International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979, Impact Factor: (RJIF 5.72)
www.allsubjectjournal.com
Volume 3; Issue 3; March 2016; Page No. 81-91

A study of mathematical aptitude of third gender and their attitude towards mathematics

Sneha Tyagi

Student, M.Sc Mathematics Education Cluster Innovation Center Delhi University

Abstract
There are umpteen number of studies present which throw light on the association of mathematics with binary genders. These studies are related to the aptitude, attitude, achievements, phobia, interest, anxiety level etc of boys (males) and girls (females) only. The people belonging to the third gender community have never been considered in relation to mathematics. Studies have shown that the people of third gender community face discrimination in every aspect of life which in turn make them a deprived minority of society. So, the present paper attempts to study about the third genders' aptitude and attitudes towards mathematics. The usage of mathematics in their daily lives has been discussed in this paper. The perspective and outlook of third genders towards mathematics has also been highlighted. We all do have an aptitude of mathematics but some get the chance to foster and learn about it. But some do not get the suitable environment, facilities, education etc in order to nourish and develop it. The researcher is keenly concerned to know more about the connections of mathematics and gender. Hence this exploratory research design was used to conduct this study that enabled us to know whether the gender of a person really makes a difference to mathematical aptitude. Mathematical aptitude test and the interview schedule were the tools used to generate relevant data for the study.

Keywords: mathematical aptitude, third gender

Introduction

The society is considered as a combination of just two genders broadly. The laws, rights and changes are brought just for the two main stream genders. The school or education system is always formulated keeping in mind the two genders. These two genders include the male and the female. (Whether they are students or teachers). Nonetheless, we come across persons who don't come under these two broadly known genders in our day to day lives. Despite this, the laws, rights, changes and society do not think about them and have a tendency to overlook them. These people are known as LGTB (Lesbians, Gays, Transgender and Bisexual). They are not taken seriously and are considered abnormal. This kind of social response makes them to detach themselves from the mainstream and form their own groups. They are found in a minority and follow their own rituals, customs and traditions. They do not even get their family support and so they leave home and join various people who are just like them. They done not identify with the gender stated on the birth certificate and so has no access to jobs and education. They are abused and have to beg or take up prostitution for survival. But that does not mean that they are not 'human' or they have not had their childhood. We have so many eminent personalities who do not belong to so called two mainstream genders but have created an identity for themselves and are also known for their work. Some of them include renowned personalities like Giorgio Armani, Rohit Bal, Angelina Jolie, Laxmi Narayan Tripathi and many more. But they face umpteen number of difficulties and are debarred from schools and other social institutions and activities to get the recognition from society.

The present study focus on the education of eunuchs and therefore includes them as the sample for the study. Theories and researches focus on the liking, phobia, attitudes, and aptitudes of the two genders in education specifically towards mathematics. But there is not a single study which has ever talked about the relation of mathematics with the third gender. Education is not just limited to the school boundaries and not just with in the two genders. It is for the human kind and mathematics is the essence of the world.

As there is a right to education RTE for everyone whether the child belongs to any gender, caste and creed, so in that manner the third gender people also hold the same right to get educated. UNESCO initiated the concept of EFA (Education for All) that has brought home the beautiful concept of Inclusion which demands that there should be such educational policies, programmes and institutions so that education is accessible to everyone. It should also include minorities into the mainstream as all of us have equal rights to educate.

Now, India is among those countries who give dignity and rights to the third gender. These minorities have got the special recognition in various countries as well. This three-gender-choice system was first introduced in 2011 in Australia. In 2011, Nepal was the first nation who allowed the people to register as a gender other than male or female in its national census. New Zealand acquired this suit in 2012. In 2013, Germany was the first European country that gave the right to the parents of babies that have no clearly defined gender characteristics can leave the binary field on birth certificates and select the category of third sex in the public register. In Thailand and Cambodia, kathoey or ladyboy is the category or term used for those males that dress and behave like women.

Investigator was wondering about the usage of mathematics by third gender in real life unconsciously(just by standing on the alternative red lights and counting of their daily begging)…perhaps any of them ever studied mathematics in

their lives and at any point of time wanted to study it further and could not do it.

Since the Supreme Court has given them a special name "Third gender". And for the first time India's election Commission allowed a third gender choice on voter registration forms as others. Delhi University has also introduced a separate category in application form for post graduate admission and jobs in D.U. 9 students from transgender community have applied for post graduation in university of Delhi. So why cannot we educationist try to develop their interest in education and specifically in mathematics? We can enable them to see the relevance of knowing mathematics in their lives. How the knowledge of a single subject/discipline can change the way of living and earning their livelihood? As mathematics is just not a subject rather it's a way to see and perceive things analytically. This outlook can be helpful for them. Or it can be possible that any of them doesn't want to live their life and dream of to be a teacher. (as they have full right to be the part of mainstream.). This study explores the relationship between everyday practices and mathematical understanding of third genders.

Framework

The people of third gender community belongs to the low social class. They face so much discrimination that they themselves set back from the normal activities of mainstream population which in turn deteriorate their education and upbringing. Their (barbaric) personal history regulates their preferences (regarding education) in their lives which determine their action (of quitting or non going to school). Hence, they start begging and prostitution for earning their livelihood and education takes backseat in their lives. This scenario is confirmed by Bourdieu (sociologist) as he says that every individual's personal history, preferences and disposition are placed in the context of the surrounding social reality that to a certain extent predetermine the individual's potential courses of action. Social class, education, upbringing as well as individual's past choices all form the part of the structure in determining part for the behaviour of an agent in the field. This is the framework of the present study.

Hypothesis

There is no significant difference between mathematical aptitude of third gender and male & female.

Significance of Study

This data regarding of binary gender has been taken from National Sample Survey Organisation (NSSO), All India School Education Survey (8th AISES), Census of India. gov.in. which are the most reliable and authentic statistics that covers even the minute information of various areas.

Table 1

	Male	Female	Total
Population	623270258	587584719	1210854977
Enrolment	66,370,683	61,590,567	127,961,250

Source:- National Sample Survey Organisation (NSSO), 2011, NCERT, New Delhi.

None of the data shows any representation as far as the third gender is concerned. This shows the absence of knowledge and information about the third gender. Similarly, there are tons of studies and literature about the linkage of mathematics with males and females. This study aims to link the subject mathematics with the third genders' aptitude towards the same. The research aims to know their attitude towards mathematics and the ways in which they use mathematics in their lives. Since there is a paucity of research done in the area of third gender, this study can be the first ever in itself. We all do have an aptitude of mathematics but some get the chance to foster and learn about it. But it also happens that some do have this aptitude but could not get the suitable environment, facilities, education etc in order to nourish and develop it. And in some cases, inspite of having this aptitude people do not have the attitude towards mathematics. The researcher is keenly concerned to know more about the connections of mathematics and gender. Hence this study would enable to us know whether the gender of a person really makes a difference to mathematical aptitude.

Objectives

1. To compare the mathematical aptitude of third gender with respect to other binary genders.
2. To explore the usage of mathematics in their daily life.(in order to know their attitude)

Methodology

Population: - All the people who belong to Third gender community are the population for this study.

Sample:- Convenient sampling has been used for the study. It consists of those persons that are available for the study. It is used because of paucity of time and difficulty of contacting those kind of people. So, 10 males, 10 females and 10 people of third gender community have been treated as sample for this study. Research includes 10 males of 20-30 years of age group, earning 4,000-10,000 rupees per month with schooling upto 5^{th} grade or no formal schooling. Similarly, 10 females of 20- 30 years of age group, earning 4,000-10,000 per month with schooling upto 5^{th} grade or no formal schooling. 10 people of third gender community of 20- 30 years of age group, earning 4,000-10,000 rupees per month, with schooling upto 5^{th} grade or no formal schooling have also been taken as sample for the study.

Tools:- Self-made Mathematical aptitude test having 20 pictographic questions covering basic counting, simple operations i.e addition, subtraction and mathematical skills like Estimation, quantification, grouping, analysis, combination, differentiation, classification, seriation, conservation, shape recognition, transformation, orientation has been prepared by the investigator to collect the data. Interview schedule to test attitude of third gender towards mathematics has also been prepared. Interview schedule has been used for qualitative data analysis.

Research Design

Exploratory design would be the approach of this study. The major emphasis in this design is on discovery, ideas and insights as such. This design provides opportunity for considering different aspects of a problem under the study. The researcher is keen to explore the various aspects through the present study.

Keywords (Definition)

Aptitude

According to Encyclopedia Britannica, "Aptitude is a natural ability, talent and capacity for learning (language/mathematics). It is a special and usually inborn ability (has an aptitude for math)

Attitude

According to Encyclopedia Britannica, "Aptitude is a

- a mental position with regard to a fact or state <a helpful ~>
- a feeling or emotion toward a fact or state
- an organismic state of readiness to respond in a characteristic way to a stimulus (as an object, concept, or situation)

Third gender

- According to Supreme Court, "Hijras, Eunuchs, apart from binary gender, be treated as "third gender" for the purpose of safeguarding their rights under Part III of our Constitution and the laws made by the Parliament and the State Legislature. Transgender persons' right to decide their self-identified gender is also upheld and the Centre and State Governments are directed to grant legal recognition of their gender identity such as male, female or as third gender."

Delimitations:- The study is delimited to only 10 people of third gender community because of less time available to conduct this study. It is delimited to the area of north Delhi only as it is near by the residence of researcher and availability of people of third gender community in that area. There is paucity of research studies in the related area so less in depth literature studied for the study.

Summary of Review of Related Literature

All the studies undertaken in this field talked about performances and achievements of males and females in mathematics. Majority of them threw light on gender differences regarding mathematics. However, none of the study had been taken into account the relation of third genders with mathematics. Therefore, the investigator has decided to undertake this study in order to study the mathematical aptitude of third genders and their attitude towards mathematics.

Analysis and Interpretation of Data

Basic Information

Surprisingly, nine out of ten people from the sample of third gender community are not sure about the exact date or month of their birth but they tell their age very confidently. Only 2 of them are from Delhi. Majority of the respondents belong to outside Delhi (other states). All of them belong to a relatively lower socio economic status. The average income of all the respondents ranges between Rs 4,000 to Rs 7,000. Eight out of 10 got chance to study mathematics in school. All of them had to leave the school as they were teased by elders, neighbours at home or bullied by other students in schools.

Sushila (name changed), 22, from Calcutta, "Mujhe sharam aata tha sab k saath jane mein, sab mujhko hijra keh k chedte the." They had to earn money for themselves and for their family so they left school and village. They came to Delhi, joined the group and started begging. According to them, they do not get any other job so they are bound to beg. Rakhi (name changed), 30, from Andhra Pradesh, "humko koi job nahi deta kyunki hum ese hai isliye liye." Only one out of 10 is working as a sweeper in an institution but there also she is being harassed and forced to leave the job. So, begging remains the last option to do for their survival.

Affinity For Mathematics

Six out of eight liked mathematics in schools and want to study it further if given a chance. They feel that mathematics may be useful for them as learning and studying is always good to make the person better and upgrade their social status.(If she ever gets a chance to study mathematics or anything, she would do.) Majority of them think that girls do better in mathematics than boys as they are serious about studies. All of them can pronounce single digit numbers only in English or Hindi. They cannot join 2 different digits and pronounce as a complete number. They spell both digits as a single one.

Usage of Mathematics in Daily Life

According to them, they directly do not use mathematics in their daily lives. But after a little intervention with them, they said they do use numbers to count their earnings (begging), paying rent, covering electricity and water bills, saving mobile numbers, buying clothes, etc. Each of them contribute in paying house rent as they live in groups. (She pays 2500 rupees as a rent of her house.) Every person of third gender community has a guru. Each Guru has 50-60 groups. There are 4-5 people in a group. They give their earned money to their respective 'Gurus'. Guru does the money distribution among the group. Rani(name changed), 26, Delhi, "jese hum 4 log badhaai toli pe jate hai agr 11,000 mile toh guru ko dete hai fir guru use se nayaaj ka nickaal k apna hissa rakh k fir hum 4 mein baat dete hai." They have been begging for years in Delhi. They learnt numbers and counting from begging and members of their group. Guru teaches them the required mathematics that is essential and useful for their occupation. Reeta (name changed), 20, calcutta, "guru ne 100 tak sikhaya, ye 10 ka note h, 5 ka note h, 20 ka note h bas wahan se a gaya." They earn more from 2pm to 8pm. Majority of them understand the meaning behind green light and red light and work according to lights. If any of them face difficulty in understanding lights then other members tell his/her to act according to traffic. Sooner or later, they get to learn the traffic lights. Guru sends different people on different transactions of lights. They earn more during holi and diwali i.e. in month of march and October. Majority of them do not play any game. They go for begging from morning till evening and have to do prostitution work in night. So, they do not get time to play. Only one or two confirms that they play snakes and ladders, Ludo and carom.

Professional Interaction

They themselves do not charge differently from persons. They work or charge as per their Guru's order. They get information of events from neighbours or people of the specific locality. They charge differently for different occasions but that too is guided by the Guru. So, they do not decide about variations in charges. There is a hierarchy in every group wherein Guru are placed on a higher position while the others occupy a lower

one. So, they can not take decision about monetary aspects. But they can estimate their profit or loss without going for any complex mathematics. As Munni (name changed), 20, Gujarat, "Poor family kam deta h toh nuksaan hota hai rich family deta hai to faida hota hai." They do not have any bank account. They either give to their respective gurus or send money to family at village. Only one out of ten confirms that she opened an account recently under the scheme of zero balance that Prime minister offers for everyone but for transaction and other services she is dependent on others.

Analysis for the Level of Proficiency in Basic Mathematics Skills

1. Although only four in numbers but still females and third gender attempted the question one better than males (2/10). This question was about to select an animal from given options and seriate it with other animals in the given specific order. The collected data shows that seriation logic of pictographic things needs supplement help like formal schooling or education, as only 10 out of 30 answered it right. Higher ability of seriation is absent in the sample. Their routine jobs don't include and emphasis on seriation so they are not able to develop the seriation ability.
2. Almost all samples of third gender (8/10) rightly answered question two then males(6) and females(5). This question was containing the four pictures of cards in serial order of counting. Respondents had to select and tell the fifth card from the given options. The aim was to know their knowledge of simple numbers. Their basic schooling helped them to answer it right. Moreover their working condition like begging involves knowledge of basic counting. As 19 out of 30 attempted it right. This proves that irrespective of formal schooling, the working conditions of persons help them to know and learn the basic counting and knowledge of numbers. So, ability to recognise simple numbers is there in samples.
3. Three of each third gender & female and only two males answered question three right. This question consisted of arrows in different colours. Respondents had to select from the given options by analysing the similarities and differences of arrows shown in question. The aim was about to test the ability of analysing the pattern and orienting the things. The difference is very marginal(10%). Here, we see that skill of analysing the similarity and difference between two or more objects is only fostered in educational environment or formal schooling as just eight out of 30 answered it right so the analysing ability was not present in majority of the studied sample.
4. Equal number of trio genders (3/10) attempted the question four. This question was having square blocks consisting red coloured dots moving in a specific direction. Respondents had to select the next placement of dots in square block from the given options by looking the direction of dots shown in question. The aim was to test the ability of analysing the orientation of dots. Since only nine out of 30 attempted it right, it is observed that thinking about pattern in the area of direction requires formal schooling. Ability to orient things in particular direction is missing in majority of the samples.
5. Same number of males(5) and third gender(5) answered question five right than females(2). This question was about the estimation of quantity which comprises five groups of different shapes and respondent had to estimate and select that group which was having large number of objects. This found data shows that aptitude/ability of estimation might not be present in everyone. But estimation skill is fostered with more experience of the outside world. Males and third genders get more chance of dealing with people and do variety of things outside home so, they did well in estimating the large number. The selected samples were from the age group of 20-30. Since this estimation ability should have been developed with the age and experience, but that was not found true for all the samples, as just 12 out of 30 attempted it right.
6. More of third gender (8/10) answered question six right than binary genders male (5) female(6). This question was about simple pattern of counting but with sticks not with only numbers. The aim was to know whether they can handle a little variation in simple number counting. This shows that third gender can deal with little variation in counting, whereas males and females struggled with the arrangement of the sticks in the pattern, not with the counting as such. Males were least bothered about the patterns of sticks next comes the females and best out of sample were third gender because males and females are subjected to one to one dealing in their working condition on other hand third genders have to deal with many things at a time like traffic lights, vehicles, people, money. So, they focused on both factors (counting and arrangement of sticks) and answered right.
7. More of third gender(5/10) answered question seven right than binary genders male(3) female(2). This question was based on similarity among shapes and colour combinations. There were different figures. Each figure has specific design. That design is present in and out of that figure but in different colours. Respondents had to select from the given options by keeping the given pattern in mind. 1/3 rd of total sample i.e. 10 out of 30 answered it right. Half of third gender answered right. Sample were not able to combine two different aspects altogether for answering. 1/3 of the sample answered on the basis of shape, next 1/3 of sample answered on the basis of colour rest of the sample answered right. Ability to combine various aspects while answering the question is not present in the sample.
8. Almost all third genders(10) and females(10) rightly answered question eight then males(9). There were 17 cookies of three shapes i.e. triangle, square, and circle. This question was about to differentiate the cookies and select those cookies that having corners in them. The collected data shows that basic knowledge of shapes can be acquired even without non schooling and working in the outside world can bring this knowledge to any person. Basic shape recognition ability is present in almost all the samples. This aptitude is present in all of them.
9. Almost no one attempted question nine right. This question comprises a picture of two sets of bangles. Although the number of bangles were same, but both the sets were placed a little tilted. Respondents had to estimate, conserve and select that set which is having more/less number of bangles. The aim was to test the

conservation skills of respondents. Only one out of 30 answered it right. Although each set of bangles comprises same bangles but everyone chose one set of them because they could not conserve the idea that the both sets are same. Inspite of analysing the length of bangles set, they reached to their conclusions and answered the question wrong. So, aptitude or ability of conserving is not present in anyone. But conservation skill can be acquired by education or formal schooling.

10. Same number of males(10) and third gender(10) answered question10 right than females(8). Almost everyone answered this right. There was a pictorial complete square in the question. The square was cut from one corner first and then from another opposite corner. Respondents had to tell the number of corners present in all three pictures. This is the question of shapes that again shows that basic knowledge of shapes can be acquired or learn even without schooling. Working in and outside world can bring such kind of knowledge to any person. Shape recognition is present in all the samples but schooling can help them to know more about the naming and dimensions of the shapes.
11. More of third gender(4/10) answered question 11 right than binary genders(2,2). This question was containing five different polygons. It was based upon two aspects one is of different shapes and second is to seriate them according to number of sides. The aim was to test their aptitude of seriation. Most of the samples were inclined toward the sizes of the polygon rather than the number of sides in the polygon. Respondents answered on the basis of size. This shows that seriation on the basis of size is easily adaptable as compared to number of sides of polygon as it includes geometry as well, which made the question a little complex.
12. More of third gender(6/10) answered question 12 right than binary genders female(1), male(3). This question was based on simple subtraction of lines in different figures. There was a figure, two lines were added in that figure and then those two lines were removed from that figure. Respondents had to choose those added and removed lines from the given options. In this question males and females got confused themselves as the subtraction concept was induced in pictorial question, whereas third gender focused on subtraction concept, so more of third gender attempted it right. only 10 out of 30 answered it right because ability of using a concept in different context requires higher skills, training and aptitude.
13. Same number of females(8) and third gender(8) answered question13 right than males(6). There are three different figures. In first step a cross is added to each figure and in second step that cross is transformed into small four dots. Those four dots are placed in four different directions. Respondents had to select the required figure from the given options. This question needs the skill of transformation of lines and their arrangement in figures. The collected data shows that ability of transformation is present in most of the sample studied as 22 out of 30 answered it right.
14. Just 10 percent third gender(3/10) answered question14 right than males(2) and females(2). There was a picture of wheel in the question. A one-fourth section is cut out of wheel. There were four options which were looking alike. Samples had to select among them by focusing on shapes. This requires a little minuteness for shape concept because size is also another factor to look upon. Seven out of 30 answered the question right. Those who answered it right were by coincidence as they were not sure whether they could even answer it right. This question require both shape and sizing concept together with very little changes in the available options. The samples have aptitude but lags required attitude, because when shape and size concepts were dealt individually the results were much better.
15. Almost all females respondents (9/10) rightly answered question15 than males(2) and third gender(4). This question comprised pictures of four sarees in which respondents had to estimate about the sarees' weight and select the lightest saree among them. The collected data shows that ability to estimate the weight is present in half of the sample. Since this question requires the estimation skill of weight of different sarees which is a thing mostly used by females. Males did not have any interest in the object of question so they were at last, second in order comes third gender. Almost all females answered it right as this question is of their interest and they might have the experience with clothing (texture and weight). Ability to estimate can be fostered with experience.
16. Third gender(7) and males(6) rightly answered question16 than females(2). This question is about the size of figures. The aim was to test the aptitude of analysing big and small or making comparisons among figures. There are five options for the answer out which two were nearly same with little change in orientation, most of the females did not pay attention towards the minute changes in orientation whereas males and third genders were very detailed. Hence ability of analysing size is present in everyone but skill of orientation lags in samples which in turn affects the quality of answering.
17. Although only two in numbers but still males and third gender attempted the question17 better than females(1/10). This question was about to make a new figure join two similar shapes of different colours in different orientations and select the answer from given options. The aim was to check the presence of aptitude of adding the two different objects and just combine them with a little focus/observation. Since sample belongs to low socio economic background and their main goal for life is to earn bread and butter. So they hardly focus on detailing of concept or process. Hence only five out of 30 answered it right.
18. More of third gender(6/10) answered question 18 right than binary genders female(4) male(3). There is a complete pattern of different colours and shapes in this question. There are nine blocks out of which eight were given. Respondents had to choose from the given options for the ninth block. 13 out of 30 answered it right. Rest of them were not able to combine two different concepts altogether for answering. Ability to combine various aspects while answering is not present in the sample. Such skill can be developed by formal schooling.
19. All third gender(10) answered question 19 right than binary genders females(8) males(6) . This question is about the classification of various figures in different categories of shapes (circle, quadrilateral and triangle).

Six respondents who answered wrong were classifying on the basis of colours rather than focusing on shapes, but 24 out of 30 answered right which again proves the presence of ability to recognise and classify the figures under different category of shapes.

20. Males(3) answered question 20 right than females(1) and third gender(1). This question was a step ahead as it required orientation pattern. There were three different figures in different orientation pattern. They had to select the answer on the basis of direction pattern from given options. This needs aptitude for direction or orientation. Five out of 30 answered it right. Aptitude of direction or ability to orient the pattern is missing in the sample. They do not do a little extra effort to think about direction for right answer. They just answered and overlooked the concept of direction in question.

Analysis for the Level of Proficiency in Basic Mathematics Skills (Extended Analysis (Skills/Theme Wise))

Knowledge of Estimation and Conservation

Same number of males (5) and third gender(5) answered question five right than females(2). This question was about the estimation of quantity which comprises five groups of different shapes and respondent had to estimate and select that group which was having large number of objects. This found data shows that aptitude/ability of estimation might not be present in everyone. But estimation skill is fostered with more experience of the outside world. Males and third genders get more chance of dealing with people and do variety of things outside home so, they did well in estimating the large number. The selected samples were from the age group of 20-30. Since this estimation ability should have been developed with the age and experience, but that was not found true for all the samples, as just 12 out of 30 attempted it right.

Almost all females respondents (9/10) rightly answered question15 than males (2) and third gender (4). This question comprised pictures of four sarees in which respondents had to estimate about the sarees' weight and select the lightest saree among them. The collected data shows that ability to estimate the weight is present in half of the sample. Since this question requires the estimation skill of weight of different sarees which is a thing mostly used by females. Males did not have any interest in the object of question so they were at last, second in order comes third gender. Almost all females answered it right as this question is of their interest and they might have the experience with clothing (texture and weight). Ability to estimate can be fostered with experience. Almost no one attempted question nine right. This question comprises a picture of two sets of bangles. Although the number of bangles were same, but both the sets were placed a little tilted. Respondents had to estimate, conserve and select that set which is having more/less number of bangles. The aim was to test the conservation skills of respondents. Only one out of 30 answered it right. Although each set of bangles comprises same bangles but everyone chose one set of them because they could not conserve the idea that the both sets are same. Inspite of analysing the length of bangles set, they reached to their conclusions and answered the question wrong. So, aptitude or ability of conserving is not present in anyone. But conservation skill can be acquired by education or formal schooling.

Aptitude for Basic Counting and Addition / Subtraction

Almost all samples of third gender (8/10) rightly answered question two then males (6) and females(5). This question was containing the four pictures of cards in serial order of counting. Respondents had to select and tell the fifth card from the given options. The aim was to know their knowledge of simple numbers. Their basic schooling helped them to answer it right. Moreover their working condition like begging involves knowledge of basic counting. As 19 out of 30 attempted it right. This proves that irrespective of formal schooling, the working conditions of persons help them to know and learn the basic counting and knowledge of numbers. So, ability to recognise simple numbers is there in samples.

More of third gender (8/10) answered question six right than binary genders male (5) female(6). This question was about simple pattern of counting but with sticks not with only numbers. The aim was to know whether they can handle a little variation in simple number counting. This shows that third gender can deal with little variation in counting, whereas males and females struggled with the arrangement of the sticks in the pattern, not with the counting as such. Males were least bothered about the patterns of sticks next comes the females and best out of sample were third gender because males and females are subjected to one to one dealing in their working condition on other hand third genders have to deal with many things at a time like traffic lights, vehicles, people, money. So, they focused on both factors (counting and arrangement of sticks) and answered right.

More of third gender(6/10) answered question 12 right than binary genders female(1), male(3). This question was based on simple subtraction of lines in different figures. There was a figure, two lines were added in that figure and then those two lines were removed from that figure. Respondents had to choose those added and removed lines from the given options. In this question males and females got confused themselves as the subtraction concept was induced in pictorial question, whereas third gender focused on subtraction concept, so more of third gender attempted it right. only 10 out of 30 answered it right because ability of using a concept in different context requires higher skills, training and aptitude.

Although only two in numbers but still males and third gender attempted the question17 better than females(1/10). This question was about to make a new figure join two similar shapes of different colours in different orientations and select the answer from given options. The aim was to check the presence of aptitude of adding the two different objects and just combine them with a little focus/observation. Since sample belongs to low socio economic background and their main goal for life is to earn bread and butter. So they hardly focus on detailing of concept or process. Hence only five out of 30 answered it right.

Their Familiarity with Shapes and Sizes

Almost all third genders(10) and females(10) rightly answered question eight then males(9). There were 17 cookies of three shapes i.e. triangle, square, and circle. This question was about to differentiate the cookies and select those cookies that having corners in them. The collected data shows that basic knowledge of shapes can be acquired even without non schooling and working in the outside world can bring this knowledge to any person. Basic shape recognition ability is

present in almost all the samples. This aptitude is present in all of them.

Same number of males(10) and third gender(10) answered question10 right than females(8). Almost everyone answered this right. There was a pictorial complete square in the question. The square was cut from one corner first and then from another opposite corner. Respondents had to tell the number of corners present in all three pictures. This is the question of shapes that again shows that basic knowledge of shapes can be acquired or learn even without schooling. Working in and outside world can bring such kind of knowledge to any person. Shape recognition is present in all the samples but schooling can help them to know more about the naming and dimensions of the shapes.

All third gender(10) answered question 19 right than binary genders females(8) males(6). This question is about the classification of various figures in different categories of shapes (circle, quadrilateral and triangle). Six respondents who answered wrong were classifying on the basis of colours rather than focusing on shapes, but 24 out of 30 answered right which again proves the presence of ability to recognise and classify the figures under different category of shapes.

More of third gender(5/10) answered question seven right than binary genders male(3) female(2). This question was based on similarity among shapes and colour combinations. There were different figures. Each figure has specific design. That design is present in and out of that figure but in different colours. Respondents had to select from the given options by keeping the given pattern in mind. 1/3 rd of total sample i.e. 10 out of 30 answered it right. Half of third gender answered right. Sample were not able to combine two different aspects altogether for answering. 1/3 of the sample answered on the basis of shape, next 1/3 of sample answered on the basis of colour rest of the sample answered right. Ability to combine various aspects while answering the question is not present in the sample. More of third gender(6/10) answered question 18 right than binary genders female(4) male(3). There is a complete pattern of different colours and shapes in this question. There are nine blocks out of which eight were given. Respondents had to choose from the given options for the ninth block. 13 out of 30 answered it right. Rest of them were not able to combine two different concepts altogether for answering. Ability to combine various aspects while answering is not present in the sample. Such skill can be developed by formal schooling.

Just 10 percent third gender(3/10) answered question14 right than males(2) and females(2). There was a picture of wheel in the question. A one-fourth section is cut out of wheel. There were four options which were looking alike. Samples had to select among them by focusing on shapes. This requires a little minuteness for shape concept because size is also another factor to look upon. Seven out of 30 answered the question right. Those who answered it right were by coincidence as they were not sure whether they could even answer it right. This question require both shape and sizing concept together with very little changes in the available options. The samples have aptitude but lags required attitude, because when shape and size concepts were dealt individually the results were much better.

Skills: Seriation, Orientation, Analysis and Transformation

More of third gender (4/10) answered question 11 right than binary genders (2,2). This question was containing five different polygons. It was based upon two aspects one is of different shapes and second is to seriate them according to number of sides. The aim was to test their aptitude of seriation. Most of the samples were inclined toward the sizes of the polygon rather than the number of sides in the polygon. Respondents answered on the basis of size. This shows that seriation on the basis of size is easily adaptable as compared to number of sides of polygon as it includes geometry as well, which made the question a little complex.

Although only four in numbers but still females and third gender attempted the question one better than males (2/10). This question was about to select an animal from given options and seriate it with other animals in the given specific order. The collected data shows that seriation logic of pictographic things needs supplement help like formal schooling or education, as only 10 out of 30 answered it right. Higher ability of seriation is absent in the sample. Their routine jobs don't include and emphasis on seriation so they are not able to develop the seriation ability. Equal number of trio genders (3/10) attempted the question four. This question was having square blocks consisting red coloured dots moving in a specific direction. Respondents had to select the next placement of dots in square block from the given options by looking the direction of dots shown in question. The aim was to test the ability of analysing the orientation of dots. Since only nine out of 30 attempted it right, it is observed that thinking about pattern in the area of direction requires formal schooling. Ability to orient things in particular direction is missing in majority of the samples.

Males (3) answered question 20 right than females(1) and third gender(1). This question was a step ahead as it required orientation pattern. There were three different figures in different orientation pattern. They had to select the answer on the basis of direction pattern from given options. This needs aptitude for direction or orientation. Five out of 30 answered it right. Aptitude of direction or ability to orient the pattern is missing in the sample. They do not do a little extra effort to think about direction for right answer. They just answered and overlooked the concept of direction in question.

Third gender (7) and males (6) rightly answered question16 than females(2). This question is about the size of figures. The aim was to test the aptitude of analysing big and small or making comparisons among figures. There are five options for the answer out which two were nearly same with little change in orientation, most of the females did not pay attention towards the minute changes in orientation whereas males and third genders were very detailed. Hence ability of analysing size is present in everyone but skill of orientation lags in samples which in turn affects the quality of answering. Three of each third gender & female and only two males answered question three right. This question consisted of arrows in different colours. Respondents had to select from the given options by analysing the similarities and differences of arrows shown in question.

The aim was about to test the ability of analysing the pattern and orienting the things. The difference is very

marginal(10%). Here, we see that skill of analysing the similarity and difference between two or more objects is only fostered in educational environment or formal schooling as just eight out of 30 answered it right so the analysing ability was not present in majority of the studied sample.

Same number of females(8) and third gender(8) answered question13 right than males(6). There are three different figures. In first step a cross is added to each figure and in second step that cross is transformed into small four dots. Those four dots are placed in four different directions. Respondents had to select the required figure from the given options. This question needs the skill of transformation of lines and their arrangement in figures. The collected data shows that ability of transformation is present in most of the sample studied as 22 out of 30 answered it right.

Summary

Each child and person is supposed to know alteast the 'three rs' in order to make his /her life easy, better and meaningful. The three rs (Rs) are reading, writing and arithmetic. They have been referred to the foundations of a basic skill of education since 1818 in print as a space-filler in "The Lady's Magazine". Since mathematics is considered as one of the basic skills to be acquired by everyone, there are many skills of mathematics that are inborn, innate and present in nature of persons. There are many skills of mathematics that are acquired, nurtured and learned by a little higher education. So, this study has been conducted in the light of those innate mathematical skills i.e. the skills of estimation, combination, familiarity with shapes, seriation, orientation, analysis, conservation etc.

It is known for centuries that mathematics is the field for males. Females were supposed to lag behind from males in the field. But this gap regarding mathematics between the males and females is getting diminished in the past few years. Males and females stand on an equal footing today. There is a another category of gender i.e. third genders. Researcher wants to explore about the third gender and compare them with other binary gender.

Education is not just limited to school boundaries and not just with in the two genders. It is for human kind and mathematics is the essence of world. Mathematics should be accessible to everyone. Paucity of research done in this area motivated the researcher to perform this study.

Third genders are now allowed to take admissions in educational institutions. They come under the category of other backward classes. Supreme court, UGC, HRD allowed them to feel free and pursue any kind of job opportunity they wish. Third genders have to quit their schooling and can not avail jobs because of societal pressure. This can be the reason for them of not knowing about the mathematics more. They can have mathematical aptitude and attitude for it but are unaware from its essence. Their relation with mathematics have not been discussed yet in any study. Hence, this study has been conducted in order to know about the mathematical aptitude of third genders with respect to other binary genders and their attitude towards mathematics. There are various findings given ahead from this study that throw the light on this association and are helpful to understand the same.

Findings

Knowledge of Estimation and Conservation

Although males and third genders did well in estimating the large numbers but aptitude of estimation of quantity was not found in all the samples. Ability to estimate the weight is present in half of the sample. Almost all females have this estimation skill of weight regarding saree(texture) than males and third genders. Aptitude of conservation is not present in anyone of the selected samples.

Apptitude for Basic Counting and Addition / Substraction

Ability to recognise simple numbers in pictorial form is there in samples. Third genders are better in dealing with little variations in counting than males and females. Third genders have more ability of using concepts in different context than males and females. Aptitude of combining or adding different things with focusing was absent in almost all of the respondents.

Their Familiarity with Shapes and Sizes

Basic shape recognition ability is present in almost all the samples. This aptitude to classify the figures under different category of shapes is present in all of them. Third genders are more capable to combine two different aspects together for answering than binary genders. Ability to combine various aspects while answering the questions is not present in the majority of the sample. 1/3 of the sample answered focusing on the shape only, next 1/3 of sample answered focusing only on colours. Rest of the sample answered right. The samples have aptitude of combination but lags the attitude required, because they didn't want to give their selves more to question. At times when the shape and size concepts were dealt individually, the results come better as compared to when these both concepts are dealt together.

Skills: Seriation, Orientation, Analysis and Transformation

Aptitude of seriation is present in everyone. Most of the samples were inclined toward the sizes of the polygon rather than the number of sides in the polygon. Respondents answered on the basis of sizes. This shows that seriation on the basis of size is easier as compared to seriation on the basis of numbers of sides of polygon. This is because it includes geometry as well, which makes seriation a little complex to do. Logical and complex seriation is absent in everyone. When it comes to pictographic elements where the placements of completely different things are needed, they found it too tough to do. Aptitude of direction or ability to orient the pattern is missing in the respondents of the males, females and the third gender studied. They do not put even a little extra effort to think about direction for the right answer. They just answer and overlook the concept of direction in question.

Ability of analysing size is present in everyone but skill of orientation lags in samples which in turn affects their quality of answering. Most of the females did not pay any attention towards the minute changes in orientation whereas males and third genders were very specific about it. The skill of analysing the similarity and difference between two or more objects is not present in the majority of them.

The ability or aptitude of transformation is present in most of the respondents. It is more in females and third gender than males.

Attitude Towards Mathematics

Majority of third genders are from outside Delhi. They are not aware about their date of birth but know their age. The selected group of the third genders reported that they had left their school education in a younger age as they were harassed and teased by other binary genders. This resulted in no formal schooling and hence no job. Begging remains the last option for them to survive.

They liked mathematics and want to study it further if given a chance. They feel that mathematics may be useful for them for their betterment. Majority feel that girls do better in mathematics than boys as they are serious about studies. All of them can pronounce single digit numbers only in English or Hindi. They can not join two different digits and pronounce as a complete number. They spell both digits as a single one.

They confirmed about using numbers to count their earnings (begging), paying rent, covering electricity and water bills, saving mobile numbers, buying clothes, etc. They learnt more about numbers and counting from begging and from members of their group. Respective Gurus teach them the required mathematics that is essential and useful for their occupation.

Majority of them understand the meaning behind green light and red light and work according to lights. If any of them face difficulty in understanding lights then other members tell his/her to act according to traffic. Sooner or later, they get to learn the traffic lights. Rarely anyone of them play any game in their free time. They go for begging from morning till evening and have to do prostitution work in night. So, they do not get time to play. Only one or two confirm that they play snakes and ladders, ludo and carom.

There is a hierarchy in every group of third gender wherein Gurus are placed on a higher position while the others occupy a lower one. So, all of them can not take decision about monetary aspects as their respective gurus take care about finance. But they can estimate their profit or loss without going in for any complex mathematical calculations. They do not have any bank account. They either give it to their respective gurus or send money to their family hailing from different villages or towns/cities.

Conclusion

From the above mentioned findings, the researcher concludes that although the third genders is marginalised from the society yet they do have a good attitude towards mathematics and so towards education. They know the presence, usage and relevance of mathematics in their daily lives. Their ability of learning mathematical skills are nearly same as main streamed people of society. Moreover, their mathematical aptitude has been found better than other binary genders in many respects. Their knowledge of ‘basic counting and simple addition-subtraction' is the result of their occupations i.e. visit on occasions and begging on traffic lights. This proves that irrespective of formal schooling, the working conditions of persons help them to know and learn the basic counting and knowledge of numbers.

They can deal with little variation in counting more effectively, whereas males and females struggle with the changes in the pattern, not with the counting as such. Since males and females are more involved in one to one dealing in their working conditions whereas third genders have to deal with many things at a time like traffic lights, vehicles, people, money, etc., so they are more focused than binary genders.

There are skills that are present in them as in the others also. For instance, the ability to recognise simple numbers, basic shapes and ability of transformation of things or shapes. Basic knowledge of shapes are acquired even without non schooling and working in the outside world that bring this kind of knowledge to them or any other person. Schooling can help them to know more about the naming and dimensions of the shapes. Aptitude of seriation is also present in everyone. Seriation on the basis of size is easier as compared to seriation on the basis of numbers of sides of polygons for everyone as it includes geometry (a bit of mathematics) as well, which makes seriation a little complex to do. Their routine jobs don't include and emphasize on seriation so they are not able to develop the seriation ability more. Seriation ability of pictographic things needs supplement help like formal schooling or education. Everyone has the aptitude of combination but lack the attitude required, because when shape and size concepts were dealt with individually, the results come better as compared to times when these both concepts are dealt with together.

There are skills regarding various aspects that can vary from person to person. For instance, aptitude or innate ability of estimation of weight of clothes are good in females whereas aptitude of estimation of numbers and quantity are good in males and third genders as they deal with people and do variety of things and occupations. This estimation ability develop with the age and maturity and can be fostered with more experience of the outside world. Ability of analyzing size is present in everyone but skill of orientation lags in samples which in turn affects the quality of answering. But few abilities can be found rarely in people. For instance:- Aptitude or ability of conservation is not present almost in anyone. Ability of using a concept in different context requires higher skills, training and aptitude. Analysing ability and aptitude to orient things in particular direction is missing in majority of the respondents. They do not do a little extra effort to think about direction for right answer. Thinking about pattern in the area of direction requires formal schooling. Ability to combine various aspects while answering the question is not present in them. 1/3rd (10/30) of the sample focus on one aspect (shape), next 1/3rd (10/30) of sample focus on other aspects like colour. Very few can focus on both aspects simultaneously and combine them. Since sample belongs to low socio economic background and their main goal for life is to earn bread and butter, so they hardly focus on detailing of concepts or processes. They just want to answer and get products. Such abilities of analyzing the similarity and difference between two or more objects can only be developed and fostered in educational environment or by formal schooling. Hence, the study concludes that third genders have nearly similar mathematical aptitude as of binary genders and good attitude towards mathematics which actually varies from person to person.

Educational Implications

This research draws attention to certain important education concerns which needs further research and probe. It is important that third genders should get every facility for education and job, so that they do not need to beg. They should get admission in every school in the light of the concept of inclusive education and teachers should treat them as equal on the basis of grounds of genders. Students should

get more knowledge and awareness about the third gender community. All forms of schooling i.e. formal, informal and non formal should be open for them to avail. Finally, the third gender should not be treated as a stigma on human race rather should be treated as another gender of human beings. The primary concern is that this is not representative of entire population of the third gender. Selected samples can be of same work culture and condition. There can be more questions to know attitude and aptitude towards mathematics. The present study focuses on a very small and selective sample group is therefore there is a need to study larger samples for generalisation of these findings. This study can be taken to a higher level by involving the study of the psychological sensitivity of this highly sensitive and important social group.

Acknowledgements

The investigator expresses her deep gratitude to her guide Dr. Pratyasha Sahoo, Asst. Prof., Masters of Mathematics Education, Cluster Innovation Centre, University of Delhi for her cooperation and encouragement extended towards completion of the present research. The investigator expresses her special thanks to Dr. Jyoti Sharma, Associate Professor, Masters of Mathematics Education, Cluster Innovation Centre, University of Delhi for providing an opportunity to carry out the present research.

The investigator would like to thank the teachers and staff of the Mathematics Education for their cooperation. Her appreciation goes to the library staff of Cluster Innovation Centre, Central Institute of Education, NUEPA and NCERT.

The investigator sincerely appreciates the cooperation extended by the Males, Females respondents and Third Genders from Srijan Foundation and Naturals Care Society for cooperating in the data collection for her study.

References

1. Amelink T. Literature Overview: Gender Differences in Math Performance, Virginia Tech, 2009. Retrieved August 14, 2014, from https://www.engr.psu.edu/…/ ARP_Math_GenderDiffer_Overview_06300...
2. American Psychological Association. Science and math aptitude is unrelated to gender, Vol 37, No. 1, Print version, 2006, 12. Retrieved August 22, 2014, from http://www.apa.org/monitor/jan06/gender.aspx
3. American psychological association. In Gender Gaps Linked to Status of Women, According to New Analysis, WASHINGTON Retrieved, 2010. from http://www.apa.org/news/press/releases/2010/01/gender-math.aspx
4. Hyde S, Mertz E. Gender, culture and mathematics performance Edited by Randy Schekman, University of California, Berkeley, CA, and approved, 2009. (received for review February 5, 2009) Retrieved August 12, 2014, from http://www.pnas.org/content/106/22/8801.full
5. Kane M, Mertz E. Debunking Myths about Gender and mathematics Performance, V, 2012, 59(1). Retrieved August 10, 2014, from http://www.ams.org/notices/201201/rtx120100010p.pdf
6. Lindberg M, Hyde S, Petersen L. New Trends in Gender and Mathematics Performance: A Meta-Analysis, University of Wisconsin – Madison Retrieved, 2010. August 12, 2014, from www.ncbi.nlm.nih.gov › Journal List › NIHPA Author Manuscripts
7. Spencer SJ, Steele CM, Quinn DM. Stereotype threat and women's math performance. Journal of Experimental Social Psychology. 1999; 35:4-28.
8. Spelke SE. Sex Difference in Intrinsic Aptitude for Mathematics and Science? Retrieved, 2005. August 10, 2014, from http://www.wjh.harvard.edu/~lds/pdfs/spelke2005.pdf
9. Thomas R. Third Gender In India – From Ancient Literature to Present Scenario[Blog post] Retrieved, 2013. August 5, 2014, from http://reshmaelizabeththomas.wordpress.com/2013/08/27/third-gender-in-india-fromancient-literature-to-present-scenario/
10. UNESCO, Guidelines for inclusion. Ensuring Access to Education for All. Paris, UNESCO, 2005.
11. Supreme court Retrieved, 2014. August 11, 2014, http://supremecourtofindia.nic.in/ outtoday/wc40012.pdf
12. Wade L. article The Truth About Gender and Maths, Retrieved, 2013. August 8, 2014, from http://thesocietypages.org/socimages/2013/03/07/the-truth-about-genderand-math/
13. Mahapatra D. Supreme Court recognizes transgenders as 'third gender'. Times of India. Retrieved, 2014. August 13, 2014, from http://timesofindia.indiatimes.com/india/Supreme-Court-recognizes-transgenders-as-thirdgender/articleshow/33767900.cms
14. Aptitude. (n.d.). In Encyclopaedia Britannica. Retrieved August 14, 2014, from http://www.britannica.com/bps/dictionary?query=aptitude
15. Aptitude. (n.d.). In Encyclopaedia Britannica. Retrieved August 14, 2014, from http://www.britannica.com/bps/thesaurus?query=aptitude
16. Attitude. (n.d.). In Encyclopaedia Britannica. Retrieved August 14, 2014, from http://www.britannica.com/bps/dictionary?query=attitude
17. Third Gender. A qualitative study of the experience of individuals who identify as being neither man or woman. Retrieved August 15, 2014, from http://ebangla. blogspot.in/2011/12/third-gender-qualitative-study-of.html
18. Anand U. Supreme Court recognises third gender, glimmer of hope for gays. Nation, 2014. Retrieved August 16, 2014, from http://indianexpress.com/article/india/india-others/sc-recognises-third-gender-glimmer-of-hope-for-gays/
19. Field theory - Pierre Bourdieu (uploaded on May 16, 2010) Herwin Simon Retrieved August 17, 2014, from https://www.youtube.com/watch?v=7FXPnkwSCyE
20. Non Verbal Reasoning Question and Answers: Figure Matrix. IndiaBIX. Retrieved August 18, 2014, from http://www.indiabix.com/non-verbal-reasoning/figure-matrix/
21. 11+ Non-verbal Reasoning, Webrich Software (February 26, 2014) Education. Retrieved August 19, 2014, from https://play.google.com/store/apps/details?id=com.webrich.elevenplusnvr
22. Non Verbal Reasoning: Pattern completion, section 1. IndiaBIX. Retrieved August 19, 2014, from http://www.indiabix.com/non-verbal-reasoning/pattern-completion/

23. Boards IE. Limited Retrieved August 19, 2014, from http://www.boards.ie/vbulletin/ showthread.php?t=2055681119&page=2
24. Retrieved August 19, 2014, from http://testingforkindergarten.com/wp/wp-content/ uploads/2012/10/nnat-spatial-2.png
25. Retrieved August 20, 2014, from http://www.testingmom.com/wp-content/uploads/ gifted-talented-practice-question.png
26. Brightkids NYC. Retrieved August 20, 2014, from http://i.dailymail.co.uk/i/pix/ 2014/07/08/article-2683488-1F7AF41D00000578-859_634x400.jpg
27. Retrieved August 20, 2014, from http://nycgiftedandtalented.files.wordpress.com/ 2012/06/nnat-test-practice-questions.jpg
28. Retrieved August 20, 2014, from http://www.testingmom.com/wp-content/uploads/ Untitled8.png
29. Retrieved August 20 , 2014, from http://api.ning.com/files/ b0ctHyrGzqMNDkNBeUGnRF3SjzjmKSyeJRRLehSw41lZyrLY52bK4VImtR7u6rA LnLtDFc6cDgR9dRzJHcpNzJsxDfdPwvcf/GlassBanglesDesignStyle124.jpg
30. Early childhood. Classification and Patterning: A preschool pattern. appolearning Retrieved, 2014. from https://www.appolearning.com/app_reviews/426-apreschool- pattern-recognition-games-for-ipad
31. The three Rs, wikipedia, encyclopedia. Retrieved, 2014. from http:// en.wikipedia.org/wiki/The_three_Rs
32. Datta Arko. India recognizes transgender citizens as ‘third gender, 2014. Retrieved August 2, 2014, from http://rt.com/news/india-court-third-gender-636/
33. Thewhiterabbit13, Urban Dictionary, 2011. Retrieved August 14, 2014, 2:40 PM from http://www.urbandictionary.com/define.php?term=Third+Gender
34. UGC notifies transgenders as third gender, 2014. Deccan Herald, New Delhi. Retrieved August 20, 2014, from http://www.deccanherald.com/content/421467/ugcnotifies - transgenders-third-gender.html)