Positions on and Attitudes towards Mathematics of Ethiopian Female-teachers and Female-students

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Authors’ contributions

This work was carried out in collaboration between both authors. Both authors performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript, managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

This research explores the positions on and attitudes towards mathematics held by teachers [hereafter – “teachers”] and Ethiopian female students [hereafter – “students”]. Israel is one of the largest immigration states around the globe. A successful immigration absorption is possible only when the new immigrants acquire the education and culture of their country of destination. Nevertheless, during the process of teaching, one cannot disregard the cultural context of the immigrants' country of origin. The research population consists of 28 teachers and students. This research is conducted according to the qualitative paradigm by means of a semi-structured interview which has been content-analysed. The results illustrate three similar parameters and three different parameters in the participants’ positions on and attitudes towards mathematics. The three similar parameters are: difficulty in mathematics studies, mathematics as a factor affecting future success and importance of mathematics as leverage for success according to the participants’ parents. The three different parameters are: perception of mathematics through animal
metaphors, pleasure derived from mathematics studies and importance of the subject. The students and teachers' attitudes towards mathematics indicate a difficulty in learning mathematics. However, both they and their parents perceive mathematics as an important subject and a key to success in life. The contribution of this research to the education system is uncovering and understanding the teachers and students' perception of mathematics. Learning these perceptions enables building unique programmes which respond to the real needs emerging from the field. Based on the results it is recommended that the education system builds and develops mathematics curricula for the students and in-training and mathematical professional development programmes for the teachers. Such programmes underscore the students' cultural aspect and provide an appropriate response to populations coming from different cultures.

Keywords: Ethiopians; Ethiopians in the education system; primary school mathematics education; case study.

1. INTRODUCTION

Today, mathematics constitutes one of the key subjects in the curriculum. Hence greater importance has been attributed to mathematics learning and teaching, starting from kindergarten and up to an advanced level of mathematics studies in high school. There are undoubtedly difficulties in the process of mathematics learning and teaching at school. However, these difficulties are intensified when Ethiopian female-students [hereafter – “students”] and teachers [hereafter – “teachers”] are concerned. Consequently, during the teaching process we must not ignore the cultural context of the immigrants' country of origin since mathematics is a discipline which is associated with the culture of the learner population. Those born in one culture find it hard to integrate values and thinking processes of another culture in their thinking processes. The absorption process can succeed when the new immigrants are allowed to acquire education and culture of the country to which they have immigrated [1].

This research aims to investigate whether there are differences between the positions on and attitudes towards mathematics of primary school teachers working in the education system and those of high school students.

2. LITERATURE REVIEW

2.1 Ethiopian Jews

The Ethiopian Jews refer to themselves as "Bita Israel" meaning the House of Israel. Unfortunately, there is no written literature about the origin of Ethiopian Jews and the historical time of their arrival to Ethiopia. The history was mostly maintained orally and was transferred in this way from generation to generation. A prevalent tradition among "Bita Israel" which fathers told their sons for hundreds and maybe thousands of years. Through the years, "Bita Israel" did not see themselves as local inhabitants but rather as foreigners who had emigrated from their land, from Jerusalem, to which they would return one day. The prayers of Ethiopian Jews are filled with yearnings and supplications to the God of Israel to bring His exiled sons back to Jerusalem [2].

Ethiopian Jews were not brought to Israel like their brethren from Europe, Asia and other African countries. The Jews of "Bita Israel" community were left in isolation and loneliness, confronting missionary activities and conversion to Christianity. They continued observing the Holy Commandments, kept kosher laws particularly with regard to their kitchenware and celebrated the holidays in their own way. Moreover, they meticulously observed the old laws which were devotedly transferred as a closed tradition from father to son, all the years, believing they were the real Jews in the world. In Israel, the political and religious leadership debated about their Judaism. The issue of the Jewish identity was discussed from two aspects, the religious aspect and the legal aspect. Eventually in 1973 it was determined that Ethiopian Jews were Jews for all intents and purposes [2].
2.2 Ethiopian Immigrants in Israel

Since 1984, most of the Ethiopian Jews have arrived to Israel in immigration waves entitled 'Operation Moses', 'Operation Queen of Sheba' and 'Operation Solomon'. Today their community comprises about 145,000 members. Their voyage to Israel was full of suffering, adversity and arduous stories. However, most of them have been absorbed in the Israeli society, although the absorption process encompassed problems and hardships [3]. Numerous immigrants experienced a cultural shock as a result of their encounter with the Israeli society. For the first time in their life they had to use electricity, running water, travel by bus, eat another diet, use health services, apply new communication media, live in unfamiliar housing and physical environment, use technological means and face different weather conditions. Moreover, the meeting with the Israelis exposed the Ethiopian immigrants to a strange world where they met for the first time in their life white Jews, Israelis who were not orthodox or observant. They experienced other social codes, a different way of life and daily conduct as well as a hostile and discriminating attitude on the part of the entire Israeli population. The most problematic issue was having to cope with individuals’ freedom of choice (as opposed to almost non-existent freedom in Ethiopia) and with increasingly growing gaps between generations in the family and in the Ethiopian society [4,5].

2.3 Jewish Education in Ethiopia

The Jewish education in Ethiopia was grounded in the principles of non-formal education designed to inculcate social norms, teach Jewish customs and education for social integration as a family in the wider society. Only few children studied formal education while most of the children worked in the fields or were employed in other functions when they reached the age of five. Upon arrival to Israel, the absorption process of both children and grownups was implemented in the following frameworks: formal education framework from kindergarten and up to high school in the state and religious-state sectors; absorption through the Youth Aliya (immigration of adolescents without their parents); post-secondary education and the project for 18-30 years old young people in which they were trained in special pathways of the Israeli Administration of Students; various adult education frameworks; and even programmes for recruiting youngsters to the army [6].

2.4 The Israeli Education System and Ethiopian Immigrants

The process of absorption in the different educational frameworks confronted the Ethiopian immigrants with numerous difficulties. Studies albeit not so many indicate the following hurdles: difficulties in reading comprehension; social problems between children of Ethiopian immigrants and children of veteran Israelis who have lived in the country for many years. There were also problems in the learning process such as: independent work, initiative, imagination concentration, request for help, teachers’ attitude and quite a high percentage of 1st graders who found the studies very hard. Furthermore, the new immigrants had to struggle with the acquisition of language skills, thinking and learning competences, communication skills, attitudes towards time, environment and authority [5,6,7].

The Head of the Ethiopians Steering Centre in the Ministry of Education reviewed the education system’ failure to absorb the immigrant children. According to him, the common denominator of all the mistakes was the low image of the Ethiopian community, family and learners in the eyes of the decision makers. Placing immigrant children in socioeconomically-challenged areas, their sweeping referral to boarding schools and lack of reference to their cultural affiliation constituted stumbling blocks in the integration of immigrant children in the Israeli society in general and in the education system in particular. An education system which learns and is acquainted with the characteristics of its learners can direct the way and method of studying, learning contents and means of encouragement and drive in order to lead to the optimal success of the learners. In order to succeed, the immigrant learners’ absorption in the education system should have into consideration the background from which they have come as well as the difference between the cultures, something which has not always been done [8].

2.5 Mathematics Education at School

Mathematics is a complex subject and is stereotypically perceived as difficult and challenging. Throughout all their years at school, from the 1st to 12th grades, many learners experience mathematics anxiety, find it difficult to
learn the subject and also do not like it. Mathematics is being learnt already from young age and the teachers of this subject are required to have not only disciplinary content knowledge but also pedagogical content knowledge as well as knowledge of the learners’ ways of thinking [9,10,11].

Mathematical foundations are necessary for all people in modern society even if they are not going to be mathematicians or scientists [12]. Consequently, learners should study and understand mathematics already in kindergarten and the first years of primary school. In addition, researchers recommend integrating in mathematics lessons activities taken from the world of reality relevant to the learners and from their everyday life [13]. Hence, primary school teachers who are responsible for building mathematics knowledge of learners at the beginning of their way, should be specialised in the teaching of this discipline [14,15].

Mathematics is considered as a difficult but essential subject since it constitutes the infrastructure of science and technology. Today, these are leading areas and the language of mathematics is an inseparable part of the learners’ daily language. Nevertheless, studies illustrate that many learners suffer from mathematics anxiety, have difficulties in learning it and also do not like it. Language is one of the aspects of building mathematics knowledge according to the constructivist approach. That is, learners’ difficulties stem not only from the failure to acquire mathematics knowledge but also from the use of language in general and from the abstract nature of the mathematical language in particular [10,16,17,18,19]. Mathematics has unique linguistic forms which do not facilitate an easy mapping. Key words which imply arithmetics operations are extensively used. The varied meanings of words are confusing in daily life on the one hand and in mathematics lessons on the other. All these result in problems for the learners. We should remember that every language is based on unique symbols. It has unique syntax rules which define the application of its symbols and the latter can be implemented in order to represent a meaning in a definite area. Mathematics is a language comprised of symbols and syntax rules by means of which we can describe objects, actions and relations between sizes. Language can be used either orally or in writing, by both numerical and/or graphical-iconic representations for the purpose of abstraction of reality, use of axioms and the application of linguistic-verbal representations. Based on the above, attention should be paid to the need for preparing the mathematical vocabulary and concepts both in teaching and in learning [18].

2.6 Mathematics in the Israeli Education System

In Israel mathematics has recently become one of the topics at the centre of the public arena [4]. This is mainly due to the results of international tests which show that learners in Israel are not highly ranked on the list of the involved countries. Teachers undoubtedly have a strong impact on the way pupils learn mathematics and teacher education has undeniably an essential role in their ability to teach [9]. The Ministry of Education maintains that the key to the promotion of mathematics education depends on teachers’ quality. Consequently, the various programmes implemented today are designed to enhance mathematics knowledge and innovative methods of mathematics teaching, leading to the promotion of academic attainments of learners of the education system.

Since Israel is a multicultural society, teachers and learners in the education system evidently belong to different cultures. As a result, we have to provide a worthy and appropriate response to the teacher and learner populations which come from different backgrounds and cultures. Hence, we should get acquainted with the positions on and attitudes of teachers and learners towards the understanding of mathematics in light of the characteristics of the culture in which they were born and raised.

2.7 Research Question

What are the positions on and attitudes towards mathematics of Ethiopian10th grade female students in Israel versus the positions on and attitudes towards mathematics of Ethiopian young age (2nd grade) teachers?

3. MATERIALS AND METHODS

3.1 Research Method

This research was conducted according to the qualitative-interpretive approach of the case study type. A case study is used in teaching and learning research. One of its important advantages is the ability to provide insights about incidents in the contexts and physical sites where they transpire. Cultural and social incidents can
be fully understood only if they are studied from the participants' point of view and from the way those actively involved see them. Data collected from the participants can in fact be depicted as insufficient. However, they definitely facilitate comprehension of the thoughts and feelings of a small group as well as of their attitude and approach [20,21].

3.2 Research Population

The research population consisted of 28 participants, 14 teachers of mathematics in the 1st and 2nd grades of primary school and 14 students learning in the 10th grade (aged 15-16 years). The teachers teach mathematics to young age children at elementary school and learn within the framework of teacher in-service professional development courses. Their teaching seniority was between 6-10 years and they were between 27 and 32 years old. They were chosen as research participants by the head teachers of the schools recommended for taking part in the research and gave their consent to do so.

3.3 Research Instrument

This research was based on a semi-structured interview. The questions of the interview focused on the participants' personal background and their positions on mathematics from six aspects: perception of mathematics through a metaphor; importance of mathematics; difficulty in learning mathematics as compared to other disciplines; pleasure derived from the study of mathematics; importance of the subject as affecting the future; and importance of the subject according to the parents' perception.

The research participants were requested to rank in each question their attitudes on a 5-grade Likert scale ranging between 1="not at all" and 5-"to great extent". In addition to this common instrument, the use of metaphors is gradually becoming another considerable research instrument in qualitative research. Metaphors are viewed as one of the 'figurative language' methods, become more and more important in the inquiry processes of verbal and visual language. A metaphorical language enables participants to express abstract terms or terms which they find difficult to explain by means of terms taken from more familiar semantic fields of the human experience. One of the interesting and effective ways for presenting perceptions, assumptions and sensibilities is by metaphorical images [22]. Metaphors of animals allow description of positions, events and situations with a variety of characteristics as opposed to the world of flora and inanimate objects and it is becoming more prevalent in qualitative studies [23].

3.4 Data Processing

The data collected from interviews were content analysed as is customary in qualitative research. The content analysis was performed at two levels: a normative content analysis for distinguishing prominent trends and a qualitative-interpretive content analysis for the purpose of uncovering essences and perceptions as well as comprehending different insights.

This research was conducted by two researchers. Hence, in the process of writing the results, they have concurred about the definition of the categories and the naming thereof. The categories were determined after the researchers' extent of agreement about them was at least 67% [20].

4. RESULTS

Analysis of the interviews illustrated that the teachers and the students demonstrated similar and different parameters in the positions on and attitudes towards mathematics as presented in Table 1.

Table 1 indicates that the positions on and attitudes towards mathematics demonstrated by the teachers and students are similar in three parameters, namely: difficulty in learning mathematics, importance of the subject as affecting the future and parents' perception of mathematics. Conversely, the results show differences between the two groups associated with the other three parameters: perception of mathematics through animal metaphors, pleasure derived from the study of mathematics and importance of mathematics as a discipline studied at school.

4.1 Detailed Results Regarding the Three Similar Parameters Demonstrated by the Teachers and the Students

4.1.1 Difficulty in learning mathematics as compared to other disciplines

The results illustrate that both the students and the teachers had difficulty in learning
Table 1. Distribution of positions on and attitudes towards mathematics among teachers and students (N=28)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Students</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Similar position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Difficulty in learning mathematics as</td>
<td>High level</td>
<td>High level</td>
</tr>
<tr>
<td>compared to other disciplines studied at school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Importance of the mathematics as</td>
<td>Great importance</td>
<td>Great importance</td>
</tr>
<tr>
<td>affecting the future</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Importance of the mathematics as</td>
<td>Great importance</td>
<td>Great importance</td>
</tr>
<tr>
<td>leverage for success according to the parents' perception</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Different position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Perception of mathematics through animal metaphors</td>
<td>Used 3 animals:</td>
<td>Used 10 animals:</td>
</tr>
<tr>
<td></td>
<td>Lion, snake, ant</td>
<td>Parrot, monkey,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>owl, spider, ant,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>giraffe, cockroach,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fox, lion, snake</td>
</tr>
<tr>
<td>2. Pleasure derived from the study of mathematics</td>
<td>Very low level of</td>
<td>Medium level of</td>
</tr>
<tr>
<td></td>
<td>pleasure</td>
<td>pleasure</td>
</tr>
<tr>
<td>3. Importance of mathematics as a discipline</td>
<td>Low importance</td>
<td>High importance</td>
</tr>
</tbody>
</table>

One teacher told: "It is not easy for me to explain to the students the logic of mathematics. Understanding mathematics is difficult for me. It is built of stages and is very rational and I find it difficult to understand it". On the other hand, one student pointed out: "It is difficult but we need to cope with it and I am solving exercises all the time. Sometimes I get despaired but I know that I have to make my homework and succeed in the exams". Another teacher summed up: "Learning mathematics is difficult for me and I like more the humanities. Therefore I do better in them. However, mathematics is a compulsory subject". One of the students added: "I am not connected to mathematics. It does not interest me and most certainly I find it very complicated".

**4.1.2 Importance of success in mathematics as leverage for determining the future**

The data obtained indicated that all the teachers and the students perceived mathematics as an important subject which would affect their success in life as well as their future. They all ranked mathematics at the highest level in spite of the difficulty in learning and teaching this discipline.

One teacher mentioned: "In my opinion mathematics is highly important because it is everywhere in our daily life, from the moment I wake up until the moment I go to sleep. It's there with me throughout the day. For example, in order to wake up on time, I have to set my alarm clock ahead of time. I calculate how many hours I am going to sleep and when I am going to wake up. For my wellbeing I constantly calculate weight, nutrition, number of calories and many other minor and major matters".

One student said: "It seems that mathematics has been attributed a strong status at school and it has always been at the top of the list of subjects studied at school. Moreover, the teachers tell us that it is essential to learn mathematics, that it will help us later in life".

**4.1.3 Importance of mathematics as leverage for success according to the parents’ perceptions**

The research results showed similar perceptions among the teachers and the students. All of them believed that the parents considered mathematics as a subject which would open doors in higher education and in the labour market.

One of the teachers reported: "My parents, like most of the other parents, think that mathematics is important and it can determine people's destiny. Therefore it is important to learn this subject and be successful in it". Conversely, one of the students pointed out: "It is difficult but we have to cope with it and I solve exercises all the
time”. Another teacher told: "Of course my parents find mathematics important. They would like me to be good at it because according to them mathematics is ranked high. If I succeed in it they are happy and think that perhaps I am going to be a doctor”.

4.2 Detailed Results Regarding the Three Different Parameters in the Positions of the Teachers and Students

4.2.1 Mathematics is like...

The teachers and the students were asked to describe mathematics through animal metaphors. Their answers showed that the students’ animal world is more limited (they chose only three animal types: lion, snake and ant). Conversely, the teachers used a larger and more varied number of animal types. This diversity is also numerical (they chose ten animal types: parrot, monkey, owl, spider, ant, giraffe, cockroach, fox, lion, snake) as well as richer. Almost every teacher chose another animal for describing her perception of mathematics. Moreover, the distribution of the students' answers regarding the 'attitude towards the subject' category indicated that most of them manifested a negative attitude towards mathematics (13 students) and only one student demonstrated a positive attitude (an industrious ant).

One student mentioned: "Mathematics is the king of all disciplines. Also the lion is the king of the animals and it frightens me a lot and makes me be in a bad mood and have stomach aches”. Another student said: "I prefer avoiding snakes as well as mathematics lessons. The snake is dangerous and I can never know where it is and where I am going to come across it. It's better if it stays in its hole and does not appear suddenly. There are enough topics which are more interesting to study". A student who manifested a positive attitude towards mathematics indicated: "I know that mathematics is important and although I am not so good in it, I know that I must study like the industrious ant because it is essential for the future and I might even succeed".

The distribution of the teachers' answers was the following: ten teachers manifested a positive attitude and four demonstrated a negative one. One of the teachers who used the monkey in order to describe mathematics stipulated: "I see the picture of a monkey which puts its hand on its forehead. It thinks, it is focused. That's how I see myself thinking, exerting efforts and am focused until I find the solution”. Yet another teacher told that mathematics is like a giraffe: "Like the giraffe, mathematics is higher than the other subjects, it is infinite and never ends. When the giraffe lifts its neck, it is straight as a ruler and when it looks at the ground it turns into various geometric shapes”.

4.2.2 Pleasure derived from the study of mathematics

The results illustrated that most of the teachers (12 out of 14) derived pleasure from learning mathematics on a medium level compared to 11 students learning at a very low level. The students who did not enjoy learning mathematics at school used expressions of hate of and frustration about the subject.

According to the description of one teacher: "My level of pleasure from the study of mathematics is medium. When I was a child I loved only the subjects in which I was successful, e.g. functions. On the other hand, there were other subjects which I have failed to understand even today, such as trigonometry".

A student told: "I don't like learning mathematics, I hate learning mathematics, I am frustrated and find it difficult”.

4.2.3 Importance of mathematics as a discipline

The data indicated different perceptions of the importance of mathematics. Twelve out of the fourteen teachers attributed high importance to mathematics. Almost all the students (13 out of 14) maintained that learning mathematics at school was not essential.

One teacher specified: "In my opinion, mathematics is a very important subject for our everyday life. Most employments and professions use mathematics and therefore we must learn at high school topics like percentage, multiplication table, addition and subtraction”. Unlike her, one of the students underscored: "There is nothing we can do with mathematics in our life. We can succeed also without mathematics. I think that we are living in an age which offers many instruments by means of which we can solve mathematical problems. We must not overrate the value of mathematics, it is not the most important subject”.
5. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This research aimed to understand teachers and students' positions on and attitudes towards mathematics. The research assumption was that the results would have a significance and contribution to educators of primary school mathematics teachers. They would also promote these teachers' professional development during their teaching practice as Ethiopian teachers. Furthermore, this research was designed to enhance the inculcation of mathematics language to Ethiopian students and thus would change their positions on and attitudes towards mathematics.

This research is a case study which investigated 14 teachers and 14 students. The interviews analysis showed similar parameters and different parameters in the context of the positions on and attitudes towards mathematics among the two populations. The similar results which related to both teachers and students were manifested in three parameters: difficulty in learning mathematics, importance of the subject as affecting the future and parents' perception of mathematics.

The difficulty in learning mathematics at school was stipulated by many researchers [6]. The more so when this concerned Ethiopian students and teachers who came to Israel with different positions on and attitudes towards mathematics. These positions and attitudes are combined with thinking styles and learning/teaching methods which are typical of the Ethiopian education system and are different from those of the Israeli education system. Most of the Jews in Ethiopia mainly learned in the non-formal educational frameworks and studied less in the formal education. This was due to political and social transformations which transpired in Ethiopia throughout history [7]. The goals of the formal education focused more on the inculcation of social norms, Judaism customs and meeting the expectations of the parents and the older generation [24]. Thus, the difficulty and frustration of the participants in learning mathematics becomes clearer and better understood.

Regarding the second parameter, importance of the subject as affecting life in the future, the results illustrated that both the teachers and the students think in a similar way. Studies indicate that mathematics is an important and obligatory subject at school, inculcating skills of mathematical thinking which might facilitate the teachers and students' future functioning in the modern and digital society [12].

As for the third parameter, parents' perception of mathematics, the participants' parents perceive mathematics as an essential and significant subject and they recommended their children to study it on an enhanced level because they would benefit from it in the future.

As opposed to the three similar parameters, the results showed three different parameters in the teachers and students' positions on and attitudes towards mathematics.

The teachers and the students described mathematics through animal metaphors. For that purpose, the teachers used a larger variety of animals as compared to the students. The animal world of the students is more limited and is taken from the cultural environment in which they have grown up. The animal metaphors from the teachers' world were taken from their cultural environment but the age gap accounted for the variety and number of animals which they chose for depicting mathematics.

From the aspect of pleasure derived from the study of mathematics a difference was manifested in the attitudes towards mathematics between the teachers and the students. It is noteworthy that both populations did not choose to rank their level of pleasure from the study of mathematics at the highest level: the teachers enjoyed it on a medium level and the students on a low level. It is likely to assume that if students and teachers indicated a difficulty in learning and teaching mathematics, their level of pleasure from the subject could not be high [25]. Nevertheless, both the teachers and the students mentioned that mathematics is an important discipline, which constitutes significant leverage for success in life. Since this cognitive dissonance is prevalent among the two groups, it is essential to reduce the feelings of guilt, frustration, disappointment and helplessness in the processes of teaching and learning this subject [18].

To sum up, exposing the attitudes of Ethiopian teachers and students towards mathematics manifested their social and cultural situation. Getting acquainted with these positions would facilitate building unique programmes which would respond to real needs of the student...
population and to the needs emerging from the field.

The importance of this research stems from two aspects: teaching mathematics in a cultural aspect and teaching mathematics in teacher education, teacher in-service courses and the educational field. The insights obtained from this research facilitate development of elementary school mathematics teacher education and in-service programmes in a cultural context.

The study recommendation to the education system and to teacher education colleges is to design and develop mathematics curricula for students as well as teacher training and mathematical professional development programmes which highlight the students' cultural aspect. Such programmes might attract more immigrant students to study mathematics. In addition, this research recommends conducting additional studies dealing with the teaching/learning of mathematics which is perceived both by the education system and by society as a difficult and frustrating subject. Results of these studies could serve as a key for changing the subject perception and teaching as well as for promoting students' attainments at school.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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