

offered. Consequently, many students expressed the fear of retribution from the college authorities. For example, one student (Hafsa) said “I hope this project will not be trouble for us sir.” I reassured them that the college had given me permission to carry out the research; therefore, there would be no trouble for anyone. She asked the same question again during another interview; and when I asked, “Can you explain to me your fears?”, she replied: “Is because this is new to all of us, we never did this before”. Another student (Muneera) added:

In school only the teacher think for student. Nobody can say anything different from the teacher point [of view].

The fear expressed by these students suggests to me that they had not been used to or given the opportunity to express their personal views on important issues during their school days. In addition, in response to one of the questions on the reflective questionnaire (*What do you like or not like about the mathematics projects you have completed this semester?*), various students wrote:

I like the project class because this is first time I relax in math class. In school only teacher talk and we listen, no say or argue [debate] like in this project. (Bedour)

I like because now I can talk [express] my view in class doing math. No chance in school to learn about this things. Is like politics now before I am afraid the teacher angry with me and I get trouble. (Nada)

This project teach me about asking for my right no fear like before. My teacher [in school] never try this way to teach us, may be afraid also. (Zainab)

From the participants’ comments it became obvious to me that prior to their projects, these students had not been used to taking action; therefore, the action taken by them was, indeed, exceptional and a breakthrough in their journeys towards becoming agents for change. I believe the project undertaken by these students and the action taken by them was significant in influencing their college administrators to make the changes mentioned above. Therefore, I contend that after ‘reading their world’ with mathematics the participants have also ‘written the world’ with mathematics.

Conclusion

Implications

One of the important implications of this study is related to the practice of teaching mathematics in this context. The findings from this study draw attention to an urgent need for a meaningful mathematics curriculum at the Higher Colleges of Technology – one with real life connections to the learner’s world. Such a curriculum could support students’ understanding of mathematics because it would allow them to draw upon their familiar experiences in making sense of the mathematics.

Another important implication of this study is related to the theory and research on social justice teaching. A very important aspect of this research is that the participants are young Middle Eastern Muslim women. Traditionally they are not as visible in public life as young men; but the findings in this research show that, like their counterparts in the Western world, these young women are also interested in social justice issues. This is particularly significant given the current ongoing social developments in the Middle East; extending the research to this new context of women in traditional societies shows that a focus on social justice is possible and beneficial.

Finally, this research has made a contribution to the field of teaching for social justice as well as mathematics education. It is the first study to investigate the influence of teaching mathematics for social justice in a Middle Eastern country to college students (adult learners) in normal classroom

settings. A research gap in investigating the ability of students to read and write the world with mathematics as a result of social justice teaching in the UAE was also bridged through this research.

Limitations

This research has some limitations. One is that the time spent on the research was not long enough for the kind of trust necessary for teaching for social justice to flourish. This is even more so for me being a male teacher teaching females for whom, I was probably the first male to exchange words with them in a formal classroom setting. If I had taught this class for the whole academic year, it would have allowed me more time to establish a solid foundation for better trust between the participants and myself.

Another limitation of this research is that because I come from a different cultural background to the students', it may not be possible to fully understand many of the challenges these students might have encountered throughout their journey with me in this research.

Recommendation

In terms of recommendation for future research, the findings in this research could serve as a springboard for future research in the Middle East. In particular, it would be valuable to attempt a longitudinal study, tracking a group under a social justice learning paradigm vs. a control group with a similar educational/social profile, through several years of College, through various levels of study, in order to ascertain long-term benefits of the pedagogy. This is important because it is needed to show that teaching for social justice does not disadvantage students academically; instead it provides them with opportunities to be better prepared for their future educational journeys.

A final comment

I humbly believe my research has uncovered certain things. First, although there is still a lot more to be done in terms of exploring the effectiveness of Gutstein's framework for teaching mathematics for social justice in the Middle East, data analysis from this study suggests that his framework is relevant and applicable in the UAE. By utilizing Gutstein's framework in this context, students have developed a significant ability to use mathematics as a tool to *read* and *write* their world. Secondly, the findings show that these young women are also interested in social justice issues. Finally, restricted in scope though this research has been, it contributes to the limited literature available on the teaching of mathematics for social justice.

Reflecting on my journey in this research, it was both interesting and salutary for me to be made aware, through frequent discussion with the students, just how limiting social and cultural constraints can be for students. However, for these young women, the Social Justice Pedagogy employed within their classroom gave them unprecedented insight into their learning process. For the first time they took responsibility for learning outcomes rather than have them dictated by their teacher mentor or, equally common, by reference to the answer section at the back of a textbook! By applying mathematics to their everyday lives, it suddenly became relevant to them, and they realised the potential which it could have for re-examining often long-established norms and communicating new ideas in a locally appropriate way.

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Appendix 1

Work presented by the Car Parking Group

Now we show you our calculations:

- We divided the student parking area into rectangles and triangles as in the diagram.

$$\text{Area of triangle} = \frac{1}{2} \text{base} \times \text{perpendicular height}$$

$$\text{Area 1} = \frac{1}{2} \times 5 \times 15 = 37.5 \text{m}^2$$

$$\text{Area 2} = \frac{1}{2} \times 5.15 \times 15 = 23.6 \text{m}^2$$

So, the total area is approximately $750 + 500 + 300 + 37.5 + 23.6 = 1611$ square meters

1. We measured the lengths of an average car as 4.7 meter by 1.6 meter

So, the area is $4.7 \times 1.6 = 7.52$ square meters

2. It means, for the students' car park, we have approximately $1611 \div 7.52 = 214.23 = 214$ car parking spaces. We have rounded down our answer here so that we don't have more cars than space available.

3. And, since there are 2150 students at WC, it means we will have the ratio as

$$214: 2150 = 1:10$$

This means there is only one parking space to every 10 students.

This is clearly not fair!

4. For the teachers, there are 3 car parking areas and we calculated the total area as 3440 square meters. And, there is 212 staff at WC.

Therefore, there are approximately $3440 \div 7.52 = 457$ car parking spaces. We have rounded down like before.

This means:

$$457: 212$$

2: 1, this answer is rounded down.

This means there are 2 parking spaces for every staff at the college.

Looking at the above results one will easily say the parking space allocation at WC is not fairly done. Then, we remembered that not all students drive car to college, some come by bus. Therefore, we asked for more information and we were told that approximately 300 students are registered to drive and park at the college premises.

Below are our calculations with the new information:

Teachers:

5. *Nothing changed.*

Students:

6. *Car: population*

214: 300

1: 2, we rounded up here to make sure we don't have cars without place to park.

This means, there is one car parking space for every two students at WC.

Car Parking group's letter to College Director:

The Director

Dear Sir,

CAR PARKING PROJECT

For few weeks now, with the help of Mr. Y, we were engaged in a project that we thought will help to further improve the quality of life of students and staff here at WC.

Many of us (students who drive to college) have concerns with the space provide for us to park our cars, so when Mr. Y introduced us to "Social Justice Mathematics", we immediately thought the car parking project would be a great one to pursue.

Below are our findings:

1. We found the ratio of parking space to population as follows;

Staff member: parking space

1:2

This means, there are two parking spaces to every staff at WC.

Student: parking space

2:1

This means, there is one parking space to every two students at WC

2. Student car parking entrance and exist are the same.

Suggestions and Conclusions:

1. We initially thought that the parking space allocation at WC was not fairly done. We are happy to report to you that, contrary to our initial perception, the parking space allocation at WC is reasonably fair. However, there will be the need to provide more parking when the number of students registered to drive and park at the college premises increases.
2. For safety reasons, we would like to suggest that, the entrance and the exits be separate or at least be made wider.
3. Through this project we have discovered the hidden powers of mathematics to resolve potential conflict. What we initially thought was unjust turned out to be just. We would like to recommend that more of this type of project be encouraged at our campus, and may be across the whole HCT colleges in the future.

Thank you very much.

