stage, every female student faces their challenges and takes steps towards their career which turns out to be a milestone for their identity construction. I studied Gautam (2017), leaving the village, leaving parents and leaving school and travel to a new place is the transition period of people to make their carrier. In this research study, Kiran, Nisha, Mamata, and Sabina narrated their stories which they had faced bitter reality and obstacles about the early stage of transition period moving from the school education towards the university education. First and the foremost obstacle of the transition period in the line was the socio-cultural perspective that is the bar of the societal rule and regulation. The cultural differences, poverty, and socioeconomic conditions were the hindrance of female for further study (Parajuli, 2010). In this cultural difference scenario, Bhandary (2017) have reported that some parents believed that daughters do not need an education for their roles as housewives after getting married. Due to poverty, daughters are taken as a financial burden for the family. In this scenario, Mamata expressed that she left her parents' home and move to her husband's home after getting married, so her parents thought that the investment on her education was nothing more than a waste of money. In those days, the society did not encourage the thought about sending the daughters far away from home for studies. If some families were found sending their daughters away for study, they used to suffer a lot from backbiting from their societal members. Thapa (2012) agreed that society looks women with a wrong perception regarding their thoughts, actions, appearance and social roles. According to Kiran's plan of achieving higher education, it was always affected by the people around. She had to pass through the ups and downs of the social superstitious perception. The mentality was that daughters were the ones who went to their husband's home; they had the thinking that it would be useless to spend money for their education as it was just "investment without return", the whole society would think of it. Bhattacharjee (2017) expresses that many parents view educating sons as an investment because the sons will be responsible for caring for parents when they are old, so they see son's education as an investment. Similarly, Nisha's situation was pretty much similar to Kiran's. The perception of society was that educating a girl would be no longer useful since they were sent to their husband's house. Both Nisha and Kiran's stories were not different from each other in this scenario. In this regard Olmos (2011) states that "Female education is consequently viewed as a useless investment". So, the societal members didn't want to invest in further study of the female.

Mamata's and Sabina's situation was also growing through the same kinds of challenges and obstacles as the family and society. The first and foremost thing was that the economic condition of their family was poor. UNESCO report 2015 mentions that the economic status of the household is a key determinant of the transition to higher education. Mamata and Sabina had faced such kind of transition. Another thing was that their parents didn't find it easy to send them away for study because they were female. Sending girls away was not normal in the society back then. They were supposed to discontinue their study to

get ready to go to their husband's house, take care of her husband and his family and help them at work. The misleading concept of the society was one of the serious obstacles that Nepali culture supports those females who were born only to serve males domestic chores, and to work on farmland (Bhandari, 2013). It was the concept that the entire society would have in the past. Here in the perspective of self in cultural historical activity theory (SCHAT) as Stetsenko and Arieviditch (2004) say that socio practice expresses the certain mechanism that causes a transition between the individual and socio-cultural process. Here, the participants are also struggling to make the identity in education grow through the prevailing socio-cultural practices and barriers in a transition period from school to university. In my experience, those types of obstacles came into their transition period when the female challenged the harsh rules and went against the cruel role of the society of not sending the girls far away for studies and going away from home to pursue higher education. The transition phase from high school to university is filled with challenges about the adjustment and to a new environment (Chidzonga, 2014). The second level challenge Kiran, Nisha, Mamata, and Sabina were facing how to comfortably get adjusted in a university education and to adjust in a new place and environment. I presented the following sub-theme related to their transition period to construct their learner identity in Undergraduate education.

Challenges Give Birth to Opportunities

Like a frog leap out of the pond, looks out to a totally new environment; a female also goes to university, gets an opportunities to explore a new environment. There is a totally new and different environment, lifestyle, new friends, teachers, and whole campus society. The challenges include adaptation to new environment, get familiar with new friends, new teacher, and get used to new pedagogy and equipment. Chidzonga (2014) added their challenges create great difficulty in adapting to higher education further. There is also a challenge while choosing the right subject. After choosing right subject for them, there are opportunities; opportunity helps them to transform their knowledge and skill to deeper level.

According to Kiran, after getting enrolled to the university education, she faced challenges to get adjusted and transform in the university environment. She said that *"the environment and education were new and all the friends and teachers were also new."* How to get adjusted to the new environment was a part of my struggle. There was an opportunity too. After struggling in the new adjustment in new environment there was also an opportunity to prove herself in the new environment. Thereafter, choosing a major subject was also another challenge. She was interested in mathematics since childhood. Her father also suggested her to optional for mathematics but her friends advised her not to take mathematics as a major subject. In this situation, she was in a dilemma about which subject to choose. In this context, Mezirow (1978) when any person has an experience which does not fit with pre-existing meaning structure causes disorienting dilemma. After choosing the subjects there were opportunities to develop her future career through mathematics.

Firstly, the challenge for Nisha was to get adjusted in the new environment and to pick the subject like Kiran. Another challenge that Nisha had to face was that there was no good English teacher where she did her schooling, so she had to face some complications in foreign language. Language comprehension may impact students' attitudes toward mathematics learning and, as a result, their self-efficacy too (Truxaw & Rojas, 2014). To face the challenge she took an extra class in English and got opportunity to increase her knowledge in English. Vygotsky described how learning was undertaken through a large interaction of linguistic, with learner understanding depending on dialogue with a more

learned other in a 'zone of proximal development' (Vygostky 1978, as cited in Stables, 2009). After facing the challenge, it helped her to gain greater appreciation of challenges and affordances inherent in learning mathematics as a second language.

Mamata and Sabina also had quite a similar struggle. They did not have difficulties to choose their major subject as they were dedicated to study mathematics as their major subject. The first hurdle for them was a poor financial condition. There were no any financial support for Mamata. The poverty she grew through was one of the main barriers in order to make her career. There exists a deeper connection between higher educational attainment and the economy (UNESCO, 2015). After facing this difficulty, Mamata, Kiran, and Sabina were granted scholarship benefits for their achievement as the top students in the class and got privileged to study further and show their accomplished. In my opinion, those particular women who can cope with the different challenges and other obstacles, get opportunities to transform them and can help them to generate their identity.

Trace of Identity

When Kiran, Nisha, Mamata, and Sabina entered the enchanting world of university, they chose mathematics as their major subject. They started measuring distance of their career in mathematics education. They began to visualize and analyze different aspects to gather blocks in building up their mathematical recognition. When a running race is about to start, athletes generally start from a given mark just like a trace which is the starting line. Likewise, they started communicating and making friends circle accordingly. They tried to intermingle and adjust themselves in different situations among the university society friends and teachers. They slowly changed their value belief like creating a mark for identity.

Here, my four participants chose mathematics as their major subject. The first stage of marking their identity is to choose the subject of their interest. They started sharing, discussing, interacting ideas and problems with their friends. Varelas, Martin, and Kane (2012) argue that the ideology of the academic identity that the female were constructing was marked by exploration, questioning, challenging ideas, seeking understanding, making mistakes and learning from them. Similarly, they gained their confidence to interact and question their teachers. Their self-confidence and taking responsibility for their learning of mathematics to some extent helped in building social relations between the teacher and themselves (Norén, 2011). In this context, Nisha shares her feeling in this way, "*when I heard the result; at first, I couldn't believe it myself. Wow! I topped the campus. I became so happy and desperate to share this news with my family, especially to my teachers*". With the support of teacher, Nisha worked harder and topped the college in undergraduate level. Kiran invested her maximum time for mathematics, took help of her friends and was successful to be the only regular passing female student in mathematics group. Similarly Mamata was a remarkable student in mathematics. She used to frequently ask questions to the teachers and help all of her friends in studies. Likewise, during the time of practice teaching, she went to one of the schools to take classes. When she returned from the practice teaching she was awarded by the school as the best female mathematics student teacher in history of teaching practice at that school. Sabina was a bright student in mathematics. There was a non-native teacher teaching them mathematics in a foreign language. Most of the students were facing a language problem and pedagogy. She acted as a guide to her friends. Whenever the teacher was absent Sabina used to take classes as the teacher's substitute and make her friend's concept clear. She began with gaining teaching experience between friends circle which can be seen as she indirectly stepped to a teaching career. When she took her final exam,

topped her class. Not only that, she obtained the highest mark in mathematics as well. She started trace/shaping her identity in her group, campus and the entire society. According to Vygostky (1978) in his self in cultural-historical activity theory, the view of an individual is always affected by the social, cultural norms, values and thus grows forward creating his/her identity within a society accordingly. In this way, all four participants set up the mark for identity in mathematics at university society in undergraduate education. I realized that being laborious and doing continuous hard work traces a mark for identity.

Empowerment Leading to Professionals

Women empowerment includes women's awareness of their rights, self-confidence, to have a control over personal and professional lives and their ability to bring a change in the society. Earnest (2002) discussed that empowerment as a process of gaining power in particular domains of activity by individuals or groups and also as the processes of giving power to them, or processes that foster and facilitating them taking of power. Similarly, Empowerment is also acquiring knowledge and awareness which enable them to move forward towards life with higher nobility and personal pledge (Dominic & Jothi, 2012) However, women are subjected to the will of their fathers, brothers, husbands, and sons regarding the decision making and power (Rich-Zendel, 2006). These were the conditions when there was a lack of empowerment. Slowly, when Kiran, Nisha, Mamata, and Sabina reached undergraduate level, their capability got enhanced which led to self-empowerment. Here, when they arrived at that level they found their way towards a career, became motivated and empowered themselves. They made the meaning through experience that eventually leads to new concrete experience and future direction. When students make meaning from their experience they succeed in personal transformation and empowerment (Mizero, 1991, as cited in Luitel & Wagley, 2017)

According to Kiran, Nisha, Mamata, and Sabina's narrative they became little bit matured and started thinking differently. They got opportunities to increase their skills and knowledge level for survival and also obtained knowledge about the accessibility to more enterprising career paths for women. They gained confidence and also came to realize the importance of mathematics education and empowerment. In this context Schenk, & Schroder, (2018) agrees that in order to provide equal status in the society women need to be empowered. From the participant's story, I also agree with Bhattacharjee (2017) that "It is impossible to think about the welfare of the world unless the condition of women is improved similarly as it is impossible for a bird to fly on only one wing". The best way of empowerment of my research participants was perhaps through empowering women with knowledge, skills, and abilities. I found that if female are empowered firmly, they become able to make their career.

Conclusion and Reflection

During the journey of this study, I found that for identity construction, it takes a long period of time. The identity construction is a story of struggle and has been a multi-dimensional construction, in the sense that it goes along with the transformation of different societies and culture. In terms of undergraduate level, what could be observed was that they had to grow through the transition like coming out of society to the common social ground and to adjust themselves in a new university environment. After they faced the challenging situations, they got the opportunity to gain higher education. Then, gaining an education; they got empowerment to assert their identity and moved towards career path slowly. They struggled a lot in order to strengthen their identity by exposing themselves to society. The twists and turns in their life the timely transformation of society, culture, residential status,

struggles, motivation, inspiration, and dedication provided them with an opportunity to construct their identity.

This research stands out to be a platform for knowledge enhancement as I learned so many different things. At first I learned what identity really is; what it does take to be constructed and then I learned about identity fluctuation along with the change in the environment where we live in. It provided me with golden opportunity to look back to my past and discover myself and my identity till date. As my research is based on narrative inquiry, I learned various valuable lessons from each female participant about undergraduate education journey. I figured out that every female has their own unique story of their experience which is bound by struggle and experience. Some struggled financially, some socially and some emotionally which make their narratives different and unique in their own way. Though these difference in experience and struggle, the way of success is similar which is because of their continuous hard work, dedication and strength to go against the harsh barrier of the society. Similarly, this research has also allowed me to explore the situation of female students' in Nepali culture and society about how this very society and culture become both the source of a boon as well as a curse during identity construction.

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