

## Classroom climate and teaching methods in mathematics classes

### Clima educativo en el aula y los métodos de enseñanza en las clases de matemáticas

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#### Abstract

*This study examines the differences between pupils' perception of classroom climate during mathematics classes conducted according to the frontal teaching method versus the cooperative teaching method. For the study purposes, 2.565 pupils in Grades 4, 5 and 6 from 32 Arab elementary schools located in different regions of Israel were selected. The research tool was a standard questionnaire that examined classroom climate during mathematics classes as perceived by the pupils (ZEDAN, 2006). The findings show that the pupils in the Arab elementary schools in Israel reported higher level of satisfaction and enjoyment, teacher-pupil relationship, pupil to pupil relationship, and a generally better classroom climate for math classes using the frontal teaching method than those using the cooperative teaching method.*

**Key words:** classroom climate, learning, teaching, mathematics.

#### Resumen

*Este estudio de investigación examina las diferencias entre las percepciones de los alumnos el clima educativo en el aula durante las clases de matemáticas que se llevan a cabo con métodos de enseñanza frontales y las percepciones de los alumnos el clima educativo de las clases que se llevan a cabo con métodos participativos. Con fines de la investigación fueron seleccionados 2.565 alumnos de cuarto, quinto y sexto grado*

*en escuelas árabes primarias en Israel en distintas regiones. La herramienta de investigación elegida fue un cuestionario estándar que examinó cómo perciben los alumnos al clima educativo del aula durante las clases de matemáticas. (ZIDAN, 2006). Se llegó a la conclusión que los alumnos de escuelas primarias árabes en Israel, prefieren y disfrutan más de la relación, profesor-alumno, de la relación alumno-alumno y en general de un mejor clima educativo en el aula cuando las clases de matemáticas se llevan a cabo con métodos de enseñanza frontales más que las clases con métodos participativos.*

**Palabras clave:** matemáticas, enseñanza, aprendizaje.

#### INTRODUCTION:

##### Classroom Environment

The concept 'classroom environment' is a synonym for classroom climate, and refers to the processes created as a result of the mutual activities occurring in a learning environment, which is the classroom. This concept concerns the personal, social, educational, and cultural characteristics of pupils found in the same learning environment, and the way in which they perceive what takes place within it as a result of

the interactions of pupils among themselves and between teacher and pupils (SCHMUCK & SCHMUCK, 1974).

PAZI (1977, in SCHWARTZMAN, 2001) defines classroom climate as a totality of environmental factors – norms, positions, the execution of tasks, democracy, assistance, cooperation, interpersonal expectations, solidarity, pattern of communication – that influence the unique character of the interrelated activities in the classroom and the patterns of behavior.

Moos (1979) identified nine environmental constraints that affect the classroom climate, and divided them into three clusters:

- 1) Personal Relationship Dimensions: Involvement, Affiliation and Teacher Support.
- 2) Personal Growth or Goal Orientation: Task Orientation and Competition.
- 3) System Maintenance and Change: Order and Organization, Rules Clarity, Teacher's Control, and Innovation.

ZIDKIYAHU (1988) assembled the desirable components for classroom environment into four main factors:

- i. Open-mindedness: The behavioral and mental open-mindedness of pupils and teacher.
- ii. Support: Teacher support for pupils, and the support of pupils for their classmates on emotional, social and cognitive levels.
- iii. Equality: Egalitarian relationship of the teacher towards his pupils, and the pupils towards their classmates.
- iv. Order and Procedure: The existence of a system of clear rules and regulations for pupils and teachers that will allow for organization, order, security and impartiality.

SHARAN and colleagues (1985) refer to two main aspects in classroom climate. The first is the learning aspect that focuses on the positions, expectations and beliefs of the teachers and pupils in the process of teaching, their achievements and evaluation. The second is the social aspect associated with the quality of the relationships between the teacher and his pupils, and the pupils among themselves, and their affinities with each other. This includes behavioral expectations and communication patterns. The theoretical assumption is that classroom climate must be measured according to the subjective perceptions of the pupils, because it is their feelings and perceptions of what surrounds them that influence their behavior and the system of mutual relationships in the classroom (SCHWARTZMAN, 2001). A positive climate makes pupils study better (FRASER, 1998).

In the 1980s, FRASER (1986) claimed that too little attention had been given to the application of research into classes of a specific discipline in special environments and in different countries and cultures.

The subject of **mathematics** is one of the most centrally important ones taught in schools at all levels. The educational challenges that the modern age pose for us require the provision of a mathematics education for the entire population. The importance of mathematics lies in its being necessary for coping with scientific studies and the exact sciences.

ARIEH LEVY (1983) notes the fact that the structure of mathematics, the environmental relationships, the attitude of the teachers and pupils towards the subject, places it in the forefront of problematic subjects. Therefore it is of special importance to collect information on the events and situations that occur within the reality of the mathematics teaching process, whether they influence the learning process as measured by the educational achievements in this subject, or whether they hinder it.

Information of this kind must precede any attempt to improve the learning system, and this is one of the things that this study attempts to provide.

Previous studies have not focused on the conditions of learning or methods of teaching, but in concrete didactic solutions to specific problems, mainly in the use of computers and practical exercises as the efficient solution to coping with the difficulties and turning the abstract material into something more concrete. However, classroom climate and its possible influence on the conditions of learning in mathematics teaching have not yet been dealt with properly.

## TEACHING METHODS

The traditional frontal method of teaching in which the teacher is at the front of the room presenting the material is the most widely used one in the majority of schools in this country (LAZAROVITCH and KRASENTI, 1990; SHAHAR, 1997). This is the method that is very frequently used in

the Arab sector in which 50% of teaching time is conveyed in the frontal method, according to the test results of 'Meitzav' - School Index for Efficiency and Growth for 2004 in the Arab Sector (Ministry of Education, 2005). This method places the pupil in the position of a passive information receiver, while the responsibility for the process of learning is focused upon the teacher who plays a central role in the acquisition of the information. In the cooperative method, on the other hand, the educational approach of learning in small groups stresses two way pupil-to-pupil and pupil-teacher exchange, as well as between them and the environment with all its events and occurrences. In this method, the pupil is active in the process of learning and a partner in the processing, analysis and integration of the learning material.

The cooperative method is still not as widespread as it should be in the Arab sector (SHARAN, 2002). The classes in the Arab sector are large and crowded, and the classroom area is small for the number of pupils studying in them. Under such conditions, the teachers can only use the frontal method that compels the pupils to remain fixed to their seats (SHARAN, 2002).

**The study question** is: Are there any differences between the perceptions of the classroom climate by pupils learning in a mathematics class conducted according to the frontal teaching method, compared to the cooperative teaching method?

**The procedure** used in this study is of the Ex Post Facto type – a descriptive, and correlative, quantitative field research.

In this study, comparisons were made between pupils who studied mathematics according to the traditional frontal method and those who studied according to the cooperative method with regard to their perception of the classroom climate and its factors. The study duration was one whole school year. The teachers carrying out the cooperative method of teaching were not the same who taught the traditional method.

## RESEARCH POPULATION AND THE SAMPLE MODEL

For purposes of research, 2565 pupils studying in Grades 4, 5 and 6, were chosen from 32 Arab elementary schools in various regions in the State of Israel.

The education system in the Arab sector suffers from serious problems: low achievement level, high dropout rate, insufficient budgets and resources, and low teaching quality in the schools. The deficiencies include a lack of teachers and staff assistants, school buildings that are poorly constructed and maintained, are distantly located, and there are not enough libraries, computers and laboratories (ZEDAN, 2005).

The management of Arab schools is far from being a democratic one. On the contrary, the Arab educational system is in a state of somnolence with regard to local initiative to introduce changes, and to refresh the educational environment (AL-HAJJ, 1996).

Besides this, the Arab educational system is conservative since it operates within a society that is conservative by nature. The neglect of education naturally leads to problems in the comprehension of mathematics. Learning difficulties that originate from cultural disadvantages among economically deprived children can cause them to fail in the study of mathematics (AL-HAJJ, 1996).

A new approach to education among this population of weak students is the only tool that is capable of halting the process of cultural and political sterility, and instills trust and self-confidence, economic viability, and social solidarity (SHAHAR, 1997).

The research tool is a standard questionnaire to examine the class climate during math classes according to the perception of the pupils (ZEDAN, 2006). The questionnaire is constructed in the form of positions according to the Likert scale. It contains 38 questions, all of which are closed questions, and the pupil is asked to select the degree of his agreement with each item graded on three levels: (1) Not True; (2) True, to some extent; (3) True. A number of items are formulated in the negative sense in order to avoid a systematic response.

38 questionnaire items consist of five factors: Satisfaction and enjoyment, Teacher-pupil relations, Pupil-pupil relations, Tension and gender inequality, Competition.

The Cronbach Alpha reliability of each factor of the classroom climate ranges from 0.572 to 0.846. These values are satisfactory in view of the effective variables in which the number of questions for each factor is not very large.

## RESULTS AND FINDINGS

From an examination of Table 1, a significant difference can be seen between pupils' perceptions of the factor 'satisfaction and enjoyment' in the math classes conducted according to the frontal method

and the cooperative method ( $t(2564)=2.433$ ,  $p<0.05$ ). Pupils report a higher level of satisfaction and enjoyment in frontal method classes.

Table 1

Means and Standard deviations of pupil perception of learning environment factors in math classes during frontal and cooperative teaching methods

| Factor                        | Teaching Method | N   | M<br>(1 – 3) | SD   | t      |
|-------------------------------|-----------------|-----|--------------|------|--------|
| Satisfaction and enjoyment    | Frontal         | 172 | 2.64         | 0.41 | 2.43*  |
|                               | Cooperative     | 393 | 2.60         | 0.40 |        |
| Teacher-pupil                 | Frontal         | 172 | 2.53         | 0.36 | 3.08** |
|                               | Cooperative     | 393 | 2.48         | 0.35 |        |
| Relations Tension and         | Frontal         | 172 | 1.35         | 0.53 | 0.51   |
|                               | Cooperative     | 393 | 1.34         | 0.51 |        |
| gender inequality Pupil-pupil | Frontal         | 172 | 2.27         | 0.39 | 2.36*  |
|                               | Cooperative     | 393 | 2.23         | 0.37 |        |
| Relations Competition         | Frontal         | 172 | 1.49         | 0.62 | -0.93  |
|                               | Cooperative     | 393 | 1.51         | 0.63 |        |
| General classroom climate     | Frontal         | 172 | 2.45         | 0.26 | 2.98** |
|                               | Cooperative     | 393 | 2.42         | 0.25 |        |

\*  $p < 0.05$ , \*\*  $p < 0.01$

It was also found that there is a significant difference between pupil perception of the factor 'teacher-pupil relationships' in frontal mathematics classes and those in cooperative ones ( $t(2564)=3.082$ ,  $p<0.01$ ). Pupils report a higher level of teacher-pupil relationship in frontal method classes.

There was also a significant difference between pupil perception in the two groups of the factor 'pupil-pupil relationships' ( $t(2564)=2.361$ ,  $p<0.05$ ). Pupils expressed higher level of 'pupil-pupil relationship' in frontal than cooperative methods classes.

A significant difference was also found between pupil perception of the general classroom climate in frontal and cooperative math classes ( $t(2564)=2.983$ ,  $p<0.01$ ).

No significant differences were detected between the two groups' perceptions of the factors 'tension and gender inequality' and 'competition'.

## DISCUSSION

The traditional, frontal method of teaching is very frequently used in the Arab sector. The cooperative method is not yet as widespread as it should be in the Arab sector (SHARAN, 2002). CRONBACH (1967) calls for attention to be paid to the fact that different kinds of pupils have different ways and methods of learning. The matching of pupil to method in a comfortable and positive atmosphere is the most efficient way to improve learning and productivity. Teaching and study methods are the factor that influence classroom climate.

The findings of this study are contrary to the many studies that were conducted in the Jewish sector in Israel and in the world. This justifies the view that the more general and universal the findings, the less they correspond to particular localities. Human behavior cannot be learnt independently of the cultural context in which it is realized. FRASER (1986) says that one should create systematic typologies for every culture. The field of learning is also a relativistic one and requires much importance to be given to the research of classroom climate, especially in mathematics classes (FRASER et al., 1986).

Our findings show that the level of satisfaction and enjoyment among pupils learning by the frontal method is higher than that of pupils learning by the cooperative method. It was also found that the teacher-pupil and pupil-pupil relationships in the frontal method are clearly much better than those of the cooperative method. The frontal method of teaching causes pupils to perceive the classroom climate in a more positive manner than the cooperative method of teaching.

Several studies found that cooperative learning has a very positive influence on classroom climate and on learning achievements; it improves the process of learning and makes it more efficient (SHARAN et al., 1984; SHAHAR, 1997).

In a study that was conducted in Israel (KRASENTI, 1984) in biology classes taught in the cooperative method, it was found that these classes

had a higher level of cooperation, satisfaction, solidarity as well as competition, while classes taught according to the frontal method had a high level of difficulty, competitiveness, indifference and lack of organization.

Cooperative learning has a considerable teaching and educational potential in creating a positive classroom climate and improves the efficiency of the learning process (LAZAROVICH & KRASENTI, 1990). They found that pupils learning by the cooperative method evaluated their classes as having solidarity and unanimity, and that the study matter was less difficult. They reported on having more satisfaction, less indifference, less group closure and rivalry, less teacher preference for boys than for girls.

Pupils' perceptions of classroom climate in this study is more positive in the frontal method. This is contrary to many other studies. It may be that this is caused by the traditional character of Arab society in which the child is used to listening and obeying and does not take an active role in any process. Traditional Arab society is characterized by conformity and obedience to the wishes and instructions of the father of the family. In addition, the character of Arab school management is not a democratic one (AL-HAJJ, 1994). This is contrary to the basic nature of cooperative learning in which the pupil has to be active and the teacher supervises and guides, as compared to frontal learning in which the pupil is passive and only the teacher can provide knowledge.

Our study shows that pupils perceive the teacher-pupil relationship in a math lesson in a more positive manner when it is given in the frontal method rather than the cooperative method. This is to say that the system of relationships between a teacher and his pupils in an elementary school mathematics class is positive, supporting and warm both personally and professionally. The pupils value the fact that the teacher insists on learning norms that lead to their success. The pupils report that the teacher offers them a high degree of assistance, support, interest and friendship towards them. The results of the MEITZAV 2004 report indicates that 66% of the pupils in the Arab sector noted that the teacher-pupil relationships were good, and 69% noted that they were satisfied with their school (Ministry of Education, MEITZAV, 2004).

The pupils reported that the math teacher gave clear instructions and insisted on discipline and order, as well as on maintaining a clear system of rules and regulations that the pupils knew and were aware of the penalty for transgressing them.

They also reported on the degree of inflexibility by the teacher in applying these rules and regulations, his strict punishment for transgressions, and his supervision of inappropriate behavior. The pupils attribute their success to the teacher. The results of the MEITZAV 2004 report showed that 83% of the pupils in the Arab sector noted the order and clear borderlines in the classroom (Ministry of Education, MEITZAV, 2004).

In Arab society there are clear borderlines between parents and children, and the leeway granted to children is not supposed to infringe on family and social order. Arab pupils accept the involvement of parents and teachers in their private lives and in their studies, and this is the natural characteristic of traditional Arab society with its patriarchal structure in which the father stands at the apex of the pyramid. The relations between him and his family members are those of maximum dependence in all spheres of life, on complete obedience and submission to the wishes and instructions of the father of the family (AL-HAJJ, 1996). This implies that the value and respect accorded to the teacher in the Arab sector is higher in comparison with Western sectors and cultures.

The status of the Arab teacher is still maintained as authoritative and fatherly, authorized to impose norms of behavior and even to punish. Discipline is one of the characteristics of Arab education, pupils still treat the teacher with respect, and do not allow themselves to be "rude" during classes and violate classroom rules and norms. This fact is a very prominent one in the present research findings.

This research also shows that pupils perceive the pupil-pupil relationships in math classes in a more positive manner when given in the frontal method rather than the cooperative method. This finding corresponds to the results of the MEITZAV report for 2004, which says that 75% of the pupils in the Arab sector noted that relationships among the pupils were good (Ministry of Education, MEITZAV, 2004).

Norms of mutual assistance, cooperation, consideration for each other, and tolerance were found to exist among them. The pupils behaved in mathematics classes in a pleasant and polite manner, and without much quarrelling among themselves.

The schools in Arab localities are neighborhood schools, where the entire family lives in the same village neighborhood, so that the pupils

in many schools have the same surname. The pupils in a class are mostly relatives, neighbors or acquaintances. They begin their studies together in the kindergarten, and the composition of the class remains the same throughout the period of elementary school. There are only a few instances of dropouts or transfer from one class to another. The small Arab villages do not have businesses? There are no places of entertainment, no organizational bodies, and no informal activities. The children have no choice except to gather during the afternoon hours in the village square, in the dusty field on the village borders or on some hill. These are the same children that studied in the morning in the same classes at school. This contributes to a closer relationship among the pupils of a class and leads to unanimity and solidarity, and may lessen the level of competitiveness and tension in the classroom.

## CONCLUSIONS

This study focused on the classroom climate in Grades 4, 5 and 6 during math classes in the Arab sector elementary schools in Israel. The aim of the research was to examine the differences between pupil perceptions of classroom climate in math classes conducted according to frontal method as compared with those conducted according to the cooperative method.

The research results contradicted those universally found in many other studies on the same subject.

The findings showed that pupils in Arab elementary schools feel greater satisfaction and enjoyment in math classes taught in the frontal method than in the cooperative method, and that teacher-pupil and pupil-pupil relationships are better with the frontal method than with the cooperative method. The frontal method of teaching causes pupils to perceive classroom climate in a more positive way than the cooperative method of teaching.

It may be that this results from the traditional character of Arab society in which the child is used to listening and obeying, rather than taking an active role in a certain process. In addition, the style of management in Arab schools is not a democratic one and this is contrary to the basic principles of cooperative learning. Arab society has a patriarchal structure, and the value and respect shown to the teacher in the Arab sector is greater in comparison with Western sectors and cultures. The status of the Arab teacher is still maintained as authoritative and fatherly, with the authority to impose norms of behavior and even to punish. The high level of homogeneity among the residents of Arab villages and among pupils in Arab schools (neighborhood schools), contributes greatly to the lessening of tension and competitiveness, and causes a more positive perception of classroom climate.

The Arab population in Israel, in general, and in the Arab schools and educational system in particular, is still a matter that requires much research. A study of classroom climate that concerns processes linking to the level of pupil achievement and classroom behavior is very important, especially in central subjects such as math. A study of classroom climate is valuable in assisting teachers and educational policy

makers to understand the conditions needed to develop a learning environment that provides a positive classroom climate in math classes at school. Such a classroom climate is important for the emotional, social and learning development of the pupils.

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